TUESDAY AM - The Ecosystem Approaches in Fisheries Management

Jack Jones Lecture

The Big Fish of Belfast; a 30 year case-study on the re-establishment of an extirpated Atlantic salmon stock in the river Lagan.

Robert Rosell[1]

The river Lagan rises in County Down, enters the Irish Sea through the port of Belfast and has historically supported Atlantic salmon. Cumulative pressures from industrialisation, urban development, abstraction, weirs, canalisation, and inadequate water quality led to extirpation of the native stock in the 1700s. Following water quality improvement, a salmon reintroduction feasibility study was completed in 1990, comprising habitat surveys, barrier passability and water quality assessments . A plan to re-establish salmon was initiated in 1991 using donor stock from the River Bush. Over 1 million juvenile salmon were introduced throughout the catchment between 1991 and 2014, with follow-up surveys to check for fry survival and natural reproduction. Adult salmon upstream migration resumed in 1993 and natural reproduction was observed from the first returns. Fish passes were constructed on the least passable weirs in the 1990s. Salmon numbers are now monitored annually by electronic fish counting and electric fishing surveys. Following cessation of stocking, the genetic identity of the re-establishing stock has been assessed in relation to adjacent river populations, with some evidence of divergence from the donor River Bush stock. Given contemporary sharp declines in salmon abundance across the North Atlantic, many populations are threatened with or have suffered extirpation and there is considerable fishery management interest in the effectiveness of restoration attempts. The efficacy of the Lagan salmon restoration programme has been reviewed, and lessons learned for conservation and management are discussed.

1: Agri-Food and Biosciences Institute (AFBI), Belfast, Northern Ireland, UK

Metabolic Trade-offs in a Warming World: Latitudinal-Driven Patterns in the Metabolism and Growth of Juvenile Salmonids

Peter Betts[1], Anna Sturrock[1], Thomas Cameron[1], Rasmus Lauridsen[2], Colin Bull[3], and Eoin O'Gorman[1]

Rising global temperatures are reshaping the thermal habitats of organisms across their geographic ranges. As ectotherms, fish are particularly vulnerable to these changes, which can profoundly affect their behaviour, feeding, growth, and increase basal metabolic rates. These metabolic increases necessitate adjustments in energy budgeting and allocation, yet data on how metabolic rates vary with temperature in

fish in situ and how this, in turn, influences somatic growth remain limited. This is of particular importance for salmonids, whose complex habitat needs make them especially susceptible to climate change.
In this study, we investigate the field metabolic rate and somatic growth rate of wild juvenile salmonids across a broad latitudinal gradient from Spain to Iceland. We find that at lower latitudes, higher metabolic rates are associated with increased growth during the first year of life. However, at higher latitudes, this relationship reverses, with elevated metabolic rates coupled with reduced growth. Additionally, we demonstrate that temperature exerts a stronger influence on the metabolism of smaller individuals, suggesting that early-life thermal sensitivity may be a key factor shaping population dynamics.
These findings reveal fundamental latitudinal variation in the metabolic and growth responses of juvenile salmonids to temperature underscoring how adaptation to baseline climate can alter the impact of warming on key physiological rates. As climate change continues to alter thermal regimes, understanding these interactions will be critical for predicting future shifts in fish populations and developing effective conservation and management strategies.

1: University of Essex, UK
2:Laxinn, Iceland
3: University of Stirling, UK

Atomic Ecology – Stable isotopes as an underused resource in fisheries management

Brian Hayden[1]

Stable isotopes are a widely used tool in many aspects of fisheries research, providing insights into consumer ecology, food web structure and fish migration. However, while tools such as eDNA and GIS telemetry rapidly transitioned from academic to applied fields of fisheries management, the uptake of stable isotope-based tools has been slower. This is a hindrance to fishery management as these stable isotope-based techniques can be used to rapidly answer multiple questions pertinent to fishery management. Here, I present a suite of 'out of the box' stable isotope-based tools designed to complement existing fishery management practises. These tools founded on, decades of academic research, can easily be adapted and tailored to specific needs of any management project.

IsoDiet – Determine the diet and trophic ecology of an individual fish or population, identify timing of ontogenetic shifts and seasonal changes in feeding.
IsoInv – Identify recently introduced or invasive individuals within a population, and measure the strength of dietary interactions between resident and invasive fish.
IsoHabit – Distinct habitats have distinct isotope profiles, meaning that we can ascertain the contribution of specific habitats to any individual fish or population.
IsoWeb – Integrating stable isotope ratios of an entire fish community allowing managers to ascertain community health and compare among systems.

In this presentation I will provide examples of how these tools have been applied to fisheries management programs in North America, and identify comparable scenarios within Europe.

1: University of New Brunswick, Canada

Tracking marine migration, habitat use, and predation of inner Bay of Fundy Atlantic Salmon kelts

Caliyena Brown[1], Morgan Piczak[1], Robert Lennox[1]

Marine Predation as a Barrier to inner Bay of Fundy Atlantic Salmon Recovery
The inner Bay of Fundy (iBoF) Atlantic salmon (*Salmo salar*) is a unique population characterized by local marine migrations and greater dependence on repeat spawning compared to other Canadian populations. It is the only population listed as endangered by the Canadian Species at Risk Act (SARA) and is currently maintained by a Live Gene Bank hatchery program. The gene bank-supported recovery strategy has successfully re-established the number of juvenile fish leaving rivers and entering the marine environment; however, the return rates of virgin and repeat spawners remain low. Previous work suggests marine predation is a primary driver of poor marine survival, but updated evidence is needed. In collaboration with Fisheries and Oceans Canada (DFO), we surgically tagged 103 hatchery-raised iBoF kelts (post-spawned adults) with acoustic transmitters equipped with temperature sensors. Tagged kelts were released into the Stewiacke River, Nova Scotia and tracked throughout their marine migration. The temperature data will allow us to identify likely predation events and predator types, while spatial modelling will help locate where these events are happening in the Bay of Fundy. Predation events will be quantified and compared to earlier data to evaluate shifts in predation pressures over time. This research contributes to DFO's ongoing efforts to understand drivers of marine mortality in iBoF salmon and supports the development of informed conservation strategies for this ecologically and culturally significant species.

1: Dalhousie University, Canada

Local environment and fragmentation by drought and damming shape different components of native and non-native fish beta diversity across pool refuges

Joana Martelo[1], Christos Gkenas[2], Diogo Ribeiro[2], M. Judite Alves[3], Filipe Ribeiro[2], Julien Cucherousset[4], João Gago[2] & M. Filomena Magalhães[5]

Pool refuges are critical for maintaining stream fish diversity in increasingly intermittent streams. Yet, the patterns and drivers of beta diversity of native and non-native fish in pool refuges remain poorly known. Focusing on Mediterranean streams, we decomposed beta diversity of native and non-native fish into richness difference (RichDiff) and species replacement (Repl), and local (LCBD, LCBDRichDiff and

LCBDRepl) and species (SCBD) contributions. We assessed the influence of environmental and spatial factors associated with drought and damming fragmentations on beta diversity components and LCBDs, and of local species richness and occupancy on LCBDs and SCBD, respectively. Overall, non-native species showed a more limited occupancy of pool refuges than native fish. RichDiff dominated beta diversity, though it was influenced by drought and damming fragmentations for native fish and local environment for non-native fish. Repl for native fish was slightly influenced by local environment, but for non-native fish was largely driven by drought and damming, albeit with a contribution of local environment as well. LCBD and LCBDRichDiff increased in pools in low order streams for native fish and at low elevations for non-native fish, and with high or low species richness. SCBD was higher for native species with intermediated pool occupancy, but for non-native species with low occupancy. Our results suggest that stream fragmentation may drive native species loss and non-native species replacement in pool refuges, and that environmental filtering may shape non-native species loss. Pools in lower order streams harbouring unique species-rich or species-poor assemblages should be prioritize for conservation and restoration, respectively, and pools at low elevation with unique non-native assemblages should deserve control efforts. We encourage the partitioning of beta diversity and individual analysis of native and non-native fish in intermittent streams, which may be key in stressing the importance of pool refuges in safeguarding native fish diversity.

1: Centre for Ecology, Evolution and Environmental Changes, Portugal
2: MARE – University of Lisbon, Portugal
3: Natural History Museum, University of Lisbon, Portugal
4: Centre for Research on Biodiversity and Environment, France
5: University of Lisbon, Portugal

Catchment-scale eDNA sampling reveals no evidence for negative effects of beaver recolonisation on the distribution of migratory fish

James A Macarthur[1], Alan Law[2], Nigel Willby[2], Dasha Svobodova[1], Nathan P. Griffiths[1], Roo Campbell[3], Martin J. Gaywood[3], Colin W. Bean[3], Lori Lawson Handley[4], Melanie Smith[5], Shaun Leonard[6], Chris Conroy[5], Victoria L. Pritchard[1] & Bernd Hänfling[1]

Reintroduction of keystone species is considered part of the solution to the current biodiversity crisis. The Eurasian beaver (*Castor fiber*) is one such species, shaping its habitat by felling trees, building dams and creating wetlands. However, while the potential benefits to aquatic biodiversity and ecological functioning have been studied on a local scale, the impacts of beavers on catchment-scale processes such as fish migration remain understudied. Sequencing of environmental DNA (eDNA metabarcoding) from water samples is a cost-effective method to study species distributions across large geographical scales. Here, eDNA samples (n=426) were collected from 142 sites across the UK's oldest and largest established wild beaver

population, located on Tayside, East Scotland, and analysed using a vertebrate specific metabarcoding assay. We combined presence/absence data from eDNA results with other environmental and anthropogenic variables to model the effects of beaver presence on the distribution of three migratory fish species. Using generalised linear models, we found no effects of the current beaver presence on the distribution of Atlantic salmon or lamprey, but a positive co-occurrence with European eel at the catchment scale. The models were also consistent with previous findings on the impact of barriers to migration and other abiotic and biotic factors on fish species, demonstrating the effectiveness of eDNA sampling in rivers for understanding species distributions at a catchment scale. This case study provides novel insights towards the co-distribution of beavers and migratory fish, and highlights how catchment-wide eDNA monitoring can be applied by environmental managers to aid decision-making and impact assessment more generally.

1: University of Highlands and Islands
2: *University of Stirling, UK*
3: NatureScot, UK
4: CEH, UK
5: Atlantic Salmon Trust, UK
6: Wild Trout Trust, UK

The use of fish communities to monitor and assess estuarine environmental quality

Michael McNeill[1], Trevor Harrison[1] & Gordon Gilmour[1]

The Department of Agriculture, Environment, and Rural Affairs (DAERA) carry out annual estuarine fish surveys, which contribute to the assessment of ecological status under The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. Fish are one of the key biological elements required in the assessment of transitional waters. The fish community of each transitional water is sampled using a variety of methods, including seine netting, fyke netting and beam trawling. This multi-method approach is designed to ensure that representative habitats and species are sampled within each estuary. The ecological status of the fish community captured within each system is assessed using the Estuarine Multi-metric Fish Index (EMFI). The EMFI comprises a balanced and complimentary set of 14 metrics that represent four fish community attributes: species diversity and composition, species abundance, estuarine utilisation, and trophic composition. The use of fishes and the EMFI as a monitoring tool is demonstrated through its application to the Lagan Estuary over the period 2010 to 2024. The Lagan estuary is a heavily modified system which flows through the urban development of Belfast City before discharging into Belfast Harbour. The fish community is sampled annually during the autumn (September/October). The EMFI results indicate that the fish community is typically situated at the good/moderate boundary, reflecting its highly urbanised condition. Several declines in EMFI status have been reported over the monitoring period and these can be linked to various activities and episodes within

the system such as dredging works, pollution incidents, and extreme weather events. By integrating environmental conditions at both spatial and temporal scales, fish communities provide an effective method of assessing overall ecological status.

1: Department of Agriculture, Environment, and Rural Affairs, UK

Impact of future climate change on the Irish Sea ecosystem.

Niamh P.G Esmonde[1], Caroline Mckeon[2], Steven Beggs[1], Ruth Kelly[1], Francisco de Castro[1].

Sustainable use of the marine environment is needed both to protect existing marine biodiversity and to continue to benefit from it. Here we use Mizer, a size-based food web model based on ecological theory for multi-species stock assessment and understanding how increasing temperatures and exploitation could impact the Irish Sea ecosystem. Projections from RCP emission scenarios predicted faster reproduction and growth rates for all fish species, compared to the scenario without warming. However, this did not translate to higher yields as lower carrying capacities resulted in the decline in abundance of larger fish and hence spawning stock biomass. Our findings suggest that increasing temperatures caused by climate change will have detrimental effects on biomass production, size-structure and potential yields of marine fishes. The development of this model provides a useful tool for communicating complex ecosystem impacts to stakeholders and ultimately informing an ecosystem-based approach to marine management.

1: Agri-Food and Biosciences Institute (AFBI), Belfast, Northern Ireland, UK
2: School of Zoology, Trinity College Dublin, Dublin, Ireland

Measuring Management Intensity of State-Managed Marine and Coastal Fisheries along the Southeast and Gulf Coasts, USA

Apria N. Valenza[1] & Frederick S. Scharf[1]

The Southeast and Gulf coasts of the US are home to many popular marine and coastal fisheries. So popular, in fact, that in the late twentieth century, these fisheries were faced with high levels of fishing mortality and low biomass. By the early 2000s, many states, as well as the federal government, updated their harvest control rules, fishing regulations, and even management structure to better manage these important stocks. Fast forward to today, and while some of these regional stocks have recovered, others are still struggling. In North Carolina, to strengthen the management process and conserve coastal fishery resources, the NC State Legislature passed the Fisheries Reform Act (FRA) in 1997. This act included several policy changes and mandated the creation of fishery management plans (FMPs) for state-managed species. It was passed with hopes that updates to the management structure would improve stock status. After almost 30 years since the adoption of the FRA, we asked whether North Carolina's fisheries are healthy and well-managed? To

answer this question, we developed the "Index of Management Intensity" (IMI) to quantify variation in regulatory tactics, management thoroughness, and the flexibility of management to effectively adapt to changes in stock conditions and fishery execution. The IMI was applied through time to North Carolina's 13 state-managed coastal fisheries, as well as to the same fisheries in the Chesapeake Bay, South Carolina, Georgia, Florida, Louisiana, and Texas. Findings revealed that the management intensity for North Carolina's fisheries has been steadily increasing since the adoption of the FRA. Additionally, North Carolina has the highest average management intensity score in recent years, compared to all other states and regions. The Chesapeake Bay and Louisiana are the next two regions that also have high management intensity scores. Common attributes leading to higher management intensity include the presence of routine stock assessments, FMPs, performance indicators and/or adaptive management strategies, and consistent updates of harvest control rules and regulations.

1: University of North Carolina Wilmington, USA

Fine-scale seasonal movements of invasive chain pickerel (*Esox niger*) and smallmouth bass (*Micropterus dolomieu*) in the last remaining habitat of Endangered Atlantic whitefish.

Ava Sergio[1], Jeremy Broome[2], Morgan Piczak[1], Liza Tsitrin[2], Andrew Breen[3], Hugo Flávio[1] & Robert Lennox[1]

The wild Atlantic whitefish (*Coregonus huntsmani*) population persists in just one watershed on Earth, in Nova Scotia, Canada. Despite being one of the first species protected under Canada's Species at Risk Act (SARA) in 2003, they remain Endangered. The species' rarity has resulted in scarce observations and documentation of wild individuals, limiting knowledge regarding the habitat requirements of Atlantic whitefish. The once abundant Atlantic whitefish population supported recreational freshwater and marine fisheries in Nova Scotia. Improved understanding of the species' habitat dynamics is essential for their recovery and re-instating recreational fisheries. One of the top threats to Atlantic whitefish is predation and competition with invasive chain pickerel (*Esox niger*) and smallmouth bass (*Micropterus dolomieu*). Both voracious predators alter community structure by reducing the diversity and the abundance of native species in Nova Scotian watersheds. In this study, we aim to determine the seasonal movements of chain pickerel and smallmouth bass and identify critical lake habitat for Atlantic whitefish. In 2018, 18 chain pickerel and 12 smallmouth bass were tagged with acoustic transmitters and their movements within the watershed were tracked for 11 months. In 2024, 89 captive-bred adult Atlantic whitefish were tagged with acoustic transmitters and released into the same watershed in spring and fall with data retrieval in May 2025. High-resolution positioning data was obtained using a VEMCO Positioning System (VPS) and analysed using a resource selection function. Preliminary results show distinct temporal patterns in space and depth use between chain pickerel and smallmouth bass, indicating that high-risk areas for Atlantic whitefish change throughout the year. The fine-scale movement data collected for

Atlantic whitefish will help improve the current description of critical habitat and support the effective implementation of the SARA recovery strategy to prevent the wild extinction of one of Canada's most endangered fishes.

1: Dalhousie University, Canada
2: Department of Fisheries and Oceans, Canada
3: St Mary's University, Canada

Development of an AI-Based Fishery Monitoring System for Electric Monitoring of Fishing vessel in Korea

Jung Hwa Choi[1] & Kyonghoon Lee[1]

Fishery resources are declining globally, primarily due to overfishing. This issue is significant in South Korea, where the depletion of fish stocks raises concerns about sustainability and effective resource management. Preventing overfishing is crucial for more efficient management of fishery resources. Strategies include regulations against illegal fishing, a fishing quota system, and an observer system, which involves authorized observers boarding fishing vessels to assess Total Allowable Catch (TAC) status.
However, implementing the observer system requires substantial funding and qualified personnel, making it challenging. An innovative solution is the use of AI observers, which can recognize, identify, and measure fish species using cameras, overcoming the limitations of traditional observers. In this study, we developed AI(Artificial Intelligence) learning data for TAC target species and designed AI observers for fishing boats and landing areas.
CCTV cameras were used to collect data for developing algorithms for fish species recognition and catch estimation on fishing boats, while action cameras helped identify optimal installation locations. To create an algorithm that accounts for various fishing methods and species, cameras were strategically placed to determine the best positioning.
The performance of fish species recognition was evaluated using a CNN(Convolutional neural network)-based object recognition model applied to the collected images. Results showed that, except for the camera positioned at the starboard view, the recognition rate for all other cameras averaged over 95%.

1: Pukyong National University, Korea

Assessing the status of rare fish in deep lakes: a case study of vendace (*Coregonus albula*) and European whitefish (*Coregonus lavaretus*) in the UK

Ruaidhri Forrester[1], Hannele M. Honkanen[1], Jim Lyons[2], Ian J. Winfield, Colin W. Bean[1], Melanie Fletcher[3], Chris Harrod[1], Bernd Hänfling[4], Dave Ottewell[3], Philip Ramsden[2], Colin E. Adams[1]

Vendace (*Coregonus albula*) and European whitefish (*Coregonus lavaretus*) are common and commercially important in the catchments that drain to the Baltic Sea. In the UK, in contrast, these species are vulnerable, exceptionally rare, protected and carefully monitored. The implementation of monitoring is complex; the established technique of high-intensity gill netting is destructive and there are no fisheries data for analysis. Instead, bespoke approaches are required. Here, we share efforts to determine the current UK distribution and status of these two nationally endangered lacustrine fishes. First, we describe eDNA metabarcoding of 33 UK lakes with a record of either vendace or European whitefish. In doing this we provide a comprehensive history of UK records of these species as well as evidence of their current distribution. Then, we outline recent assessments, conducted using quantitative hydroacoustics underpinned by limited gill netting, of the only two remaining native vendace populations in the UK. We set these assessments in the context of long-term monitoring data to provide evidence of persistence and recovery despite the threats that these populations face. Our results demonstrate that by using a range of complementary techniques these difficult-to-sample species can be effectively assessed.

1: University of Glasgow, UK
2: Environment Agency, UK
3: Natural England, UK
4: University of Highlands and Islands, UK

TUESDAY PM - Understanding Fish Habitat Dynamics

Navigating Urban Streams: How Cities Transform Fish Communities Over Time

Mark Poesch[1] & Sebastian Theis[1]

Urbanization significantly impacts aquatic ecosystems by altering species composition, often displacing native species and promoting non-native, disturbance-tolerant species. This study utilizes a decadal fish dataset (1971-2010) from 16 subwatersheds within three watersheds in the Greater Toronto Area to investigate changes in fish communities over time. We focused on three species assemblages: native species only, non-native species only, and all species combined. Additionally, we assessed the complexity and spatial structuring of fish communities across urbanized watersheds, using modularity analysis and partial least square path modelling to identify distinct groups based on sampling locations. Three key environmental variables—catchment area, distance to species pool, and urban cover—were considered to determine their effect on species richness. Our findings reveal that while total species richness increased over time, native species richness declined, whereas non-native species richness increased. Native fish exhibited higher nestedness, indicating a more stable and interconnected community, whereas non-native fish became more patchy and less predictable. We also identified three distinct community groups: (1) less urbanized areas with species exhibiting intermediate

tolerance to urbanization, (2) diverse nearshore habitats influenced by varied environmental conditions, and (3) highly urbanized areas dominated by disturbance-tolerant species. The results underscore the importance of understanding how urbanization shapes fish communities and highlight the need for tailored watershed management strategies that consider both habitat availability and species traits. Long-term monitoring and adaptive management approaches are essential to effectively conserve aquatic biodiversity in urbanized regions.

1: University of Alberta, Canada

Warming Waters, Changing Behaviours: How Brown Trout Respond to Heatwaves in a Changing Climate

James Barry[1]

Climate-driven heatwaves are increasingly altering freshwater ecosystems, yet the behavioural responses of cold-water fish in lake environments remain poorly understood. Warming lake water temperatures and resulting changes in stratification can restrict thermal habitat for cold water species. In this study, we utilised acoustic telemetry data paired with high-frequency environmental data to investigate the movement patterns of brown trout (Salmo trutta) during the summer months of 2023 and 2024 in Lough Sheelin, a relatively shallow lake (mean depth 4.4m max depth 15m). A key aim was to understand how individuals respond to thermal stress and how their depth use and movement patterns change during heatwave events. In 2023, an intense heatwave (DOY 155–178) resulted in surface water temperatures exceeding 20°C (lake floor to surface) and a significant contraction of suitable oxythermal habitat available for trout. During high-temperature periods, brown trout consistently occupied deeper water and exhibited movements to thermal refugia. However, despite the more severe thermal conditions in 2023, trout exhibited slightly higher daily displacement during high-temperature periods (mean: 5.74 km/day) compared to 2024 (5.05 km/day). This suggests that movement may not be suppressed under heat stress but instead may reflect increased searching behaviour for suitable habitats within a compressed oxythermal window. These findings demonstrate that both the intensity and duration of heat waves can drive significant shifts in depth use and activity, with potential behavioural consequences even after surface conditions improve. Understanding these patterns is critical for predicting species resilience under future climate scenarios and for informing management strategies aimed at protecting thermal refugia and mitigating the impacts of heat stress on cold-water fish populations.

1: Inland Fisheries Ireland, Republic of Ireland

Comparison of survival, behaviour and return rates of sea trout smolts across Irish coastal rivers.

Richard Kennedy[1], Robert Rosell[1] & Dennis Ensing[2]

Acoustic telemetry has enabled fish biologists to effectively investigate the behaviour, phenology and survival of migratory fish species, providing essential background knowledge for fishery managers. Anadromous Salmo trutta (sea trout) smolts can display significant variability in subsequent life-history decisions, with some individuals returning to freshwater after only a few months at sea (finnock). In total 344 sea trout were acoustically tagged between 2018-2024 across eight different coastal rivers around N. E. Ireland, inclusive of systems entering sea Loughs and some entering directly to sea on the open coast. Survival of tagged smolts from river to sea was highly variable between rivers, ranging from 37% to >90%, with lower survival consistently recorded from rivers entering sea loughs such as Strangford Lough. In total 43 post-smolts returned to freshwater as finnock with 30 (70%) returning to their natal stream and 13 (30%) detected in a different river. Based on smolts which successfully reached the sea the subsequent return rates of finnock, re-entering freshwater after 2-4 months at sea, tended to be higher for open coast rivers (20%) and lower for rivers entering sea loughs (8%). A range of individual biological characteristics were explored to determine which, if any, potentially explained the variation in seaward survival and finnock return rate. The management implications of this work were discussed.

1: Agri-Food and Biosciences Institute (AFBI), Belfast, Northern Ireland, UK
2: Department of Agriculture, Environment, and Rural Affairs, UK

Effects of Artificial Light on European Glass Eel (*Anguilla anguilla*) Movement Behaviour and Passage Success

Benjamin Bluck[1], Paul Kemp[1], Andrew Vowles[1], Jonathan Whitmore[2], Andy Don[3], Perikles Karageorgopoulos[3] & Alex Scott[4]

Anguillid eels are predominantly crepuscular and nocturnal, and considered negatively phototactic. However, this phototaxis can vary in both kind and degree by species and lifestage. As a result, there is potential for humans to inadvertently impact important aspects of eel behaviour, for example impeding or delaying movement at river infrastructure that creates unnatural light gradients. Conversely, how eels respond to light could be exploited by humans, for example lamping, the use of light to attract animals, remains a widely used method of eel fishing. To better inform eel conservation and management we need to understand how they respond to various characteristics of artificial light. We initially investigated behavioural response of critically endangered European glass eel (*Anguilla anguilla*) to light in a still-water tank, where eel passed from a light or dark start zone through a light gradient to an oppositely lit zone. Here we found that glass eel display a general aversion to light, and engage in more erratic movement behaviour in the presence of light. However, the brightness of the light used (measured in lux) had little to no effect on eel behaviour. Preliminary results from a second study, investigating glass eel

passage success and movement behaviour through a lit and/or shaded treatment zone in upstream flow within a recirculating flume, will also be discussed. Further research is needed to better understand these behaviours within a more applied context, e.g. in the field, in order to help inform methods of mitigating the potential impacts of artificial light and infrastructure on glass eel populations.

1: University of Southampton, UK
2: JBA Consulting, UK
3: Environment Agency, UK
4: JBA Trust, UK

Leaping to Conclusions: Context-Dependent Behavioural Responses of Juvenile Atlantic Salmon to River Barriers

Ellen J. Dolan[1], Gareth Arnott[1], Jaimie T.A. Dick[1], Ross N. Cuthbert[1]

Freshwater biodiversity is increasingly threatened by global stressors, with habitat fragmentation being a primary concern. In recent decades, the reconnection of fragmented rivers through the removal of artificial barriers (such as dams and weirs) has gained momentum, largely driven by conservation efforts focused on Atlantic Salmon (*Salmo salar*). This study experimentally examined the context-dependent responses of salmon parr to novel obstacles. Using semi-natural mesocosms with a multi-factorial treatment design, we tested two common barrier types—v-notch and vertical weirs—alongside ecological cues resembling 'risk' and 'reward': a model predator (seagull) near the barrier and a food source (INICIO® pellets) upstream in a mesh bag. Behaviours displayed by the fish were recorded, including the number, latency, and duration of approaches, assessments of the barrier, attempts to cross, and successful crossings. Results show that the presence of either barrier type significantly reduced the likelihood and total number of successful crosses and significantly increased the duration of time it took for them to cross the middle of the tank. The total number of crosses of the v-notch barrier were significantly lower than the vertical barrier. While the presence of a food source did not significantly affect any behaviour, predator presence significantly reduced probability to approach and assess barriers. Our findings highlight the nuanced and context-dependent nature of juvenile salmon behaviour in fragmented systems. Understanding these responses is essential for designing effective restoration strategies that support salmon throughout their entire life cycle.

1: Queen's University Belfast, UK

Spatial Patterns of Juvenile Atlantic salmon (*Salmo salar*) and Brook trout (*Salvelinus fontinalis*) in Canadian Rivers

Paris Mastrodimitropoulos[1], Morgan Piczak[1], Alex Bevilacqua[1], Hugo Flávio[1], Keila Miller[2], Hannah Murnaghan[3] & Robert Lennox[1]

Salmonids of Prince Edward Island (PEI), Canada have historically been subjected to overexploitation, habitat degradation and pesticide runoff, leading to major declines in their populations over time. Local restoration efforts have focussed on the protection of spawning and rearing grounds where Atlantic salmon (*Salmo salar*) and Brook trout (*Salvelinus fontinalis*) are produced. One of the key knowledge gaps regarding freshwater production of salmonids is the lack of understanding surrounding their fine-scale habitat use at a sub-reach scale, which is crucial for designing effective conservation strategies. Microacoustic transmitters (0.2g) are now available to track salmonid parr and investigate their movements, providing valuable insights for production models and habitat management. Additionally, remote sensing drones are increasingly being used to investigate riverine environments. In collaboration with the PEI Branch of the Canadian Wildlife Federation and the Morell River Management Cooperative, over 100 salmon and trout parr were tagged with Lotek Pin Tags and tracked in high resolution in North Lake Creek and Morell River to better understand their movements. Both rivers were also surveyed with an aerial drone (DJI Mavic 3T) to assess their habitat types. By integrating movement data with these habitat assessments, we aim to enhance our understanding of parr movement through their freshwater habitats, with the goal of improving conditions for salmonid production and resilience to human-induced changes.

1: Dalhousie University, Canada
2: Souris and Area Branch of the PEI Wildlife Federation, Canada
3: Morell River Management Cooperative, Canada

Studying fish traits along latitudinal gradients

Martha Patricia Rincón-Díaz[1], Pablo Merlo[1], Gastón Trobbiani[1], Mauro Marcinkevicius[2] & Alejo Irigoyen[1]

In the context of global change, reviewing the relationships between marine fish traits and their range shifts is required to (1) identify ecological generalizations regarding the influence of traits on range shifts at a global scale and (2) investigate the rationale behind trait inclusion in models describing those relationships. We systematically searched for studies on marine fish assemblages that identified distributional shifts and analyzed the relationship between fish traits and these shifts. We reviewed 29 papers and identified 11 shift type characterizations and 41 traits, noting significant variation in measurement methods and model types used to describe their relationships. We identified global trait redundancies in the relationship between fish traits and latitudinal range shifts. These trends are related to the fishes' latitudinal range, trophic level, water column habitat, body size, size-at-settlement, growth rate, and larval swimming ability. The first four traits, along with fish bottom habitat, biogeographic affinity, diet, and thermal affinity, also showed significant relationships across four ways to characterize horizontal range shifts of fish species. The significance of these traits suggests their relevance in range shifting, regardless of the analyses conducted, biogeographic realm, and range shift type. However, trait

redundancies require further consideration, mainly because some traits show opposing relationships in different studies, and important biogeographic research gaps limit global generalizations about the trait–range shift relationship. Half of the studies analyzed provided a rationale for 23 out of 41 traits. We also provide guidelines for future work to better understand the influence of traits on fish range shifts.

1: CESIMAR, CONICET CENPAT, Argentina
2: National University of Patagonia, Argentina

Analysing trends in long-term data from Atlantic salmon populations over multiple geographic scales.

Phoebe Kaiser-Wilks[1], Colin Adams[1], Jessica Rodger[1] & Jon Emery[2]

Atlantic salmon (*Salmo salar*) populations have faced significant declines over the past decades, driven by multiple factors such as habitat degradation, hydropower regulation, disease, pollution, and climate change. These pressures pose a threat to both the ecological balance of freshwater and marine environments, and the cultural and economic importance of salmon across their distribution. This research will investigate the long-term trends of Atlantic Salmon populations across the North Atlantic, using data from the Working Group on North Atlantic Salmon covering a period from the 1970s to the 2020s. Using different statistical approaches including generalised additive models and spatial analysis of telemetry data, I aim to identify drivers behind these population changes.
The study will focus on comparing populations from both the eastern and western Atlantic, then focusing on a fine scale on Scottish rivers. I will aim to assess these trends on a variety of spatial scales. I will also aim to examine the impact of variation in environmental factors such as water temperature, habitat connectivity, and anthropogenic activities on salmon migration and populations. These findings will underscore the importance of integrated, multi-scale approaches in developing effective strategies for the protection and restoration of Atlantic salmon populations, supporting broader efforts to preserve aquatic biodiversity.

1: University of Glasgow, UK
2: Atlantic Salmon Trust, UK

Ecological Change and Reduced Pollan (*Coregonus autumnalis*) Recruitment in Lough Neagh

Kevin Gallagher[1], Adele Boyd[1] and Harry Teagle[1].

Pollan (*Coregonus pollan*), a glacial relict and IUCN-listed vulnerable species, persists in only a handful of Irish lakes, with Lough Neagh representing its largest remaining habitat. Long-term ecological monitoring of the lake has revealed major structural changes in recent years, including a sustained decline in chlorophyll a concentrations and a marked increase in water clarity. These changes are likely

closely associated with the proliferation of invasive zebra mussels (*Dreissena polymorpha*), which have likely altered nutrient cycling and pelagic resource availability through filter feeding. Concomitantly, there have been significant declines in two key invertebrate prey groups—chironomid larvae and *Mysis salemaii*.—which are critical to the diet of Pollan. While larval surveys indicate successful spawning continues, fry surveys consistently show very low abundance, suggesting a failure in early survival or recruitment. Fish stock assessments further support evidence of a population under stress. These findings illustrate how multiple, interacting ecological pressures—particularly invasive species and reduced food availability—can drive functional collapse in a native fish population, with important implications for conservation policy and fisheries management.

1: Agri-Food and Bioscience Institute, UK.

Head Shape Bimodality in European Eel: Consequential Impact on Fat Accumulation, Ontogenetic Development and Spawning Likelihood across the Broadhead Ecotype

Niamh Heatley[1,2], Derek W Evans[1], Jon Houghton[2]

European eel (*Anguilla anguilla*) is an economically relevant species supporting two large fisheries in Northern Ireland. Its continental range and complex semelparous, catadromous lifecycle present challenges for stock recovery and management. The 'yellow eel' growth stage exists as two ecotypes with differing morphology and trophic ecology: broadhead and narrowhead. Fat content is an important factor in triggering the 'silvering' process and onset of migration to spawning grounds in the Sargasso Sea. Broadhead reproductive potential is questioned due to their depleted fat profiles resulting from their piscivorous, proteinaceous diet. This study investigated how diet affected fat accumulation, growth, and ontogeny between yellow eel ecotypes in Lough Erne, Northern Ireland. Stomach contents revealed a higher fish proportion in broadhead diet. Broadheads had significantly lower fat content and were older than sympatric narrowheads. Most broadhead individuals were older than the mean age of silver eels migrating from the Erne (18±5), yet contained fat reserves below the levels required (16- 20%) to trigger silvering and migration. Results suggest that broadheads silver, migrate and spawn under a different timeframe to narrowheads which stock management is based on. These findings highlight the need to incorporate ecotype ontogeny into silver eel escapement models and stock recovery targets.

1: Agri-Food and Bioscience Institute, UK.
2: Queen's University Belfast, UK

Escapement and inshore movements of chalk stream silver eels Anguilla anguilla in Southern England

Sibusisiwe Moyo[1], Thomas Major[1], Ros Wright[2], Tea Basic[3], Peter Davies[4], Emma Sheehan[4] & J. Robert Britton[1]

The catadromous European eel *Anguilla anguilla* is assessed as critically endangered on the IUCN Red List, with knowledge on silver eel escapement from freshwaters and their subsequent inshore movements and behaviours fundamental to understanding the threats during this part of their lifecycle. To assess their escapement, and inshore movements and behaviours, 25 silver eels were implanted with acoustic transmitters (with a pressure (depth) sensor attached) in the upper River Test, England in November 2023. Their in-river and inshore movements were then tracked on acoustic receivers. There were 15 eels detected as reaching the downstream limit of the river, taking between <0.5 and >25 days to emigrate, with this variation in emigration time not significantly related to eel length. All in-river detections and movements were at night, with differences in the speed travelled by eels between unobstructed reaches and reaches affected by barriers quantified. There were then 14 eels detected on receivers in the inshore areas of the English Channel, with the majority of eels only moving westwards and leaving the receiver array (approximately 80 km linear distance) within an average of 40 days. Detections were in the sea occurred across the 24 h cycle, with detection depths being up to 20 m in daylight but a little as 1 m at night. These escapement rates and movement patterns of this critically endangered species thus provides valuable insights into how silver eels initiate their spawning migration and identifies that even at this early stage, only a proportion of silver eels manage to emigrate out from their freshwater and inshore environments.

1: Bournemouth University, UK
2: Environment Agency, UK
3: Centre for Environment, Fisheries, and Aquaculture Science, UK
4: University of Plymouth, UK

Predicting European eel aggregations in a landlocked drinking water reservoir

Michael J. Williamson[1,2,3], David Jacoby[4], Jack Brand[1,5], Rosalind Wright[6] & Adam Piper[1,2]

Aggregations are found across multiple fish species, for spawning, mating, foraging and refugia. These aggregations are often driven by specific environmental conditions, but can also be driven by active social preferences. Multiple anguillid eel species have been found to aggregate but the spatial and temporal drivers of these aggregations are poorly understood. Here, we use high resolution acoustic telemetry data and social network sampling in combination with generalised additive models to assess the spatial and temporal distribution, and environmental drivers, of European eel (*Anguilla anguilla*) aggregations in Abberton reservoir, Essex, UK, a landlocked drinking water reservoir, over four seasons from September 2023 to August 2024. These models were used to inform seasonal predictions of the location and size of European eel aggregations at this site. Despite seasonal differentiation in the drivers of both aggregation location and size, water temperature, lunar cycle, time of day, and distance to and max rate of inputs were significant drivers of eel aggregations. European eel are listed as Critically Endangered and current regulations require increased escapement to the sea. Landlocked drinking water reservoirs hold significant populations of European eel, which are trapped in these systems and

cannot migrate to complete their breeding cycle. Prediction of eel aggregations could be utilised to optimise management methods, such as 'Trap and Transport', to increase escapement from these systems and hit policy targets.

1: Zoological Society of London, UK
2: University College London, UK
3: University of Exeter, UK
4: Lancaster University, UK
5: Swedish University of Agricultural Sciences, Sweden
6: Environment Agency, UK

Hot 'Tuna' Summer: The spatial ecology of Irish Atlantic bluefin tuna (Thunnus thynnus)

Grace McNicholas[1], Nicholas Payne[1]& Catherine Waters[2]

In the last 10 years Atlantic bluefin tuna (*Thunnus thynnus*) (ABFT) have reestablished historic foraging grounds in Ireland after disappearing for almost a decade due to global overexploitation. Currently Ireland has no quota for ABFT, however, a recreational catch-and-release fishery has been in operation since 2019. Understanding the movements of ABFT is necessary to appropriately interpret their responses to fishing pressure and environmental changes. To explore the spatial ecology of Irish ABFT, we used two datasets (1) pop-up archival satellite tagging (PSAT) data and (2) reported catch-and-release fisheries data. We used a range of modelling techniques, including presence/absence data simulated by correlated random walks coupled with a suite of environmental data to produce Atlantic scale habitat suitability predictions, as well as kernel utilization distribution modelling to investigate fisheries patterns around Ireland. We then explored the role of temperature on both the horizontal and vertical movements of ABFT. PSAT data shows several individuals travelled to latitudes as far north as the Norwegian Sea in response to warming events, indicating the impact climate change may have on occurrences around the Irish coast. Diving patterns were also influenced by sea surface temperature, with fish diving significantly deeper in winter months. Furthermore, seasonal size differences and catch rates provide additional perspective on the importance of temperature on the catch-and-release fishery in Ireland. Our findings are pertinent to future fisheries management decisions, particularly with regards to the timing and locations of the catch-and-release fishery, as they indicate how ABFT distributions in Irish waters may be impacted by a warming climate.

1: Trinity College Dublin, Ireland
2: Marine Institute, Ireland

Inferring ecological processes supporting endemic fish diversity structure in a biodiversity hotspot

Rohitashva Shukla[1], Ada Fontrodona-Eslava[1], Vidyadhar Atkore[2] , Anuradha Bhat[3], Neelesh Dahanukar[4], Jeyaraj Antony Johnson[5], Rajeev Raghavan[6], Maria Dornelas[1], Anne E. Magurran[1] & Kartik Shanker[7]

Endemic fishes that are unique to biodiversity hotspots are severely threatened and facing extinction crisis in Anthropocene. This crisis is even more serious in tropical hotspots where conservation resources are comparatively limited. No biodiversity management strategy is effective unless the processes that sustain diversity are maintained. Therefore, understanding how endemics participate in regional spatial processes that support overall diversity structure at macroecological scale is an important step for better conservation planning. To address this, we developed a novel fish occurrence and morphological trait dataset for the freshwater fishes of the Western Ghat Escarpment (WGE). We suggest that these endemic species can be classified using a framework defined by the taxonomic and functional diversity and can help revealing how they drive spatial homogenization and differentiation processes. We found that widespread, trait distinct endemics are disproportionately present in west-flowing basins of the WGE where they promote taxonomic homogenization and functional differentiation. While in east-flowing basins, the lower richness of the same group fosters taxonomic differentiation and functional homogenization. We attribute this heterogeneity to western-flowing basins having 1) higher ecosystem productivity that supports trait distinctiveness, and 2) temporary lateral connectivity that facilitates fish dispersal among the river basins. Our study highlights that different dimensions of diversity interact to produce regional diversity structure and underlines the importance of understanding fundamental ecological processes that maintain this structure. This integrated diversity framework has application in conservation and policy, and can guide global efforts to protect endemic biodiversity in hotspots.

1: St Andrew's University, UK
2: SACON, India
3: Indian Institute Of Science Education And Research Kolkata, India
4: Shiv Nadar University, India
5: Wildlife Institute of India, India
6: Kerala University of Fisheries and Ocean Studies, India
7: Centre for Ecological Sciences, Indian Institute of Science, India

Systematics and biogeography of Middle American Rhamdia (Siluriformes: Heptapteridae)

Jairo Arroyave[1]

Neotropical catfishes of the genus *Rhamdia* are divided into cis- and trans-Andean/Middle American (MA) reciprocally monophyletic components, the latter notable for its considerable cave-dwelling diversity. Uncertainties remain regarding the systematics and biogeography of the MA clade. This contribution presents recent

progress in our understanding of the evolutionary history of this clade as a result of phylogenomic studies based on complete mitochondrial genomes and genome-wide SNP data. Results corroborate this clade as divided into two reciprocally monophyletic groups: a clade representing the widespread species *R. guatemalensis* and a clade consisting of the remaining MA species. Results also corroborate the notion that *R. laticauda* is deeply paraphyletic and that phylogenetically scattered geographic lineages of this taxon could represent different species. Divergence time estimates coupled with present-day distributions support the biogeographic scenario in which northward dispersal and colonization of Central America and southern North America by *Rhamdia* was catalyzed by the emergence of the Panamanian Isthmus and stream captures across Lower Central America. Cave colonization in MA *Rhamdia* is widespread, convergent, relatively recent, and most likely opportunistic, with established cave-dwelling populations possibly representing "evolutionary dead ends".

1: National Autonomous University of Mexico, Mexico

Local adaptation in Baltic cod; Insights from early development

Maddi Garate Olaizola[1]

Atlantic cod (Gadus morhua) lay pelagic eggs that must be buoyant to develop. Baltic cod, phenotypically and genetically distinct from Atlantic cod, are uniquely adapted to the brackish Baltic Sea. Eggs from the eastern Baltic stock are buoyant at >14-15 psu, salinities found only in the south and central Baltic Proper, their historical spawning grounds.
However, laboratory experiments have shown that some Baltic cod eggs can develop at salinities as low as 7 psu, with a high survival rate at 9 psu. This environment exists in the northern Baltic Proper, in the Åland Sea, where cod are large, healthy, and in breeding condition. Yet, eggs from both northern and southern populations are negatively buoyant at these salinities, raising the questions: i) are northern cod better adapted to low salinity and ii) have they developed demersal spawning?
This study examined whether the northern population is better adapted to northern conditions than the southern population. We assessed larval survival and neutral buoyancy after incubation at 17 psu (control), 9 psu, and 7 psu, expecting northern cod to outperform southern cod showing higher survival at low salinity and more buoyant larvae. Additionally, we tested whether Baltic cod eggs hatch from sediment. Results show a decrease in survival rate at the lowest salinity treatment, but equally between the two populations. Neutral buoyancy differs between the salinity treatments but not between the populations, suggesting that larvae from both populations show similar physiological responses to the salinity decrease. Interestingly, northern eggs hatched from sediment but so did southern eggs, without differences from the control (non-sediment) treatment. These results do not support the hypothesis of local adaptation to the northern Baltic environment and thereby a divergence between the two populations, but do not discard the possibility of cod being able to reproduce outside what is considered the historical spawning ground.

1: University of Uppsala, Sweden

Mitigating the impacts on and of long-term scientific surveys by MPAs and Offshore renewable energy developments – Why and How?

Pia Schuchert[1]

The loss of long-term scientific survey areas due to the installation of offshore renewable energy (ORE) sites and the introduction of Marine Protected Areas (MPAs), 30% by 2030 in UK waters, many preventing survey access, and the resulting impact on fisheries assessments, has been largely overlooked in site planning to date. While ORE site installation may temporarily disrupt their host ecosystems, long term shifts of species abundances may also result; the same applies for MPAs.
While various site monitoring requirements are in place, most apply different scales and technologies which have not been calibrated against long standing data series. Research vessels (RVs) often cannot enter ORE sites, while MPAs prohibit the use of the traditional fishing gears and biomass extraction.
To monitor, assess and manage sustainable fisheries into the future, an understanding of stock/ population dynamics across the full species range is essential.
While efforts are made to establish enhanced monitoring strategies (e.g. remote vehicles, eDNA, smaller vessels and camera systems, etc.), the new monitoring technologies are not calibrated against long standing time series used for fisheries assessment.
Technologies such as video footage are promising but require substantial upscaling; MPA application of these systems must consider species inaccessible to video systems and the biological sampling requirement for to identify e.g. length, age, sex and maturity stage.
A workshop aimed at developing an ICES strategy to address ORE and MPA impacts on long-term scientific surveys was implemented, bringing together specialists in surveys, stock assessments, statistics, OREs, MPAs and policy making.
Here we highlight the workshop outcomes and provide an overview of the strategies and work going forward aimed at maintaining the provision of timely, accurate, and precise scientific advice to support fisheries and ecosystem management.

1: Agri-Food and Bioscience Institute, UK.

ETN-UK & Ireland; transitioning from local / regional telemetry initiatives towards a coordinated and efficient network

Jonathan Bolland[1]**,** Vivian Nguyen[2], Valerie Berseth[2] & Jan Reubens[3]

Over the past 20 years, technological advances in telemetry have transformed our ability to observe aquatic animal behaviour and movement. These developments are revolutionizing the scope and scale of questions that can be asked about the causes

and consequences of movement, which directly influence how we manage fish populations, anthropogenic pressures and entire ecosystems. The frequency and extent of telemetry projects in the UK and Ireland are increasing, but they typically happen under locally or regionally motivated initiatives. Hence, to achieve a bigger impact, a degree of centralisation, collaboration and coordination is necessary, which are core values of The European Tracking Network (ETN). To align tracking initiatives at a UK and Ireland level with the ETN, researchers actively performing aquatic animal telemetry research in freshwater and marine environments completed a survey about historic and current tracking projects. This was followed by a face-to-face workshop (University of Hull, February 2024) where a Three Horizons Framework was used as a future analysis approach and develop a roadmap towards greater telemetry impacts. This talk will reflect on the status of aquatic animal telemetry in the UK and Ireland, and the progress transitioning from local / regional telemetry initiatives towards a coordinated and efficient network of telemetry researchers and infrastructure.

1: University of Hull, UK
2: Carleton University, Canada
3: VLIZ, Belgium

Wednesday AM - Inclusive Outreach Strategies

KEYNOTE:
A wish list for fish: integrating climate change into Southern Ocean ecosystem-based fisheries management

Rachel Cavanagh[1]

Rachel's talk will give a broad look at work she has carried out identifying gaps, improving communication with policymakers, and translating science into policy – all through the lens of working with CCAMLR in the Southern Ocean.
Not only a physically challenging environment, in Antarctica there is an additional level of complication interfacing with policy too – as throughout the process of identifying challenges, exploring solutions and impacting policies, progress can only occur with the consensus of the 27 Member States.
Here - even with the best science and ideas in the world, changes cannot be made unless all Members agree.

1: British Antarctic Survey, UK

Bridge the knowledge gap, solidifying your storytelling leads to more robust and effective visual science outputs

Kirsty Bradley[1]

The sustainable management of fish affects several groups beyond the scientists exploring the intricacies of fish biology or stock assessment. Outcomes inform policy makers and decisions may affect stakeholders and the public. Specialists are inherently experts in a particular topic, but the need to share and communicate science across a variety of knowledge bases. Science encourages us to find as many pieces of that puzzle as possible to build the most complete picture we can on a topic but how do you distil so many pieces into a simpler image for a wider audience? This talk will underline foundation steps linked to key audiences to help distil key messages, solidifying your storytelling to cross the knowledge gap and effectively communicate fisheries science linked to visual science outputs.

1: Centre for Environment, Fisheries, and Aquaculture Science, UK

Integrating acoustic telemetry research into management: successes and challenges in the Laurentian Great Lakes

Natalie Klinard[1], Christopher Vandergoot[2*], Andrew Briggs[2], Connor Elliott & Matthew Faust[4]

In the Laurentian Great Lakes, a region characterized by a history of environmental degradation, the application of acoustic telemetry to track fish movements has evolved into an integral part of multi-jurisdictional management. Nevertheless, barriers remain in translating telemetry research into management or conservation actions. We synthesize acoustic telemetry literature within the Great Lakes basin to identify trends in research and management themes and explore factors that have contributed to successes and failures of integrating acoustic telemetry with the needs of decision-making processes. Direct collaboration between researchers and managers, facilitated by consistent opportunities for stakeholder engagement, stood out as one of the most effective ways to implement telemetry-derived knowledge into management. For example, 79% (95 of 127) of articles published (up to 2023) included co-authorship by both government and academic organizations. Case studies on three species characterized by different management needs (lake sturgeon *Acipenser fulvescens*, walleye *Sander vitreus*, and sea lamprey *Petromyzon marinus)* further highlight specific examples of how telemetry has informed management through collaborative engagement among researchers, stakeholders, and managers, as well as ongoing challenges. By exploring facets of acoustic telemetry research and connections to local and regional conservation and fisheries concerns, we identify pathways to reduce common knowledge-action gaps that persist in North America and Europe

1: Dalhousie University
2: Michigan State University
3: Queen's University, Canada
4: Ohio Department of Natural Resources
** deceased*

Bridging the Knowledge Gap: Inclusive Outreach Strategies for Enhancing Fish Welfare in African Aquaculture

Felix Nwose Onyeka[1], Jerimoth Kesena Ekelemu[1] & Francis Oster Nwachi[1]

Fish welfare is a critical yet often overlooked component of aquaculture, particularly in Africa, where rapid industry expansion presents challenges for ethical and sustainable farming practices. Many small-scale fish farmers face limited access to knowledge, financial constraints, and weak regulatory frameworks, leading to overcrowding, poor water quality, and stressful handling practices. These issues not only compromise fish health and productivity but also threaten farm profitability and sustainability.

To assess the extent of these challenges, we conducted a survey among 325 fish farmers across cluster farms in Southern Nigeria, revealing alarming gaps in fish welfare practices. 37.5% of farmers had never received any training on fish welfare, and 57.7% of those aware of fish welfare did not implement any related practices. Additionally, 50% of farmers admitted leaving dead fish in the pond, while 34.4% disposed of mortality in nearby streams, raising significant biosecurity concerns.

In response, we developed an inclusive outreach strategy to enhance fish welfare awareness and adoption through targeted training workshops, participatory extension programs, and culturally relevant educational materials. Demonstrations on cost-effective welfare improvements—including stress-reducing handling techniques, and improved water quality management—were conducted to encourage adoption. This approach also emphasized a One Health perspective, recognizing the interconnectedness of fish health, environmental sustainability, and human livelihoods.

Preliminary findings indicate that farmers who participated in structured welfare training reported higher fish survival rates, improved growth performance, and reduced disease outbreaks. Additionally, participant feedback underscored the need for continuous engagement and localized welfare guidelines.

By integrating inclusive outreach, participatory learning, and a One Health approach, this initiative demonstrates that fish welfare improvements are both practical and economically beneficial for smallholder farmers. Strengthening fish welfare awareness through collaborative knowledge-sharing frameworks is essential for fostering a more resilient, productive, and ethical aquaculture sector in Africa.

1: Delta State University, Nigeria

Perceptions and practices of fishers in inland water bodies of KwaZulu-Natal, South Africa

Ntandokayise Makhathini[1], Mathew J Burnett[2], Céline Hanzen[3], Mxolisi Nkomo[3] & Colleen T. Downs[2]

The governance of inland fisheries in South Africa is shaped by a diverse range of stakeholders, each deriving value from accessible water bodies. These fisheries include small-scale, commercial, subsistence, and recreational fishers, with recreational fishers having the dominant economic contribution. However, distinctions between subsistence, recreational, and small-scale fishing rights are unclear, leading to conflicts. Our study addressed the knowledge gap regarding economically significant fish species and their offtake based on fisher perceptions across the uMngeni and uThukela catchment management areas in KwaZulu-Natal, South Africa. A questionnaire-based interview was conducted with fishers between 2021 and 2023 across rivers and impoundments. Our findings revealed challenges in categorising fishers, particularly distinguishing subsistence from recreational fishers. This ambiguity is reflected in fishers' self-identifications and practices. Fishers' knowledge underscores the complexities of managing native (*Labeobarbus natalensis*) and invasive (*Cyprinus carpio, Micropterus spp*.) species, with *C. carpio* holding the greatest market value. Subsistence fishers were a significant fisher group and preferred river fishing, with many reporting weekly or monthly consumption of fish. This study highlighted the need for integrated management of water regulations, fish ecology, and economics to sustain inland fisheries that support livelihoods and fish conservation.

1: Durban University of Technology, South Africa
2: Institute of Natural Resources, South Africa
3: University of KwaZulu-Natal

A decade of change: Temporal changes in Malagasy coral reef ecosystem, and validating citizen science with Diver Operated Video.

Json Lee[1] & Catherine Gutmann-Roberts[1]

Coral reefs in Madagascar, particularly in the Nosy Be region, are among the most biodiverse yet understudied ecosystems in the Western Indian Ocean. Remoteness, limited funding, and accessibility challenges have hindered monitoring efforts, leaving critical gaps in understanding reef health and dynamics. The use of Citizen Science (CS) offers a promising solution to address these gaps. It's large-scale data collection capabilities are accompanied by its cost-effectiveness making it a compatible option for reef monitoring. This study aims to assess the coral reef health in Nosy Be, Madagascar and evaluate the reliability of using citizen science for future monitoring initiatives. The study focuses on (1) evaluating changes in coral reef substrate composition and fish assemblage biomass between 2013 and 2023, using two monitoring techniques: the Baseline Survey Protocol (BSP) in 2013 and the Ecological Monitoring Program (EMP) in 2023; (2) identifying spatial variations in substrate and fish abundance across sites while exploring potential drivers of change, using 2023 EMP data and Diver Operated Video (DOV) footage; and (3) evaluating the consistency of CS surveys by comparing them with DOV stereo footage. The results will contribute to ongoing research efforts in Madagascar, such as those led by Frontier and the Madagascar Research and Conservation Institute, which utilise

volunteers for coral reef surveys. This research highlights the potential of CS as a reliable tool for coral reef monitoring in data-scarce regions, providing valuable insights for local conservation strategies and marine research efforts.

1: University of Plymouth, UK

Can Southern Africa Avoid Europe's Eel Crisis? Reconciling Conservation and Economic Growth

Josephine Pegg[1], Angelica Kaiser[2], Annelize van de Merwe[2], Brett van Poorten[3], Steven Cooke[4], Anders Clarhall[5] & Sean Cox[3]

The European eel (*Anguilla anguilla*) population has declined by over 90% in the past four decades due to a combination of factors, including habitat degradation—particularly barriers to migration—overfishing, pollution, and disease. Despite the European Union's comprehensive legislative framework, including the Water Framework Directive, the Habitats Directive, and the European Eel Regulation, implementation challenges persist, and the species remains critically endangered. In contrast, Southern African eel populations are currently relatively healthier, but the region lacks a coordinated strategy for freshwater fish conservation. While Europe benefits from multinational directives and funding mechanisms, conservation efforts in Southern Africa remain largely country-specific, increasing the risk of fragmented and ineffective management. Furthermore, perspectives on resource use differ. For example, South Africa recently introduced the National Freshwater (Inland) Wild Capture Fisheries Policy (2021), which aims to regulate and formalise the sector while promoting sustainable resource use. Unlike European legislation, which prioritises conservation, this policy places greater emphasis on balancing economic development with ecological sustainability.
Although anguillid eels in Southern Africa are not currently experiencing the severe declines observed in Europe, future threats—including climate change, increasing water demand, and expanding infrastructure projects such as dams and hydropower—pose significant risks. This study reviews the current state of knowledge on anguillid eels in Southern African countries, as well as existing legislative frameworks, to identify critical gaps in both ecological knowledge and conservation policy. By drawing on lessons from Europe and considering Africa's economic development trajectory, we highlight both threats and opportunities for harmonising conservation with growth, using the eel as a flagship species for the protection of Southern Africa's freshwater biodiversity.

1: South African Institute of Aquatic Biodiversity, South Africa
2: University of Mpumalanga, South Africa
3: Simon Fraser University, Canada
4: Carleton University, Canada
5: Stockholm University, Sweden

Power structures and legitimacy in fisheries management.

Paul Hart[1]

An often-neglected aspect of a fishery management system is its power structure. Over time there has been a proliferation of agencies and institutions involved in assessing and managing fisheries and the power structure within and between these institutions determines both legitimacy and efficiency. This phenomenon has characterised the relationship between fishers, scientists and managers for over a century. A report by Buckland and Walpole in 1878 took evidence from fishers and those in the fish trade based in 44 ports around England and Wales. The fishers provided evidence of the role of mesh size on the catches of young fish, on the degree of overfishing and the role that closed seasons and mesh size limitations might play in protecting spawning fish. Rather than taking these observations as a starting point for scientific work, later developments in fish biology began as if nothing was known about fish biology and it is hypothesised that this was a result of the power imbalance between fishers (apparently uneducated) and scientists (educated). The scientists appeared not to trust the fishers' observations and had the power, and perhaps the arrogance, to think they knew better. As the Danish sociologist Bent Flyvbjerg has written knowledge is power but those in power determine what is knowledge. This power imbalance will be explored in present day fisheries management where only now are fishers being regarded as valued members of the knowledge community. Despite this there are many other organisations involved in fisheries management often with overlapping spheres of interest. Even though fishers are now more involved in managing their resources their voice is often lost in a sea of competing institutions and as a result their power is diluted. This will be illustrated with examples from a range of European fisheries.

1: University of Leicester

Understanding the drivers of non-compliance for informing effective management strategies for the Egyptian Artisanal Red Sea fisheries

Rehab Farouk[1,2], Ross Cuthbert[1] and Keith Farnsworth[1]

Egyptian Red Sea fisheries comprise three main sectors: commercial, artisanal, and recreational. While all exploit the same resources, enforcement of regulations tends to treat the artisanal fishery as commercial, whereas the recreational sector is largely exempt. The artisanal fishery is crucial for local livelihoods, providing employment and carrying cultural significance. Currently, a four-month summer closure is the primary management measure. Despite this, signs of overexploitation persist in several species targeted by artisanal fishers. To assess both the effectiveness and local perception of this restriction, face-to-face interviews were conducted with artisanal fishers. More than half of the respondents were unaware of the closure's purpose; among those informed, two-thirds found the rationale unconvincing. Additionally, their income under this management regime remains well below the

national average. These insights guided the development of alternative management strategies, which were tested via simulation using management strategy evaluation (MSE). The MSE incorporated uncertainty in fish population productivity and implementation of management strategies to allow comparison under realistic conditions. The proposed strategies showed promise, leading to improved stock status within two decades. However, their long-term success is contingent on shifting perceptions among fishers and improving alignment between management objectives and local understanding.

1. *Queens University Belfast, UK*
2. *National Institute of Oceanography and Fisheries, Egypt*

Introduction of non-native fish for aquaculture in China with a case study of *Micropterus nigricans*

Shan Li[1], Bin Kang[2] & Wei Hui[3]

Aquaculture, especially of non-native species and translocated domestic species, is a greatly encouraged way of relieving the conflicts between food and economic demand and resource depletion. We summarized the introduction history of non-native fish for aquacultural use in China, including 105 species introduced from abroad and 61 species translocated domestically across river basins. Of these, one-fourth have successfully established wild populations in natural waters and 15% have successfully invaded. We presented specific examples of seven aquaculture species/taxa and three aquarium species/taxa to explain the outcomes. We also reviewed invasion cases in lakes and reservoirs and found that lakes in western China and reservoirs made by major hydroprojects are hotspots for non-native species, and this has led to the disappearance of endemic species and changes to the original faunal composition. One of the non-native fish example was Largemouth bass *Micropterus nigricans*, which has been promoted most vigorously in the past five years in China, and it is also a popular species to anglers. We carried out risk screening of *M. nigricans* using AS-ISK, and used ENSARS to evaluate the full invasive risk of *M. nigricans* in China. The result suggested a medium invasive risk in China. We also did field survey using eDNA technology in Shanghai and the Qiantang River, and *M. nigricans* was detected. We provided management suggestions of *M. nigricans*, and it could also be reference to other non-native aquacultural species in China.

1: Shanghai Natural History Museum, China
2: Ocean University of China, China
3: Chinese Academy of Fisheries Science, China

Sharks, skates and rays: consume, conserve, consider?

Sophy McCully Phillips[1]

Historically sharks, skates and rays (elasmobranchs) were considered 'trash fish' but following extensive exploitation today they are seen as flagship or keystone species to ecosystem health and management. With over 70 species of elasmobranchs occurring around the UK, and this taxon straddling both commercial and conservation priorities, there are competing demands to support sustainable exploitation and conservation initiatives. Therefore, the need to prioritise species to study is fundamental both in the UK but also worldwide. Often species at either end of the spectrum (i.e. those of high commercial value and those considered Threatened) are the focus of research and funding, yet many species lie somewhere in the middle, or can even overlap both, thus risk being overlooked. This can result in biodiversity loss and over-exploitation. However, broadscale data-limited prioritisation exercises requiring limited empirical data can assist in focussing national research priorities by considering and assessing the commercial, conservation and ecological importance of all species occurring in an area. Such a quick triage process is not a replacement for formal stock- or Red List assessments but addresses a different policy need. The consideration of all elasmobranch species in a region is paramount to proactive conservation, which coupled with careful and knowing consumption can support sustainable exploitation and effective conservation.

1: Centre for Environment, Fisheries, and Aquaculture Science, UK

THURSDAY AM - Interdisciplinary Insights for Effective Management

Global uncertainties and a more just future for fisheries

Nicholas Dulvy[1]

The true scale and intensity of global fisheries activity as well as anticipated biodiversity loss are being revealed by the International Union for Conservation of Nature (IUCN) Red List assessment process. I draw on key data products from the global reassessment of 1,199 species in Class Chondrichthyes – sharks, rays, and chimaeras. These data provide arguably the first comprehensive assessments of the national regional and global assessments of the world's fisheries through the lens of the bycatch of intrinsically sensitive, functionally important and economically valuable wildlife. From these data we can (1) identify systemic biases and inequalities in global fisheries data, (2) shortfalls in the management of non-target species and the application of the Ecosystem Approach to Fisheries Management, as well as (3) the degree to which global trade flows are driving national unsustainability. From this comprehensive authoritative data-driven view we can identify priorities and set the agenda for global fisheries and trade regulation improvement for the next decade.

1:Simon Fraser University, Canada

Hot Sharks: Rapid ocean warming disrupts female and male movement cues causing mismatched breeding behaviour

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Coastally associated marine ectotherms are on the front line of the climate crisis. As the impacts of climate change become more frequent, severe and pervasive, there is an urgent need to better understand species- and population-level responses to extreme environmental conditions. Large-bodied, coastal chondrichthyans face multiple, substantive and synergistic threats, resulting in them being one of the most highly threatened vertebrate Orders. Using the Critically Endangered angelshark, (*Squatina squatina)*, as a model species, we use four years of acoustic tracking and remote in situ environmental sensing data (2021-24), to examine the impacts of environmental change on the movements, distribution and phenology of these sharks at the upper thermal limit of the species' distribution range. We find female sharks are considerably more attuned to changes in temperature compared to males, which appear in coastal waters during the proposed breeding season (Nov-Dec) irrespective of environmental conditions. Using data from a period of strong temperature anomalies and marine heatwaves (MHWs) occurring in the NE Atlantic between 2022 and 2024, we identify specific thermal thresholds predicting the presence/absence of S. squatina to the coastal waters around La Graciosa Marine Reserve in the Canary Islands. With network analyses we demonstrate that at the individual level, males experienced greater thermotactic gradients during their movement, but thermoregulation in females was cued at lower temperatures, with a thermal threshold identified between 22 and 23°C. As the impacts and risks associated with climate change are likely to exacerbate and interact with existing stressors, future approaches to management will need to be adaptive, whereby conservation measures account for environmental change and dynamic species responses. With improved knowledge around how species respond to environmental change, temporary or dynamic protected areas which become active during predictable short-term extremes such as MHWs, might provide greater protection going forward.

1: Lancaster University, UK
2: Institute of Zoology, UK
3: Zoological Society of London, UK
4 University of Las Palmas de Gran Canaria, Spain
5: Museum Koenig Bonn, Germany
6: Angel Shark Project, Spain

Managing human-shark interactions at a remote island in the South Pacific Ocean

Jordan K. Matley[1], Adam Barnett[2], Lauren Meyer[1,] Mark Scott[3] & Charlie Huveneers[1]

Food provisioning, where animals obtain food from humans either directly or indirectly, can have a variety of unintended ecological, social, and economic consequences. At Norfolk Island, a small Australian island >800 km from nearest land, organic waste is regularly disposed of into the ocean. A common tourist attraction is to visit the piers to watch dusky (*Carcharhinus obscurus*) and Galapagos (*C. galapagensis*) sharks feed as local fishers clean their catch. A separate provisioning activity is the disposal of livestock remains into the sea (away from beaches and surf breaks) where tiger sharks (*Galeocerdo cuvier*) aggregate, presumably for an easy meal. A significant management concern about these activities is the extent that sharks have been conditioned to human-derived food, and whether this has led to alterations of natural behaviour or risks to human safety. Accordingly, this presentation will quantify the spatial (acoustic telemetry) and dietary (stable isotopes) associations that sharks at Norfolk Island have with provisioning activities. Additionally, emphasis will be placed on exploring the viewpoints of Norfolk Islanders in relation to human-shark interactions, which often originate from the island's unique history and culture. Furthermore, the complexities of managing human-shark interactions and the effectiveness of different community engagement activities will be discussed. The findings of this study are directly pertinent to both regional and federal management of waste disposal practices at Norfolk Island but are relevant more broadly given the dynamic interactions that exist between animals and humans.

1: Flinders University, Australia
2: Biopixel Oceans Foundation, Australia
3: Norfolk Island National Park, Australia

The effect of light environment on vision

C. Silva De Freitas[1], D. Joyce[1], R. Knell[1], A. Smith[1]

Visual sensory systems of many animals are vital for perceiving their environment. In aquatic environments, light intensity and spectrum both change along a depth gradient because of the physical characteristics of water. Evolutionary change in fishes has developed ways to account for this, with a suite of opsin genes expressed in the retina that have different optimal spectral sensitivity. Different species express different opsins according to their light environment. In addition, mutations in the DNA sequence of these genes allows further spectral tuning. The alternative method to adjust spectral tuning is through the substitution of 11-cis retinal to 11-cis 3,4-dide-hydroretinal chromophore in both cone and rod opsins leads to a further shift in spectral sensitivity towards longer wavelengths. Rhodopsin (RH1) which is the opsin responsible for gathering achromatic visual information vision and playing a pivotal role in recognising light spectra at the λmax-value of 500nm. In this study, we aimed to test how these mechanisms interact by using *Astatotilapia calliptera*, a generalist species of cichlid fish found in different environments within and around Lake Malawi, which is known to be polymorphic at a location in RH1 (A292S) that leads to a blue-shifted visual optimum. We combined behaviour tests of feeding efficiency in different light environments, with gene expression studies. We found differences in

opsin expression amongst different light-coloured environments. We also found a significant upregulation in cyp27c1, a gene that codes for the conversion of 11-cis retinal to 11-cis 3,4-dide-hydroretinal to change the spectral sensitivity of RH1. Feeding efficiency was significantly different between light treatments at the start of the experiment, but not at the end, implying that individual fish can use a plastic response to adjust their visual perception according to their light environment. This has implications for the way that selection can lead to evolutionary change and adaptation in cichlids.

1: University of Hull, UK

Using commercial fishermen's local knowledge to assess pike re-emergence in Lough Neagh

C. McCoubrey[1] Jaimie Dick[2] & Derek Evans[1]

Lough Neagh was historically unusual amongst other Irish lake systems for its lack of a significant Pike population. Currently Neagh is in a state of ecological flux, changing habitats have generated conditions more suitable to Pike establishment, and is believed to have led to their population rise. This PhD investigates the re-emergence of pike as an apex piscivorous predator in Lough Neagh. As no prior study of Pike in Lough Neagh has been conducted, a baseline understanding is needed. The first thematic chapter of this PhD focuses on habitat development and Pike distribution within Lough Neagh. Local Ecological Knowledge (LEK) is harnessed through a multiple choice Fisher questionnaire distributed to the Lough Neagh commercial fishing fleet (N = 117), using current registered Fishers licensing list. Development of Questionnaire methodology received advice from the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC). This ensured alignment with international standards for qualitative data collection within fisheries. The questionnaire will collect data on observed Pike presence or absence, macrophyte development, and observed impacts on fisheries. These responses will contribute to the development of spatial maps detailing historical and current Pike populations and will advise potential ground truthing sites for assessing the distribution of this re-emerged predator.

1: Agri-Food and Biosciences Institute, UK
2: Queens University Belfast, UK

Exploring fish migration cues: diel patterns and temperature effects at a German fish lift system

C.Schlautmann[1], A. Lorenz[1], D. Hering[1]

Fish migration is a key ecological process that preserves biodiversity and sustains riverine ecosystems. However, barriers such as dams and weirs disrupt connectivity, posing challenges for fish migration. These obstacles create management dilemmas where human interests like hydropower and water storage often conflict with

conservation goals. Investigating the environmental cues of fish migration can assist to optimize management strategies.
The Baldeney Fish Lift System was developed to restore fish passage at the Baldeney dam at the Ruhr River in Germany. A conventional fish pass was impractical due to the 8-meter dam height and limited space.
This presentation will outline the fish lift's operation and present results from the first monitoring year. Fish passage was monitored using a VAKI Riverwatcher system, enabling detailed evaluation of species composition and migration timing. In total, 20 different fish species were detected in the lift system, corresponding to the species composition observed in the downstream area by electrofishing. Species-specific migration behaviour was analysed based on diel movement patterns and the influence of different temperature variables. The results indicate species-specific differences in migration timing, with environmental cues playing a critical role in shaping these patterns.
The findings contribute to improve the fish passage system by considering the species-specific migration patterns. Adjusting factors such as turbine regulation and lift operation can optimize fish migration while mitigating conflicts between ecological conservation and human impact. Long-term, this research will refine migration models, support the prediction of fish movement, and contribute to more effective management and mitigation of anthropogenic impacts on river systems, enhancing ecological connectivity and biodiversity.

1: University of Duisburg-Essen, Germany

Carryover effects of size at ocean entry for marine survival of Atlantic salmon

L.Smith[1], N. Hansen[2], C. Bull[3]. E. O'Gorman[1], A. Sturrock[1]

Over the last few decades, Atlantic salmon (*Salmo salar*) have experienced synchronous and widespread declines in abundance, thought to be driven by a large-scale regime shift in the North Atlantic and increase in marine mortality. However, Atlantic salmon experience threats to their survival throughout their complex life histories. Freshwater conditions that contribute to reduced size at ocean entry, such as food availability, temperature, habitat degradation, and contaminant load, could have important carryover effects on their subsequent marine survival.

Here we used otolith chemistry to reconstruct the size at which adult salmon left freshwater across 4 cohorts (2020-2023), sampling tissues from post-spawned carcasses from 6 rivers in the UK & Ireland. Outmigration size differed significantly among populations and years, suggesting spatial and temporal variation in freshwater conditions and strength of size-selective mortality. We are also testing whether years characterised by poor ocean conditions were associated with larger, less variable size at ocean entry, suggestive of strong size-selective mortality at sea.

Our findings indicate that archival tissues, such as otoliths, can provide important insights in to the influence of carryover effects on marine survival. If fish that leave

freshwater at larger sizes are more likely to survive to return to rivers to spawn, habitat loss, river pollution and warming, all associated with impaired growth, could have serious implications for the long-term persistence of Atlantic salmon.

1: University of Essex, UK
2: Scottish Government, UK
3. University of Stirling, UK

Evaluating Smolt-to-Adult Supplementation (SAS) as a conservation strategy: comparing movement and behavior of wild and SAS Atlantic salmon in the Cape Breton Highlands

N. Koopman[1] G.Crossin1, R.J. Lennox1, S. Penney [2], M.Stubbings[2], J. Batt[1]

Robust and healthy Atlantic salmon *(Salmo salar)* populations are integral to Canada's ecology, economy, and culture. However, Atlantic salmon are increasingly threatened throughout their range from climate change, habitat degradation, and declining marine survival. Located in Highlands National Park in Cape Breton, Canada, the Clyburn Brook has been monitored by Parks Canada for 40 years, which has revealed a dramatic 95% decline in the returning adult Atlantic salmon population. In the last 3 years Parks Canada has begun a recovery program to forestall the imminent threat of extirpation of the Clyburn Brook salmon population. Smolt-adult-Supplementation (SAS) is an emergency conservation measure that ensures some juveniles from the population survive until maturity and spawn. SAS involves taking wild salmon smolts from their natal rivers and raising them in captivity until they reach adulthood and sexual maturity (1-2 years). The adults are subsequently returned to their natal river in hopes of them spawning and adding to the population. Unlike traditional hatcheries, SAS has the potential benefits of 1) avoiding well-documented genetic risks that are a result of captive-rearing at early life stages, 2) bypassing the widespread high-at-sea mortality affecting Atlantic salmon populations globally, and 3) maintaining free mate choice in the wild. However, there has been no formal assessment of whether these SAS benefits are fully realized in the wild and how SAS salmon compare to their wild counterparts. Thus, in collaboration with Dalhousie University Aquatron Laboratory, Parks Canada, and local salmon associations, we compared the survivorship, behaviour, and movement (riverine and oceanic) of SAS salmon and wild salmon using acoustic telemetry. Accelerometer tags were used to determine the activity of the tagged salmon. Findings will contribute to the evaluation of SAS as a recovery strategy for the Clyburn Brook Atlantic salmon population.

1: Dalhousie University, Canada
2: Parks Canada, Canada

From DNA to decision-making: A tale of integrating genetics into fisheries management

N. Rodríguez-Ezpeleta[1],

Achieving sustainable fisheries management within an ecosystem approach relies on properly understanding the status of resources and their interaction with the ecosystem. This understanding depends on the availability of accurate and complete scientific information, often compromised by economic or technological limitations. Therefore, exploring alternative or complementary approaches that can improve fisheries assessment while allowing for ecosystem-based management is essential. Genetics-based approaches are among the most promising alternatives as they provide information at individual, species, and ecosystem levels that cannot be obtained otherwise. Despite this potential, the integration of genetic methods into the fisheries management process is still not widespread. In this presentation, I will review studies from our group that illustrate how advanced genetic technologies have contributed to better fisheries assessments and contribute towards ecosystem-based fisheries management. Approaches we have used include environmental DNA for estimating abundance indices to inform fisheries assessment, stomach content DNA analysis for understanding trophic interactions to inform ecosystem models, population connectivity for stock delimitation and mixing, and kinship analyses for estimating spawning stock biomass. Results from our studies have been communicated to relevant assessment and management bodies such as ICES, ICCAT, and IOTC, achieving different levels of integration within the fisheries management process. The lessons learned from these efforts will be shared to conclude the presentation.

1: AZTI, Spain

The west of Scotland herring hunt: searching for spring-spawning grounds

M.Frost[1], K. Diele[1]

Atlantic herring (*Clupea harengus)* are a prime example of how marine management requires consideration of life-history characteristics of focal species, to be effective. Herring have a unique life-history, including benthic spawning, distinguishing them from most other marine fish. Since they need specific seabed habitat to deposit their eggs on, it is essential that such areas remain available and in good environmental status. West of Scotland (WoS) herring – economically and ecologically important in Scotland for centuries – have been in decline for decades. However, in recent years large numbers of spring-spawning herring reappeared in inshore waters. This resurgence raised questions regarding the location, type and status of their inshore spawning habitat, which has experienced decades of multiple pressures. The West of Scotland Herring Hunt (WOSHH) project (https://scottishherring.org/) used participatory science to engage local communities, fishers and other stakeholders in research aimed at identifying benthic herring spawning habitat. WOSHH tested shore-based environmental DNA (eDNA) sampling as a cost-effective, non-invasive method to detect herring presence and absence, as well as pinpointing the location of spawning activity. Observational data and Passive Acoustic Monitoring

complemented eDNA analyses, to improve our understanding of WoS spring-spawning herring spawning grounds and local biodiversity knock-on effects. The shore-based eDNA water sampling successfully detected peaks in herring DNA during the spawning season. Ongoing work is assessing the efficacy of eDNA in determining relative abundance and the approximate time spawning occurred. Observed spawning locations provide renewed evidence on the importance of maerl (a fragile, coralline red algae) beds as essential fish habitat for reproducing herring. Our data will enable decision makers to implement existing scientific advice stating that any activity that could destroy herring spawning habitat should be avoided, and help to bring

1: Edinburgh Napier University, UK

Spatial organisation of Atlantic herring and implementation in management

D.Bekkevold[1]

Data routinely collected under the ICES remit for assessment of Atlantic herring stocks in the Northeast Atlantic have since 2021 included genetic marker based classification of population origin. Herring show pronounced stock-mixing in feeding and wintering aggregations which has complicated interpretations of stock dynamics. The inclusion of genetic data has now greatly increased the resolution of population specific migrations, and exploitation rates in time and space. I will present an overview of the plethora of new data already at hand and outline associated opportunities for understanding local stock dynamics as well as challenges to incorporation in stock assessment for management.

1: DTU-Aqua, Denmark

Combining morphometrics, telemetry and genomics to better understand trout and salmon movement.

Domino Joyce[1]**,** P. Moccetti[1] J. R. Dodd [1.] A. D. Nunn[1], Ben Gillespie[2], J.D. Bolland[1], C.E. Adams[3] Je. R. Rodger[3,4], H. M. Honkanen[3] , M. Newton [4] , A J. Lothian[5]

Understanding fish migration has been an important goal of management and conservation for decades. More recently, combining information from telemetry, with genetic and genomic information from individual fish has become a possibility. In this talk I would like to present some work from a team of people who have used telemetry and genomics to understand trout and salmon movement. Specifically, in Scottish rivers, we used genetic information from out-migrating salmon to show that there seems to be a predictable genetic difference between successful and unsuccessful migrants. We also studied returning salmon in a recovering population in the Ouse, northern England to find accurate, fine-scale homing, with some individuals displaying “search” behaviour across tributaries before returning to their natal tributary to spawn. This has led to rapid genetic differentiation among tributaries. Finally, we also carried out a before-and-after control-impact (BACI) study on brown

trout in the north of England. We used genetic tools to investigate the effect of a newly implemented fishway, which aimed to enhance upstream spawning migration of brown trout, and found some unexpected results. We hope the results might demonstrate the potential use of genetic tools in management, and the additional information they can uncover.

1: University of Hull, UK
2: Yorkshire Water, UK
3: University of Glasgow, UK
4. Atlantic Salmon Trust, UK
5. University of Calgary, Canada

Investigating the connectivity between cod populations in the Celtic Seas to inform fisheries management

J.V. Ellis[1], C.T. Marshall[2], M.D. Scantlebury[3], P.G. Fernandes[4]

Southern cod stocks, particularly those in the Irish Sea and Celtic Sea, are at the warming edge of the species' distribution and are at risk of local extinction as temperatures rise. Recent tagging evidence has shown movements of cod from the Irish Sea to the Celtic Sea which prompted further research into their population structures to inform fisheries management. Cod population structure around the Irish Sea was investigated using population surveys, otolith microchemistry, and tags. Survey data showed a NE shift in West of Scotland cod towards the North Sea while Irish Sea and Celtic Sea cod have only shifted slightly west. Analyses of the otolith edge and core chemistry suggested that Irish Sea and Celtic Sea cod are mixed with many Irish Sea cod predicted to have spawned in the Celtic Sea. Analysis of the whole otolith chronology suggested that there are two groups of cod in the region: one distinct to the Irish Sea and another mixed between the Irish Sea and Celtic Sea. Tagging results from Irish Sea cod showed movements towards and into adjacent regions of the Celtic Sea and West of Scotland. These findings demonstrate the high level of connectivity between cod in the Irish Sea and Celtic Sea, as well as those in the southern West of Scotland. Combining the Irish Sea and Celtic Sea cod stocks should better adapt management to promote recovery of Celtic Seas cod.

1: Agri-Food and Biosciences Institute
2: University of Aberdeen, UK
3: Queens University Belfast
4: Heriot-Watt University, UK

Ocean warming drives contrasting growth responses in a long-lived sciaenid

S. Tanner[1], N. Prista[2], B.R. Quintella[3], P. Reis-Santos[4]

Understanding how somatic growth in marine fish populations responds to environmental change is crucial for predicting population dynamics and ensuring fisheries sustainability. Especially, as variation in growth patterns has been

increasingly linked to changing environmental conditions, and particularly to ocean warming. The magnitude and direction of fish population responses to warming depend on species-specific thermal tolerance ranges and local adaptation to environmental conditions that vary throughout ontogeny, highlighting the complex interplay of intrinsic and extrinsic factors that affect growth. Here, we investigate the impact of historical and projected ocean warming on growth responses of meagre (*Argyrosomus regius*), collected along the western and southern coasts of the Iberian Peninsula, using an otolith-based growth chronology. Mixed effects modelling of intrinsic (age, age-at-capture, capture location) and extrinsic factors (sea surface temperature [SST], North Atlantic Oscillation [NAO], East Atlantic Pattern [EAP]), reveal significant interannual variability in growth, with a marked increasing trend from the early 1980s, linked primarily to rising SST. Growth responses varied with ontogeny: younger fish (ages 2–3) exhibited reduced growth at higher temperatures, while older individuals (>4 years) experienced accelerated growth. Future growth projections (2030–2100) under two climate scenarios (SSP4-6.0, SSP5-8.5) indicate a decline in early-life growth (-16% to -20% at age 2), whereas older fish are expected to exhibit substantial growth increases (up to +102% at age 40). These findings reveal that thermal sensitivity in meagre varies with age, stressing the importance of accounting for ontogenetic differences when evaluating climate-driven effects on fish populations. Our study highlights the need to integrate long-term environmental trends into fisheries management to support the sustainability of estuarine-dependent fish species in a warming ocean

1: Marine and Environmental Sciences Centre (MARE), Portugal
2: SLU, Sweden
3: University of Lisbon, Portugal
4: University of Adelaide, Australia

The hidden cost of bottom trawling on deep-sea elasmobranchs

S. Graça Aranha[1]; A. Teodósio[1,] T. Marsili[2], P.Da Rocha[1], T. Modesto[1], P. M. Guerreiro[1] A. Tambutte[3]; Alexandra Alves[4], P. Relvas[1], E.Dias[5]

Crustacean bottom trawling in southern Portugal is a an economic and culturally important fishing activity but may result in considerable bycatch of deep-sea elasmobranchs (DSE). Due to DSE life-history strategies, at-vessel mortality (AVM) rates in crustacean bottom trawl fisheries are expectedly high but require further investigations. This study assessed the at-vessel condition of 18 species of DSE, and AVM rates of four deep-sea shark species (*Etmopterus pusillus, E. spinax, Galeus melastomus*, and *Scymnodon ringens),* to understand the impact of bottom trawling on these animals. Opportunistic sampling on a crustacean trawler in the southern Portuguese coast, revealed that 95% of specimens were either dead (n=1258) or in poor condition (n=224) upon collection, underscoring their minimal chance of post-release survival. General linear model analyses showed that AVM was species-specific and highest in smaller sharks, as well as in those from hauls that exhibited larger temperature differences between bottom and surface waters, and those caught in hauls with heavier codend weight using a 55 mm codend mesh (targeting shrimp

and prawns) instead of those caught in hauls using a 70 mm codend mesh (targeting Norway lobster). These findings highlight an urgent need to find solutions to mitigate the impacts of bottom trawling on those DSE, mainly by avoiding their bycatch in first place. A coordinated, multi-stakeholder approach involving researchers, the fishing industry, and regulatory bodies is crucial for developing and implementing effective, and more sustainable fisheries management and protection of DSE populations.

1: University of the Algarve, Portugal
2: OLSPS International, Portugal
3: La Rochelle Université, France,
4: The Yas SeaWorld Research & Rescue Center, Abu Dhabi
5: CIIMAR, Portugal

Unravelling freshwater migrations and life history plasticity of European sea bass through otolith shape and chemistry

Rita Almeida[1], P. Reis-Santos[2], C. S. Mateus [3], F.Riberio [1], B. Gillanders [1], B. R. Quintella[1], S. Tanner [1]

Partial migration, where distinct migratory and resident phenotypes coexist, is a widespread phenomenon in fish populations. Linked to life-history plasticity and the ability to express different migratory behaviours, partial migration may represent an evolutionarily stable strategy, allowing individuals to use different habitats or adapt to changing conditions. The European sea bass *(Dicentrarchus labrax)* is an euryhaline species known to spawn at sea and use transitional habitats like coastal lagoons and estuaries as nursery and feeding grounds. While freshwater movements are common among the family Moronidae, the presence of adults of *D. labrax* in freshwater environments has only recently been described, with individuals found up to 150 km upstream from the Tagus estuary. This study investigated the river-sea continuum space use and potential impacts on population dynamics of *D. labrax* using otolith shape and life history elemental chemistry profiles of 244 individuals collected between 2021 and 2023 in freshwater, coastal and marine areas. Results showed differences in both otolith shape and chemical composition of the otolith edge between individuals captured along the marine-freshwater gradient. Life-history reconstructions suggest that there are migratory portfolios associated with ontogeny, and we discuss the occurrence of a potential freshwater contingent within the *D. labrax* population. Overall, recognising the role of freshwater habitats in population dynamics is essential for developing management strategies that support intraspecific variation and promote long-term population resilience.

1: University of Lisbon, Portugal
2: University of Adelaide, Australia
3: University of Évoram Portugal

High resolution modelling of potential sandeel habitat to enhance seabird conservation

Eugene O'Kane[1], **A.Callaway[1]**, A. Boyd[1], C.McGonigle[2], Robert Runya[3], Ewan Hunter[1]

Sandeels (*Ammodytes* spp.) are a vital component in marine food webs, providing an important food source for a wide range of protected bird and mammal species. Under the EU Birds Directive (2009/147/EC) Special Protection Areas (SPAs) are designated to protect bird species, usually at nesting/overwintering sites. However, recent studies on the resilience of seabird breeding colonies have expressed concerns around this approach while failing to also consider prey availability. They highlight that a shift of emphasis to investigate connectivity between foraging grounds and nesting sites is required to support breeding success. With protected species such as Atlantic puffin, razorbills, terns, Manx shearwater and kittiwakes heavily reliant on sandeels for breeding success around Northern Ireland, a greater understanding of the habitats being utilised by their fish prey species is required. Utilising documented knowledge of sandeel behaviour and habitat preferences from the literature, our study combined observed seabed sediment characteristics with modelled environmental parameters in order to train a predictive model to create a sandeel habitat preference map. The resulting output provides a useful tool that can be used by policy makers to formulate management strategies and enhance decision making around specific protected seabird colonies.

1: Agri-Food and Biosciences Institute, UK
2: Ulster University, UK
3: Marine Institute, Ireland

Environmental enrichment in the husbandry environment as a confounding variable in applied fish behaviour research

Andrew Vowles[1]& Helen Currie[2]

A wealth of laboratory-based research has been directed at better understanding and mitigating impacts of human activities on important aspects of fish behaviour to advance their conservation and management. Outputs from such research should be robust, reproducible and transferable, and assumes good study design that controls potential confounding variables. Structural environmental enrichment (EE) is an important aspect of the husbandry environment, it can improve aspects of fish welfare and influence behaviour. For example, fish from enriched (vs. barren) husbandry environments demonstrate greater rates of recovery from handling, cognitive abilities that enhance agility and lower behavioural variability during experiments in novel environments. This suggests EE could have implications for the results of applied behavioural research. However, EE is poorly documented in scientific publications. This is problematic for several reasons. Firstly, without a detailed description of the husbandry environment, it is almost impossible to precisely replicate an experiment. Secondly, variability in the provision of EE within and / or between studies could act as a confounding variable, i.e. an irrelevant

variable within the context of the study that might influence or obscure the relationship between the treatment variable(s) of interest and behavioural outcomes. In this presentation, the interplay between preferred EE, welfare, and behaviour during a laboratory fish passage study is explored. Results will be presented on the EE preference of brown trout (*Salmo trutta*) and differences in fish passage performance relative to their EE husbandry environment. This will help shed light on EE as a confounding variable in applied fish behaviour research. It is hoped that outputs will encourage more thorough consideration and reporting of the husbandry environment, improving the welfare of laboratory fish as well as the robustness of studies used to advance fish conservation and management.

1: University of Southampton, UK
2: University of Portsmouth, UK

FSBI Medal Winners

Beverton Medal talk: Surviving a career in research

Colin Adams[1]
Research is difficult, but finding your way along a research career pathway is, if anything, even more difficult. Although most certainly not providing a recipe for success, I will provide an exceptionally personal view of how early career researchers might think about the challenges and pitfalls that come with navigating a course through a career in research.

1: University of Glasgow

What Tuna Fisheries Taught Me - Reflections on Operationalizing the Ecosystem Approach in Regional Fisheries Management Organizations

Maria Jose Juan Jorda[1]

This presentation reflects on the scientific and management challenges of applying the Ecosystem Approach to Fisheries Management (EAFM) within tuna Regional Fisheries Management Organizations (RFMOs). Drawing on collaborative projects across multiple ocean basins, I share career insights and lessons learned from efforts to incorporate ecosystem, bycatch and climate considerations into fisheries management advise. Key scientific tools being developed include spatial frameworks to support ecosystem-based planning and research, spatial ecological risk assessments for evaluating the vulnerability of bycatch species to fishing and environmental change and climate and ecosystem models and indicators designed to assess the cumulative impacts of fishing and environmental variability on marine ecosystems. To improve the uptake of this science in advisory processes, these tools are being paired with communication products aimed at improving transparency and uptake in advisory processes. Examples include, fisheries ecosystem overviews

and ecosystem report cards, synthesizing indicator trends and ecosystem risks to support evidence-based management. While these initiatives are being piloted in tuna RFMOs, they offer valuable lessons for operationalizing EAFM in other fisheries contexts. This talk will highlight examples, progress, and persistent challenges from ongoing applications, emphasizing the role of interdisciplinary collaboration, adaptive processes, and clear communication in advancing effective ecosystem-based fisheries management.

1: Spanish Institute of Oceanography (CSIC)

From eyeing DNA barcoding to fishing for mitogenomes: sequencing for fish species identification and building reference databases

Rochelle Chan[1]

Identification of fish larvae based on morphology is typically limited to higher taxonomic ranks (e.g., family or order), as larvae possess few morphological diagnostic characters for precise discrimination to species. When many samples are presented at any one time, the use of morphology to identify such specimens can be laborious and time-consuming. Use of the reverse workflow methodology and high-throughput DNA sequencing greatly reduces the time and financial costs of morphology-based sorting and instead deploys experienced taxonomists for species taxonomic work where they are needed the most. To date, more than 3000 fish larval specimens from plankton tows in Singapore have been collected and sorted based on this workflow. Eye tissue from individual samples were used for DNA extraction and sequencing of cytochrome c oxidase subunit I, generating more than 2746 barcodes after quality filtering and delimiting more than 256 molecular operational taxonomic units (mOTUs). We find international databases useful in identification of cosmopolitan species and local sequence databases essential in resolving identification conflicts. Nevertheless, challenges remain in ensuring that databases are well-maintained and are comprehensive. Leveraging on advances in long-read PCR and long-read sequencing technology, we barcoded the full mitochondrial genomes of several fish specimens and generated more than 181 mitogenomes, representative of 161 fish species. These data adds to existing databases and fills in information gaps useful for species identification and related studies. We discuss the practicalities of using full mitogenomes as an intuitive next step in future-proofing reference databases.

1: National University of Singapore

Importance of museums and collections – Impressions of a fish curator at the NHM London after 48 years of service

Oliver Crimmen

In this talk Oliver will give an overview of his life time of dedication and expertise in the maintenance of fish collections at the Natural History Museum in London. Oliver's

role brought him into contact and collaboration with people from all walks of ichthyological life as he provided help and advice from the home of one of the world's great repositories of scientific information. His selfless dedication to ichthyology and fish taxonomy means that his name is acknowledged in innumerable scientific publications and he has helped and inspired countless scientists. He is now in a position to look back, and forward, on the value of his role.

1: Natural History Museum, UK

Navigating Uncertainty in Fisheries Management

Application of genetics and genomics in the forecasting of pink salmon approaches and fisheries management in the Sea of Okhotsk basin.

Daria Zelenina[1], Valeria Soshnina[1], Ulyana Muravskaya[2], Boris Ignatev[1], Oksana Pilganchuk[2], Nina Shpigalskaya[2], Nikolay Mugue[1]

Currently, the rational exploitation of fish species and effective fisheries management can only be achieved through the involvement of genetics. The more distinct the population structure of a species, the more justified the use of genetic and genomic approaches becomes when predicting catch volumes in specific regions. Additionally, due to their pronounced population structure, the application of genetic and genomic methods to address a wide range of fisheries problems is increasingly significant for anadromous fish species. Pacific salmon of the genus Oncorhynchus are a group of anadromous species known for their high levels of homing behaviour. One of the primary challenges in Far Eastern fisheries science is predicting the entry of the most abundant species of Pacific salmon, the pink salmon, into the rivers of the Sea of Okhotsk basin. Pink salmon are represented by two lineages: those that spawn in even-numbered years and those that spawn in odd-numbered years. Throughout a long evolutionary period, these lineages have diverged to at least the subspecies level, necessitating independent assessment and prediction for each. Using genomic data obtained from the University of Washington, we developed two panels of SNP markers that allow for the reliable differentiation of pink salmon from the Sea of Okhotsk basin at a regional level. After establishing a baseline and validating the method, we applied this approach in practice: the data collected were used to predict the arrival and catch volumes of pink salmon. The fishing seasons of 2022, 2023, and 2024 demonstrated high accuracy in our estimates for both the even and odd-year spawning lineages. Recently, we conducted genomic research focused on a comprehensive analysis of pink salmon stocks in the Sea of Okhotsk basin. This research will enhance our ability to predict the migrations of pink salmon.

1: Russian Federal Institute of Fisheries and Oceanography, Russia
2: Kamchatka Branch of Russian Federal Institute of Fisheries and Oceanography, Russia

Advancing eDNA-Based Approaches for Monitoring Freshwater Fish Populations

Bernd Hänfling[1], Nathan Griffiths[1], Colin Bean[2], Alistair Duigid[3] & Jon Bolland[4]

The application of environmental DNA (eDNA) methods for monitoring freshwater fish populations has advanced significantly over the past decade. A major breakthrough was the development of an eDNA metabarcoding tool for assessing the ecological status of UK lakes in 2019. This presentation will report on the further refinement and evaluation of this tool, as well as the development of new frameworks and guidelines for monitoring individual species and integrating eDNA-based methods with established techniques.
We will present case studies on; site condition monitoring of priority species such as arctic charr, assessing confidence in absence when monitoring eels in lowland catchments, and stakeholder consultations on best practices for lake fish population assessments.
As demand for efficient eDNA-based assessments of fish communities, priority species, and environmental impact assessments grows, robust frameworks will be essential to support data interpretation and inform decision-making processes.

1: University of Highlands and Islands, UK
2: Nature Scot, UK
3: SEPA, UK
4: University of Hull, UK

Modelling migratory shark distribution for improved fisheries management in the British Isles

Maisie Evans[1], John Pinnegar[2], Jim Ellis[2], Bryony Townhill[2] & Carol Robinson[1]

Commercial fishing is one of the main forces driving the decline of shark populations worldwide. For migratory sharks visiting the British Isles, various levels of management are in place to reduce target catch yet high levels of incidental catch in non-target fisheries still occur. Effective fisheries management for migratory sharks needs to determine spatial overlap with commercial fishing gears whilst accounting for the seasonality of both the sharks and the fisheries. Using species distribution modelling, the current and future habitat suitability of the British Isles for migratory sharks listed under the Convention for the Conservation of Migratory Species (CMS) have been compared and discussed in relation to current fisheries space use, under different climate change scenarios. Aiming to identify where, when, and which fishing gears these species currently overlap with, and may continue to do so throughout the 21st century, this work identifies the fishing gears posing the largest current and projected threat to these protected, migratory sharks, when visiting the British Isles.

1: University of East Anglia, UK
2: CEFAS, UK

Movements, growth rates and strong sexual segregation in critically endangered tope sharks: Insights from 5 decades of mark-recapture in the Northeast Atlantic

Luke Cameron[1], Erin Jones, Paul Mensink[2], William Roche[3], Ciara Wögerbauer[3] & Nicholas Payne[1]

The tope (*Galeorhinus galeus*, Linnaeus, 1758) is a critically endangered shark, which, like many other elasmobranchs, faces severe global decline. There are, however, substantial disparities between this species' global conservation status and those of some local populations, with the Northeast Atlantic representing a relative stronghold for this species. However, numerous areas of uncertainty, particularly regarding individual movement patterns, currently hamper region-specific management. Therefore, utilising capture-mark-recapture tagging data collected over 52 years, predominantly by recreational anglers in Ireland – but with recaptures throughout the Northeast Atlantic and Mediterranean – we investigated regional population structure; spatial segregation; and individual movement patterns, and estimated sex-specific growth rates. This revealed a marked pattern of sexual segregation, with females residing further south than males overall, and with an Irish-specific trend towards male-dominated catches in Atlantic regions, versus more even sex-ratios in the Irish and Celtic Seas. Recapture timings and locations suggest that female movements are more strongly driven by seasonal water temperatures changes, being broadly in line with the North-South migratory paradigm, but with substantial individual variation. Spatiotemporal overlap of mature individuals suggests that the North Channel, Irish Sea and Northern Celtic Sea may constitute a key mating area. Female sharks may utilise southerly regions during gestation, with the presence of young-of-the-year indicating that the Irish Sea and neighbouring regions subsequently act as parturition/nursery areas. Such findings have key implications for fisheries management, given the strong tendency toward trans-boundary movements displayed here, often crossing important legislative boundaries, and the potentially higher vulnerability of large – and in some cases pregnant – females. Furthermore, our results demonstrate the value of such long-term programmes, in this case facilitated by citizen science, in addressing key areas of uncertainty for wide-ranging species, by identifying broad-scale movement patterns, alongside specific regions of interest for further study and/or implementation of targeted conservation measures.

1: Trinity College Dublin, Ireland
2: University of Western Ontario, Canada
3: Inland Fisheries Ireland

The migration of Atlantic salmon (*Salmo salar*) post-smolts through nearshore and coastal waters surrounding the British Isles.

Jessica Rodger, Jessie Lilly[1], Hannele M. Honkanen, Diego del Villar, Richard Kennedy, Niall Ó Maoiléidigh, Patrick Boylan, Robert Rosell, David J. Morris, Ross O'Neill,

Catherine Waters, Deirdre Cotter, Lorna Wilkie, Andrea Barkley, Amy Green, Samantha V. Beck, Jamie Ribbens, Jim Henderson, Debbie Parke, Alan Kettle-White, Lucy Ballantyne, Shona Marshall, Paul Hopper, Niall Gauld, Jason D. Godfrey, Lauren E. Chapman, James Thorburn, Alan Drumm, Fred Whoriskey, Brian Shields, Philip Ramsden, James Barry, Michael Milane, William Roche, John D. Armstrong, Alan Wells, Silas Walton, Melanie Fletcher, David M. Bailey, Bill Whyte, Ross McGill, Mark Bilsby, Ken Whelan, Colin W. Bean, **Colin E. Adams**

The migratory patterns and behaviours of Atlantic salmon (*Salmo salar*) post-smolts through coastal and offshore waters around the British Isles remain relatively poorly understood. Previous modelling studies have predicted that fish use a combination of active swimming and current following behaviours but little empirical data has been collected on the migratory pathways and the timings of this migration when navigating these waters. There has been a rapid expansion of developments (such as finfish aquaculture and offshore renewables) in marine waters surrounding the UK. Therefore, there is an urgency that these knowledge gaps in the migration of post-smolts are better understood as this information can be used to inform policy and management decisions.
Here, we present the findings from a collaborative acoustic telemetry study. This study draws together data collected in 2021 by 10 projects to investigate the migration pathways of salmon post-smolts through nearshore and offshore coastal waters to the west of the British Isles. The findings from this show that there is variability in the migration pathways between salmon post-smolts from different regions, rivers and between individuals emigrating from the same river. Salmon post-smolts crossed multiple legislative jurisdiction and boundaries during the marine phase of their migration, where each country has its own, sometimes contrasting management policies. Therefore, it is possible that some populations or individuals are more at risk from potential natural and anthropogenic pressures, such as developments in marine waters, than others.
This study provides much needed empirical data which can provide a basis for the assessment of the risk of coastal pressures and developments on salmon post-smolts during their migration through nearshore coastal and offshore waters to the west of the British Isles.

1: Atlantic Salmon Trust

A Decision Support Tool for Evidence-Based Salmon Conservation in the UK.

Jon Emery[1], Colin Bull[2], Neil Banas[3], Elliot Sivel[3], Emma Tyldesley[3], Graeme Diack[1] & Melanie Smith[1]

The main UK population of wild Atlantic salmon (*Salmo salar*) has recently been reclassified as endangered by the International Union for Conservation of Nature (IUCN), while global populations have shifted from Least Concern to Near Threatened. A wealth of pressures across their complex life cycle, often caused or exacerbated by climate change, are driving unprecedented declines, making it increasingly difficult for managers to predict outcomes and implement effective

conservation strategies. Navigating this uncertainty in fisheries management requires robust, data-driven tools to evaluate potential interventions and adapt to changing conditions.

As part of the Likely Suspects Framework project, undertaken on behalf of the Missing Salmon Alliance, we have developed a Decision Support Tool (DST) to assist salmon and restoration managers in making evidence-based decisions. Built upon a wild Atlantic salmon life-cycle model, the DST is a web-based application designed to make the model and underlying evidence accessible and user-friendly for managers. The tool facilitates management strategy evaluation by simulating the effect of different management interventions on salmon populations, assessing their effectiveness, and prioritizing conservation efforts.

This presentation will showcase the DST, drawing on examples from UK salmon populations and catchments to demonstrate how the tool can provide new perspectives and valuable assistance for adaptive fisheries management. By providing a structured, transparent, and accessible approach, the DST empowers managers to navigate uncertainty and make informed decisions to safeguard the future of wild Atlantic salmon.

1: Atlantic Salmon Trust, UK
2: University of Stirling, UK
3: Strathclyde University, UK

Investigating of trade-offs across the life cycle of Atlantic salmon (*Salmo salar*) for management decision support

Elliot Sivel[1], Neil S. Banas[1], Jon Emery[2], Richard Kennedy[3], Emma Tyldesley[1], Graeme Diack[2], Colin Bull[2,4]

Atlantic salmon stocks have reached alarmingly low levels of abundance in recent years and the species was recently added to the list of endangered species for UK and Irish waters. Whilst studies advance our understanding of the possible drivers of decline, fewer consider how to integrate this knowledge to test effects of commonplace fishery management policies on population status. In this paper, we present a new life-cycle modelling framework combining basic principles and simple ecological processes that allow quick run simulations to test scenarios representing current conditions and possible population-level responses. Here, we describe the model and illustrate how it can be used to test scenarios and provide new support for Management Strategy Evaluation (MSE) frameworks. Using a well-studied salmon population (River Bush, Northern Ireland) we ran the model with variations of individual parameter values, before combining scenarios to represent realistic situations and outcomes. Model outputs reflect how carry-over effects of freshwater juvenile growth may impact marine return rates. Using the same modelling approach, we explore a potential trade-off between smolt age and juvenile growth on returning adult abundance. The modelling framework described here is translated into an easy-

to-use online tool providing multiple levels of output for resource managers to test scenarios and improve their decision-making processes.

1: University of Strathclyde, UK.
2: Missing Salmon Alliance, UK
3: Agri-Food and Biosciences Institute, UK
4: University of Stirling, UK

Impact of simulated light pollution on the behaviour and physiology of European eel and brown trout

Matthew Hatfield[1], Paul [1] & Andrew Vowles[1]

Light pollution is a major form of environmental change that is growing in both extent and brightness. Although considered an emerging threat to freshwater biodiversity, research into the impacts of light pollution on freshwater systems, and fish in particular, remains understudied when compared to terrestrial environments. This presentation will focus on a series of experimental (laboratory) studies aimed at improving understanding of how light pollution influences the behaviour and physiology of two freshwater fishes, the European eel (*Anguilla anguilla*) and brown trout (*Salmo trutta*). When exposed to light pollution for a prolonged period (20 days), group level diel activity patterns were impacted, however, when this occurred within the 24h daily cycle was species dependent. For ALAN exposed trout, daytime activity was lower compared to a control group that were held under a "natural" day-night cycle. For eel, activity was higher during both the day and night when exposed to light pollution, in comparison to the control group. In another study, the relationship between personality traits (such as boldness and exploration) and physiological response (i.e. cortisol and melatonin levels) when exposed to light pollution was explored to understand impacts at the individual level. This body of work indicates that light pollution does impact various aspects of fish behaviour and physiology, and could have several fitness consequences. Importantly, it highlights that these consequences are likely to differ both between and within species, suggesting that the impacts of light pollution on fish are likely complex and difficult to predict.

1: University of Southampton, UK

Using hydropower light deflection method to increase silver eel catches at conservation fishery

Jonny McDowel[1], Derek Evans[1], Jaimie Dick[2]

In 1983, recruitment levels of European Eel (*Anguilla anguilla*) crashed, culminating in the species registration as critically endangered, prompting the implementation of

management actions (Eel Management Plans) to enhance silver eel escapement. Actions include trap and transport (T&T) of migrating silvers around hydropower stations (HPS). Lough Erne, SW Northern Ireland sustained a commercial eel fishery since 1870s. As part of its regional EMP the fishery was closed in 2010 and replaced with Europe's largest eel T&T fishery (> 240T recent 10 years). This mitigated for turbine impacts (of 81% morbidity) on migrating silvers, without access to alternative bypass routes. The research was designed by using known HPS light deflection method upstream of the hydropower stations on Lough Erne. A light array was adapted for deployment in a novel intra-lough method, aiming to boost eel capture at a Coghill net weir within the conservation fishery at Portora. Increased capture subsequently lead to increased escapement to sea upon release into the Atlantic. This study entailed the designing and piloting of a light array device with full-scale field trials application during the 2024/25 silver eel migration season. Subsequent results, observations, and conclusions from these trials will be presented.

1: Agri-Food and Biosciences Institute (AFBI), Belfast, Northern Ireland, UK
2: Queen's University Belfast, UK

Navigating Data Limitations: Developing an SDM for Indian Mackerel in Challenging Situations

Sneha Jha[1], Dhanya M Lal, Sudheer Joseph, T. M. Balakrishnan Nair

Effective fisheries management is essential for sustainable resource utilization, particularly for commercially vital species like the Indian mackerel, *Rastrelliger kanagurta* (Cuvier, 1816), crucial across the Indian Ocean Rim countries. The dynamic niche and complex migration patterns of *R. kanagurta* present substantial challenges for habitat suitability modelling, especially amidst reported population declines and climate-driven regime shifts in Indian fisheries. This research explores the application of statistical techniques and machine learning models to develop a robust species distribution model (SDM) for *R. kanagurta* in Indian waters. However, significant limitations are addressed, including the scarcity of reliable fisheries information, particularly geo-located catch records, and data gaps in remote sensing and model outputs due to cloud cover and coastal proximity. To mitigate these challenges, we integrate diverse data sources, including remote sensing and ocean assimilation models, incorporating physical and biogeochemical parameters while rigorously acknowledging and quantifying the resulting uncertainties. This study discusses the possibility of developing a reliable SDM despite these limitations for predicting the species' spatial availability, enabling the development of forecast advisory tools for fishers and providing valuable insights for fisheries management and conservation strategies in the face of ecological changes.

1: ESSO-Indian National Centre for Ocean Information Services, India

Climate-driven size reduction in tropical rays and its implications for ecological risk assessments

Mohsen Rezaie-Atagholipour[1], Claudia Junge[2], Majid Askari Hesni[3], Katrina J Davis[4], Fereidoon Owfi[5], Catherine Walton[1], Holly A Shiels[1]

Biodiversity conservation relies on ecological risk assessments to evaluate species' vulnerability to threats such as overfishing and habitat loss. These assessments consider both extrinsic susceptibility (exposure to threats) and intrinsic productivity (ability to recover). Intrinsic productivity depends on life-history traits, which can change in response to environmental dynamics. Climate change has been shown to alter life-history traits, particularly in ectotherms, whose physiology is influenced by temperature. One key trait is body size, as larger species tend to grow more slowly and recover at lower rates. Here, we investigate differences in adult male size (disc width) of three coastal tropical ray species, Cowtail Ray (*Pastinachus sephen*), Sandwich Whipray (*Brevitrygon manjajiae*), and Longtail Butterfly Ray (*Gymnura poecilura*), between the Gulf of Oman (present-day climate) and the warmer Persian Gulf (the world's hottest sea with summer sea surface temperatures >35°C for over 6000 years). We measured trawl-bycaught specimens and included only adult males, which are identifiable in the field through clasper morphology. Our results show that adult males in the Persian Gulf are significantly smaller (by 6% for *B. manjajiae*, 26% for *P. sephen*, and 33% for *G. poecilura*) with smaller size at maturity and maximum size compared to those in the Gulf of Oman. This suggests that, like teleost fish, elasmobranchs shrink in response to long-term ocean warming, potentially affecting their intrinsic productivity. Given that elasmobranchs are the second most threatened vertebrate group, with over one-thirds of their >1200 species at risk of extinction, it is crucial to develop climate-adaptive ecological risk assessments.

1: University of Manchester, UK
2: Institute of Marine Research, Norway
3: Shahid Bahonar University of Kerman, Iran
4: University of Oxford, UK
5 Iranian Fisheries Science Research Institute, Iran

Stable isotopes as tools for fisheries management

Chris Harrod[1]

Fisheries management requires a deep understanding of abiotic and biotic factors affecting the ecosystems and ecological community supporting a particular fishery. Fisheries managers have a deep and diverse toolbox of methods to aid such understanding and to support informed decision making. Here, using examples from N Europe and S America, I will present my argument that stable isotope analysis represents a candidate for inclusion as a standard tool for fisheries management. Stable isotope values from primary producers and consumers allow the characterisation of food web structure (what feeds fish), ontogenetic shifts,

movement of individuals across habitats, (often unrecognised) population sub-structure and the impacts of ecological change (non-native species, habitat degradation/restoration). I will describe approaches that minimise impacts on receiving fish populations but that maximise information quality and management utility.

1: University of Glasgow

DIASPARA project: Strengthening the scientific basis for managing diadromous fish populations

E. Díaz[1], C. Briand[2], J. Helminen[3], M. Nevoux[4], J. Pohlmann[5], E. Rivot[4], R. van Gemert[6], R. Whitlock[6], H. Drouineau[7]

Diadromous fish, such as the European eel *(Anguilla anguilla*) and the Atlantic salmon (*Salmo salar*), are emblematic species whose life cycles span freshwater and marine environments. Their conservation status is of great concern, with eel listed as critically endangered and salmon as near threatened (IUCN, 2023). These migratory dynamics, particularly the mixing of otherwise isolated subpopulations during the marine phase, create biological, spatial, and administrative interdependencies that challenge population assessments and management.
The DIASPARA project addresses these challenges by strengthening the scientific basis needed to assess population status and support decision-making. It aims to improve the alignment between data collection and the requirements of stock assessment models. DIASPARA first compiles and analyzes life-history traits to (i) identify spatio-temporal patterns in key demographic parameters and (ii) detect knowledge gaps to guide future data collection efforts.
Secondly, the project develops FAIR (Findable, Accessible, Interoperable, and Reusable) databases to improve access to data on species, habitats, and threats, supporting transparent and harmonized assessments across regions. Finally, DIASPARA introduces computational improvements to boost the performance and usability of assessment models, enabling more comprehensive scenario exploration during expert group evaluations.
By integrating ecology, data science, and modelling innovations, DIASPARA contributes to more effective, coordinated management of diadromous fish populations across Europe.

1: AZTI, Spain
2: Eaux & Vilaine, France
3: Natural Resources Institute, Finland
4: INFREMER, France
5: Thünen Institute of Fisheries Ecology, Germany
6: Swedish University of Agricultural Sciences, Sweden

Challenges in Monitoring and Assessment

To err is human: the importance of data cleaning and sense-checking in the production and use of fisheries and aquaculture statistics

J.R.Ellis[1], T. Ellis[1]

Key input data for the assessment of wild fishery stocks (and management of their fisheries) include “catch data”, comprising landings data and, where available, estimated dead discards. Catch data are typically collated nationally as official landings statistics and provided to relevant international bodies (e.g. ICES and FAO) to enable collation of international statistics. Whilst fishery statistics are subject to quality control and provide the best available evidence, such extensive datasets can still be prone to a range of errors, as well as incomplete reporting. Errors may not always be recognised and addressed by downstream users, whether for assessment or other scientific analyses, and so could affect management. Fisheries statistics are not unique in this regard, and similar errors can be introduced into aquaculture production statistics. Examples of errors include: incorrect species identification, species (code) input errors, input errors for associated data (e.g. statistical area, gear type, year), inappropriate conversion factors, confusion over units (kg, tonnes, individuals), inappropriate resolution of reported data, incomplete coverage (e.g. it can be unclear whether certain production should relate to ‘fisheries’ or ‘aquaculture’, or whether all fish landed for bait in other fisheries are reported fully). Errors in statistics can then be further promulgated into the scientific literature. Considerations for improving the quality of such statistics are discussed.

1: CEFAS, UK

Salmon Data Mobilisation

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Population declines faced by many salmon species have occurred despite widespread research and conservation efforts. The capacity to turn globally distributed freshwater and marine monitoring programmes into informed management actions is limited by a lack of coordinated publication of the resultant data for re-use by others. Useful resources tend to remain minimally accessible outside of their immediate participants, constraining opportunities for researchers to work collaboratively on broad-scale insights and solutions. With the recent International Union for Conservation of Nature extinction risk reclassification of Atlantic salmon, a move from ‘Least Concern’ to ‘Near Threatened’, and even ‘Endangered' for some populations, the need to alleviate potential research bottlenecks is clear. Creating the environment in which data resources can be shared and understood for the broader research insights they may provide - or Data Mobilisation – is a key step towards informed management actions. While Data Mobilisation is growing in the research community, it has yet to penetrate deeply into the culture of salmon research and conservation. To support this transition, our

NPAFC Bulletin 7 paper “Salmon Data Mobilization” (https://doi.org/10.23849/npafcb7/x3rlpo23a) assembled a variety of stakeholder perspectives to provide a salmon-focused definition of mobilised data. We reviewed the spectrum of Data Mobilisation participants and identified modern and innovative methods used, as well as barriers and opportunities to mobilise data for the broader good. My presentation will cover the aspects of these barriers, opportunities, and potential solutions, from the perspective of the Atlantic Salmon Trust as Data Producers and Data Consumers.

1: Missing Salmon Alliance, c/o Atlantic Salmon Trust, UK
2: Marine Institute, Ireland
3: Fisheries and Oceans Canada, Canada
4: United States Geological Survey, USA
5: Atlantic Technological University, Ireland
6: Institute of Aquaculture, UK
7: Hakai Institute, Canada
8: National Centre for Ecological Analysis and Synthesis, USA
9: CEFAS, UK
10: Fisheries and Oceans Canada, Canada
11: French National Institute for Agriculture, Food and Environment, France

Proof-of-concept use of a low-cost acoustic detection device to monitor the spawning activity of critically endangered salmonids: A UK case study

H. Currie[1], T. Meredith[1], M. Schaefer[1], K. Deane[1], P. White[1], B. Drakeford[1], P. Failler[1], A. Vowles[2], W. Beaumont[3], S. Elliot[3], L. Scott[3], D. Roberts[3], R. Forshaw[4],

Globally iconic anadromous fishes have been disproportionately impacted by human-induced changes. In the temperate North, wild populations of salmonids are diminishing drastically. Over 75% of salmon rivers in Great Britain are now considered ‘at risk’, and the conservation status of Atlantic salmon *(Salmo salar)* populations was downgraded to “endangered” following a decline of 30-50% since 2006. Wide-scale monitoring of individuals, populations, or ecosystems is essential to track progress of salmonid populations with respect to changing environmental trends, and to support recovery through evidence-driven decision-making. Traditional walkover methods that rely on human observations, such as redd counting to record annual spawning activity, are practically challenging. River conditions that impact visual detectability, demands on staff resourcing across extensive spatial scales and other limitations constrain redd survey success and data outputs. There is a pressing need for novel, robust, and cost-effective monitoring solutions to complement traditional resource intensive methodologies to better understand spatial distribution of spawning sites, fish behaviour and population trends during this phase of the salmonid lifecycle. This information is critical to inform mitigation and management decisions to support salmonid recovery. Recent technological advances have led to the emergence of low-cost, user friendly passive acoustic monitoring (PAM) devices. PAM lends itself to monitoring salmonid spawning activity, as the behaviour is

acoustically detectable, with the redd cutting process producing a distinct acoustic signature. This presentation will focus on proof-of-concept trials conducted on the River Frome, Dorset (UK: November 2024 - January 2025) to determine whether low-cost PAM devices could be used to monitor salmonid spawning activity. This talk will then discuss the benefits and limitations of outputs compared to traditional walkover and UAV drone surveys conducted within the same reach. We will argue for the complimentary value of differing approaches in our ecological survey toolkits to better support mitigation and management decisions for salmonid species population recovery.

1: University of Portsmouth, UK
2: University of Southampton, UK
3: Game and Wildlife Conservation Trust, UK
4: Ricardo Energy & Environment

Parallel multivariate phenotypic plasticity in resource polymorphisms of salmonids

J. Philip[1], M. Carruthers[2], O. Hooker[3], T. Van Leeuwen[4], A. Jacobs[1], C.E. Adams[1], K. Elmer[1]

The ability of one genome to form alternative developmental phenotypic trajectories in response to environmental variation, is defined as developmental phenotypic plasticity. Morphological and physiological responses to trophic variation are highly prevalent in salmonids and may lead to polymorphisms. However, the molecular mechanisms that underlie trait plasticity by bridging environment and phenotype, still deserved to be investigated. Particularly, it remains unknown how consistent these mechanisms are across species and how they correspond to the extent of phenotypic plasticity. Here, using a multi-taxon comparison of salmonid species (i.e., Arctic charr, European whitefish, Atlantic salmon and brown trout) exposed to contrasting diet modalities (i.e., benthic and limnetic), we investigated the extent to which, patterns of plasticity in gene expression, morphology and growth are repeated across species. We showed that body shape largely changed in consistent ways across lineages. Gene expression (from RNA-seq) patterns were compared with morphological and physiological traits to investigate the correlation between phenotypic and molecular traits. We identified greater expression of genes related to overall growth and development in benthic trophic types, while up-regulation of genes involved in metabolic processes, DNA replication, repair and immunity were significantly differentiated limnetic individual. These findings are in concordance with morphological and physiological results, where benthic individuals had larger and deeper bodies and exhibited higher growth and metabolic rate compared to limnetic individual. Our findings demonstrate the shared developmental programs of plastic divergence are conserved across related salmonid species.

1: University of Glasgow, UK
2: Queen Mary University of London, UK

3: PR Statistics
4: Fisheries and Oceans Canada, Canada

Monitoring hook to release fishing practices in a recreational fishery: the story of the English CatcH And Release Tagging (CHART) fishery for Atlantic bluefin tuna

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Many sports or recreational fisheries include catch and release elements i.e. fish are not retained and are instead released back into the environment. However, while catch and release limits mortality at the stock level, there is relatively little evidence on 'hook-to-release' fishing practices and their potential impact on individual fish. Here, we document the fishing practices in a limited, controlled trolling fishery for Atlantic bluefin tuna (BFT) in the south-west of England between 2021 and 2023. Fishers taking part were educated each year in capture, handling, data-collection and tagging techniques that were co-designed by scientists and recreational fisheries stakeholders. Practices at sea and data were self-reported and validated by direct observation and on-board camera systems. Condition assessments made by fishers at capture and at release agreed with those conducted by scientific observers or using footage from on-board cameras. In total, more than 3300 BFT ranging in size from 95 cm to 288 cm (straight fork length) were captured, providing data on fight time, hook location, injuries and alertness. Fight times varied from a few minutes to more than two hours and showed a relationship with BFT weight. Alertness at capture was occasionally reduced (79 of 3273 observations, 2.4% overall), and was statistically more likely be observed after longer fight times. However, 36 (46%) of lethargic BFT reverted to full alertness after a being towed to aid recovery at the side of the vessel for a short period. The data collected in CHART were used to categorise levels of impact and develop a 'welfare triangle' that can be used to communicate the value of mitigating avoidable impacts. Overall, the data suggest that high welfare standards can be achieved in a recreational fishery and that co-design, training and experience both play a crucial part in achieving this.

1: CEFAS
2: The UK Bluefin Tuna Association Ltd (UKBFTA)
3: Bluedog fishing
4: Natural England
5: Cornwall Inshore Fisheries and Conservation Authority (CIFCA),
6: The Marine Management Organisation

The ecomorphology of the oral and pharyngeal jaws in Loricariid catfishes using computerized tomography and feeding trials

R.F. Bentley[1]

Loricariidae (Armoured catfishes) is one of the largest family of fishes exclusive to Central and South America. The majority of Loricariid catfishes have trophic niches that specialize in algae or detritus but show a large amount of ecomorphological disparity. Previously the ecomorphology of this large adaptive radiation has been largely unexplored regardless of their diversity and importance to local human communities.
This aspect of my research has three main aims: What is the major axes of oral ecomorphology in Loricariid catfishes, and to what extent these are linked to diet but constrained by phylogenetics and modularity. Is this divergent oral morphology functional and under divergent selection? What is the diversity of pharyngeal jaws and are these functional?
Computerized Tomography (CT) scanning and macroevolutionary methods was used for over 64 species and feeding trials of 6 representative species of Loricariid catfishes. A wide diversity of ecomorphological anatomy was identified in both the oral and pharyngeal jaws. The oral jaws are used largely for food capture via a unique rasping motion and pharyngeal jaws, for food processing are shown to be linked to the dietary ecology of these fishes. Unique pharyngeal jaw anatomy has also been displayed throughout the clade with the Loricaria group displaying molariform anatomy similar to those found in durophagous cichlids. Using a large scale phylogeny I have identified how these unique morphologies have evolved across Loricariidae and identified links to where there is constraint from phylogeny.

1: University of Bristol

Biases in Batoid research put species at risk

A.J. Temple[1], S. Rosinski[1], J.Cochran[1], F.Khan[1], M.Berumen[1]

The biodiversity crisis, fuelled by anthropogenic activities, has caused species populations to decline at an alarming rate. Scientific research plays a crucial role in identifying, understanding, and managing the species most at risk. We investigated the causal effects of conservation status (IUCN Red List), accessibility (geographic and depth range, year of description, and GDP), and charisma (size, colouration, patterning, and body shape) on research outputs in 633 batoid fishes. We show that, once confounding factors are properly accounted for, conservation status actually drives a decrease in research outputs. In contrast, charisma-linked traits such as increasing size, shape, pattern, and colour uniqueness, and species accessibility emerge as strong predictors of research focus. Given the critical conservation needs of many marine species our findings suggest that many highly endangered, but non-charismatic and difficult-to-access species, are dangerously underserved by the research community, exacerbating their risk of extinction. We strongly encourage funders, policymakers, and researchers to refocus efforts on the many high-risk but underserved species to maximise our chances of bending the curve on biodiversity-loss in the marine environment.

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Understanding European eel distribution and habitat requirements with eDNA and drainage management data to guide eel regulation compliance and conservation in pumped river catchments

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In response to the European eel's *(Anguilla anguilla)* population decline and critically endangered status, European Commission Regulation No. 1100/2007 mandates eel management plans, including safe eel passage at hazardous intakes, such as pumping stations. England and Wales eel regulations require screening or alternative passage measures at many hazardous intakes. Pumping stations are a threat to seaward migration of spawning stage eels via entrainment mortality and delayed migration. Additionally, they impede upstream eel migration. River modifications for drainage can also degrade habitat. Environmental DNA (eDNA) metabarcoding offers an effective alternative to traditional fish sampling, providing comprehensive vertebrate community data. Four eDNA sampling campaigns were conducted across 144 pumping station catchments in the Anglian Fens, UK, detecting eels in 43 (30%) of them. Eel presence correlated with better connectivity to the downstream river and higher fish species richness with a significantly higher fish species richness at eel-positive sites ($p<0.01$). Remote sensing, physical habitat data and technical metadata from drainage authorities are being integrated with eDNA community data to assess eel habitat suitability and quantify suitable habitat in catchments. These findings are guiding pumping station management for costly "less damaging" downstream passage modifications and upstream passage remediation for juvenile eels to increase migration success and reduce habitat fragmentation. The Environment Agency will use these findings to provide Best Available Eel Protection across the Fens, ensuring effective funding allocation. The extensive eDNA sampling effort of the project also provides insight into rare and invasive species distribution in the fens.

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Optimizing eel passage at large hydroelectric facilities: the contribution of multiple eel ramps

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In a context of climate change, hydropower can produce renewable energy with a limited carbon footprint. However, dams and weirs built for this purpose form barriers that are detrimental for ecological connectivity. This can be particularly damaging for migratory fish species such as the European eel (Anguilla Anguilla). European eel is a threatened diadromous fish that needs freshwater habitats to grow before its reproductive migration, and impaired ecological connectivity can affect the amount

of available habitats or completely impair the migration. To mitigate the effect of obstacles, eel ramps can be installed but to be effective, such devices must be attractive. This attractiveness depends on the location of the ramps, the configuration and potential management operations of the facility (e.g. discharge repartition in different turbines) and, more generally, on the hydrodynamic conditions at different scales. In order to improve the passage of eels upstream of a large hydroelectric dam on the Dordogne River (France), one permanent ramp was added in 2010 and two additional ramps have been installed over a three-years period. A mark-recapture experiment was carried out: some eels were captured after climbing the ramps, marked with PIT-tags, and released downstream. The marked individuals could then be detected at each ramp during their second passage by antenna. With these data, we developed a hierarchical, mechanistic Bayesian model. The aims were 1) to disentangle the different drivers involved, i.e. the decision to migrate as a function of environmental conditions and the attractiveness of ramps as a function of dam management, and 2) to find out whether 3 ramps were more effective (number of succeeding individuals, delays) than a single one. This study provides recommendations on the location and number of ramps to be installed at large hydroelectric facilities to maximise the passage of eels in a minimum time.

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The role of behavioural traits in successful fishway passage during seasonal brown trout migrations

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The success in overcoming lateral obstacles in rivers is crucial for longitudinal fish migrations and is influenced mainly by fishway design, environmental variability and/or individual behavioural traits. However, the role of behavioural traits remains poorly understood. In our study, we observed seasonal migrations of brown trout *(Salmo trutta)* (Linnaeus, 1758), including passage through a bypass fishway, during a one-year field study (Úhlava River, Elbe catchment area, Czech Republic). We captured wild brown trout and analysed their individual behavioural traits, e.g., movement activity, lateralization and boldness indicators, in a T-maze experiment. Subsequently, 61 fish were tagged with transmitters equipped with temperature sensors and released near their original capture position downstream of the bypass fishway, and their positions in the stream were recorded weekly. We analysed the relationships between behavioural traits measured in the experiment and their propensity to enter the bypass and overcome obstacles. Body temperature, size and weight, sex and river flow were measured and used for analysis purposes. A total of 46 individuals entered the fishway and successfully migrated upstream, 8 individuals entered the fishway and maintained their position within the bypass and/or moved downstream, and 7 individuals migrated and/or maintained their position

downstream of the fishway with no recorded attempt to enter it. The influence of individual behavioural traits on the propensity to enter the fishway was examined.

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Dietary and spatial overlap between non-native pink salmon (*Oncorhynchus gorbuscha)* and native salmonids in the North Atlantic/Arctic region

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Pink salmon (*Oncorhynchus gorbuscha)* were deliberately introduced into rivers around the White Sea in the second half of the 20th century. Since 2017 the species has spread rapidly, with large numbers of returning adults seen in rivers across the North Atlantic region. The number of returning adults has increased with every generation: they now outnumber wild Atlantic salmon *Salmo salar* in northern Norway. In the North Pacific, Pink salmon compete for food with other Pacific salmon, but the consequences of their invasion of the North Atlantic for native salmonids is unknown. Stable isotopes were used to assess dietary and spatial overlap between native and non-native salmon in the North Atlantic and Arctic, and to determine their ecological role in recently invaded rivers. Overlaps with *Salmo salar* at sea were confirmed. Further expansions of confirmed breeding sites are detailed. Analysis of the trophic position of pink salmon juveniles as a prey and predators in rivers is also presented. The rapidly increasing pink salmon stocks in the North Atlantic should be considered as a threat to Atlantic salmon.

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7: Natural Resources Institute Finland, Finland
8: Firum, Fareo Islands
9: Institute of Fisheries Ecology, Germany
10: Marine and Freshwater Research Institue, Iceland
11: Outer Hebrides Fisheries Trust, UK
12: Six Rivers Foundation, Iceland
13: West Sutherland Fisheries Trust, UK
14: Fisheries Ireland, Ireland
15: Greenland Institute of Natural Resources, Greenland
16: University of Waterloo, Canada
17: Fisheries Management Scotland, UK

18: National Institute of Aquatic Resources, Denmark
19: Institute of Marine Research, Norway
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POSTERS

Alini Beloto Parra

Changes in fish taxonomic and functional diversity associated with the construction of a hydroelectric power plant in a Neotropical river

Dams affect freshwater biodiversity and can cause changes in the taxonomic and functional structure of assemblages. Understanding changes in the structure of fish assemblages is particularly important for predicting changes in ecosystem functioning and provisioning of ecosystem services (such as fisheries production). In this study, we quantified taxonomic and functional diversity of fish assemblages before and after construction of the Batalha Hydropower Plant on the São Marcos River, Upper Paraná River Basin, Brazil, to assess fish diversity responses to impoundment. Field surveys were conducted during the pre- (2010 to 2012) and post-impoundment (2013 to 2022) periods, upstream and downstream of the dam. Possible changes in fish taxonomic diversity were evaluated using richness and diversity indices, and PERMANOVA analysis. Functional diversity was evaluated using functional richness (FRic), evenness (FEve), divergence (FDiv), dispersion (FDis), and redundancy (FRed) indices and community weighted mean (CWM) analysis. In total, 51 taxa were recorded, representing four orders. There were no differences between periods for the taxonomic diversity indices. However, there was a difference in community structure between periods upstream (PERMANOVA; $F = 4.16$; $DF = 1$; $p < 0.01$). In contrast, FRic, FDis, and FRed decreased in the post-impoundment period downstream (all $p<0.05$). Thus, construction of the Batalha HPP primarily led to functional impoverishment downstream - possibly also influenced by the Serra do Facão HPP downstream - and taxonomic restructuring upstream. These changes are linked to environmental modifications that favor species with traits suited to lentic environments (e.g., omnivory and sedentary species with parental care) but which are unfavorable for native and migratory species without parental care at the upstream

site and detritivorous species at the downstream site, as indicated by the CWM. These findings highlight the importance of ongoing assessments to improve the planning of hydroelectric projects and mitigate their impacts on biodiversity and ecosystem services.

Amanda Gardiner

Genetic diversity and past effective population size from over a hundred fish and elasmobranch genome sequences

Genetics provides a unique lens to study population size and structure, gene flow and interbreeding, and the diversity of populations within both cartilaginous and bony fishes. With advances in whole-genome sequencing, these studies can now be carried out at increasingly higher scale and resolution. The Vertebrate Genomes Project (VGP), launched in 2017 by the G10K consortium, has the ultimate goal of generating high-quality, chromosome-level, haplotype-phased, and annotated reference genomes for every one of the over 70,000 vertebrate species alive today. The first phase of the VGP has assembled over 520 reference genomes, including at least one for more than 80% of vertebrate orders. Using 127 reference genomes for elasmobranch and actinopterygian species, together with sequence data from the alternate haplotype of the diploid individual, we are characterising inter- and intra-species heterozygosity, runs of homozygosity, and inferring past effective population sizes through the use of the Pairwise Sequentially Markovian Coalescent (PSMC) model. We expect these results to identify species that have undergone recent population decline and have low heterozygosity, and therefore are at risk of experiencing inbreeding depression. Those species at risk can then be the focus of more detailed future studies to evaluate their current population size and structure, identifying which populations are undergoing the most serious threats, and subsequently recommending policies to manage and mitigate further decline and loss of diversity.

Andrew J. Temple

Opportunities to enhance conservation success for sharks

Sharks, rays, and chimaeras are among the most threatened vertebrate lineages. Despite considerable conservation efforts, the extinction risk of sharks continues to rise. We present a quantitative analysis of the shark conservation literature, exploring trends and interconnectivities in key topics using a machine learning approach. We show that shark conservation research is a well interconnected, coherently structured, and rapidly expanding field centred around a conservation nexus linking human-wildlife interactions to species use and management. Shark conservation research is increasingly interdisciplinary and is well prioritised toward key threats that drive the decline of shark populations, both of which are key to effective management. However, we also identify opportunities to further strengthen research and management. These include improved integration of key research topics, enhancing the understanding of combined threats, and greater consideration for the

role of sub-lethal impacts. Lastly, we stress that meaningful integration of research topics, rather than simple contextualisation, is essential to building the comprehensive and nuanced understanding necessary to inform effective conservation actions. By leveraging the strengths of the field and addressing its remaining weaknesses, there is hope for a future where sharks thrive and contribute to healthy, resilient marine ecosystems.

Callum Sturrock

Disentangling climate, fishing and population dynamics effects on three decades of haddock (Melanogrammus aeglefinus) growth in the Irish Sea.

Disentangling climate, fishing and population dynamics effects on three decades of haddock (Melanogrammus aeglefinus) growth in the Irish Sea
Evaluating how fish populations respond to environmental and anthropogenic pressures is critical for forecasting future changes, yet such studies are often limited by a lack of long-term biological data. In the Irish Sea, sustained declines in the size and weight of older haddock (*Melanogrammus aeglefinus*) age classes have coincided with strong fluctuations in stock biomass, long-term warming, and decades of overexploitation. To investigate the drivers of these trends, we developed a three-decade biochronology (1990–2023) using the width of annual growth bands in otoliths as a proxy for individual growth, based on haddock data from Irish Sea components of the International Bottom Trawl Surveys. Using a mixed modelling framework, we examine how growth trends relate to key climate, population, and fishing-related variables to identify the primary drivers of haddock growth during this period. Since 2014, improved management and strong recruitment pulses have facilitated a strong increase in haddock biomass. We investigate if this has induced density-dependent limitations on growth. We also examine life-stage-specific variability in growth responses and evaluate in relation to the Temperature-Size Rule, which predicts accelerated juvenile growth but reduced adult size and could compound density dependant changes in growth. Finally, we compare individual growth trajectories between age classes to establish if size-selective fishing pressure has driven evolutionary or plastic shifts toward slower growth. Our findings will provide key insights to support adaptive fisheries management strategies which in turn help to enhance resilience to climate change in the Irish Sea ecosystem.

Charlotte Nuyt

Environmental DNA in fisheries management: future horizons for bycatch monitoring

Elasmobranch (sharks and rays) populations have declined worldwide since the mid-1900s due to the industrialisation of fisheries. Their life-history traits, characterised by strategies such as late maturity, slow growth with a long lifespan, and low fecundity – do not allow them to rapidly recover from population decline, caused by overexploitation, bycatch and habitat loss. In particular, the real impact of bycatch on these iconic species is likely underestimated. Interest in the applications of

environmental DNA (eDNA) for bycatch monitoring is increasing, highlighting its potential to supplement traditional methods like fisheries observers or fisheries logbooks. Accurate information of catch and bycatch composition and size a re essential to inform fisheries management and to allow sustainable exploitation of marine resources. However, quantifying multiple species simultaneously in the bycatch, remains particularly challenging.
This project aims to develop innovative environmental DNA (eDNA) protocols for different types of fishing gear, using both metabarcoding and species-specific digital PCR approaches, to enable elasmobranch bycatch quantification directly from the catch. This eDNA based monitoring method will be tested in gillnets and bottom trawls in Irish and Icelandic waters in order to optimise samples collection and subsequent processing. The first insights of the methodology will be presented. If successful, this will become part of a toolset for bycatch monitoring that will improve our understanding of the distribution and abundance of elasmobranchs as well as the level in which they interact with fisheries.

Claudia Allen

To Catch or Conserve? Marine governance and the UK-EU sandeel dispute. A case study of transboundary environmental-economic tensions post-Brexit and its implications for marine governance across the island of Ireland.

Legal pluralism theory explores the interaction of different legal orders at an international, regional and national level (Griffiths 1986), resulting in either cohesive legal systems or conflicting legal orders where policy goals and outcomes are misaligned. Such interactions are prominent within transboundary areas, such as the seas across the northeast Atlantic. These waters are becoming increasingly industrialised by traditional and emerging marine activities, adding to the already complex marine governance frameworks. Brexit added to this complexity (Boyes and Elliot, 2016) by facilitating misalignment in policy objectives between Northern Ireland and the Republic of Ireland. The recent EU-UK sandeel dispute provides a case study which exemplifies this issue from the broader EU-UK positions. To protect declining UK seabird populations, The Department for the Environment, Food and Rural Affairs in England and the Marine Directorate in Scotland prohibited the commercial fishing of sandeels within the UK's Exclusive Economic Zone, including the Dogger Bank fishing area, which includes important fishing grounds for the EU fleet. Sandeels are a vital food source for many UK seabird species, yet overfishing is reducing food availability and has been linked to a decrease in seabird abundance – with puffin populations declining 24% over the past two decades (Harris et al., 2024). The EU's Directorate-General for Maritime Affairs and Fisheries contested the closure in reference to obligations in the EU-UK Trade and Cooperation Agreement. Specifically: that the ban was (a) not based on scientific measures (Article 946 (2), (b) disproportionate and discriminatory (Article 496 (1); 494 (3) (3)) towards EU vessels as the grounds are predominantly fished by the Danish fleet, (c) preventing access to UK waters (Annex 38). The EU raised the issue before the Permanent Court of Arbitration (2025), which facilitates dispute resolution between the two States. This poster uses

this dispute as a case study to explore the legal uncertainties and potential for conflicts through divergence of legislation and its transferability to the island of Ireland. The findings demonstrate the complexities of post-Brexit marine governance through a misalignment of environmental versus economic policy objectives and supports broader discussions on cohesive and cooperative governance of transboundary fisheries resources.

Daniela Felix

Unravelling connectivity in the undulate skate Raja undulata populations in the northern Atlantic Ocean

Assessment of genetic diversity and population structure is essential for species with conservation status, and the life strategy of elasmobranchs makes them more vulnerable to overexploitation, making it critical to define and improve management and conservation. The undulate ray Raja undulata is a coastal skate found along the northeastern coasts of the Atlantic and Mediterranean Seas, with a patchy distribution on continental shelves; it is currently classified as endangered by the IUCN, with a declining trend, necessitating the establishment of conservation units to improve management. The purpose of this study was to determine the diversity and genetic structure of R. undulata in the Northeast Atlantic: south of England (SE), the strait of Gibraltar (SG) and Morocco (MOR), between 2017 and 2018 using a non-invasive method. For this, we used 10 species-specific microsatellites to successfully genotype 103 individuals. The results of global genetic diversity levels were high among localities (Ho=0.77). Genetic structure analysis suggested panmixia along the Northeast Atlantic coast (FST=0.03; $p<0.05$), which may be favoured by the high connectivity between localities. We then tested a pairwise FST between localities, where it showed a small but significant difference between SE vs. MOR, which may be related to the distance between localities. These results emphasise the need to assess the wide geographical area in which the species occurs to improve management policies for this threatened species.

Dario J. Di Girolamo

Fish Food Web Structure and the Ecosystem Wide Impacts of Eutrophication in the UK's Largest Freshwater Lake, Lough Neagh

Lough Neagh is the largest freshwater lake in the UK and is of significant economic and ecological importance. It supports the largest freshwater eel fishery in Europe, and provides water to 50% of Northern Ireland. Fish are key components of the ecosystem as they link energy flow and trophic interactions that underpin ecological function and economic value. Despite its importance, the lough faces several issues that are threatening its ecosystem services, including eutrophication, pollution, resource exploitation, climate warming, and invasive species. This study will construct the food web of Lough Neagh and analyze the structure, stability, and temporal dynamics of fish. Using a tri-variate approach that integrates species abundance, biomass, and species interactions, the food web will be modelled from historical records, literature, and empirical stomach content analysis. The resulting

web will identify key abiotic and biotic drivers of food web structure and network metrics, enabling predictions of future changes. By analyzing dynamics and stability of fish within the food web, this research aims to improve understanding of how individual and combined perturbations may impact the ecosystem for future management.

Derek Evans

The European Eel Production Paradox: recruitment or enrichment?

Of the causes associated with the decline in the eel population, the impact of environmental change on the aquatic ecology has been little studied. The aim was to determine whether the change in eel population in Lough Neagh was the consequence of environmental change or reflects natural fluctuations in fish populations. The stock / recruitment curve for 1923-43 was used as the baseline to quantify change. If there had been no change in the population dynamics, then the silver eel output for 1948-2024 was predicted to vary between 2.3-3.4M. Comparing the baseline output with that observed showed that from the early 1950s to late 1990s output of silver eel was higher than the baseline. After the early 2000s there was a reduction in the baseline, reflecting the decline in recruitment. Observed output declined faster, suggesting causes other than recruitment. The change can be explained by the change in natural mortality which decreased coinciding with a period of enrichment and then increased as eutrophication intensified. At the same time the algal community changed from one of high to one of poor nutritional value. This may have impacted on the nutritional quality of the chironomids, a major food source for eel.

Diarmaid Duffy

Evolving waters: Contrasting the population genetics of brown trout (Salmo trutta) across the island of Ireland

Brown trout (*Salmo trutta*) are among the most ecologically and genetically diverse vertebrates, exhibiting a wide range of life history strategies and adaptations to varied freshwater and marine environments. In Ireland, S. trutta populations are shaped by both their evolutionary legacy and the influence of human activities, including habitat modification, stocking, and the introduction of invasive species. These pressures, combined with the species' natural ecological plasticity, have produced complex patterns of population structure and genetic diversity. Despite their importance, many Irish *S. trutta* populations remain poorly characterised at high genetic resolution, particularly in systems subject to contrasting environmental pressures and management histories.
To address this knowledge gap, an ongoing study is generating high-resolution population genetic and phylogeographic data from four contrasting freshwater systems across Ireland: Lough Erne in the northeast, Lough Mask in the west, the Carnlough lakes in the northeast uplands, and the Camcor River in the midlands. Lough Erne is a large, complex lake system heavily influenced by historical stocking and environmental disturbances. Lough Mask supports important ferox trout (Salmo

ferox) populations and faces pressures from invasive species. The remote Carnlough lakes are small upland systems with an uncertain stocking history, where it is unclear whether present trout populations are wild or derived from feral farm stock, and no prior population genetic data exist. The Camcor River is home to the distinctive Croneen trout, a population of particular conservation concern.
Using a combination of microsatellites, mitochondrial DNA, and nuclear SNPs, the study explores how contrasting life histories, evolutionary trajectories, and anthropogenic impacts are shaping genetic diversity and population structure across these systems. The findings will provide valuable insights into the resilience and vulnerability of brown trout populations and inform future conservation and management strategies aimed at preserving the genetic integrity and adaptive potential of this iconic species.

Jairo Arroyave

On the discovery and description of a new endogean, dwarf, and troglomorphic species of swamp eel (Synbranchiformes: Synbranchidae) from Costa Rica

This contribution presents the process of discovery and description of *Ophisternon berlini*, a recently described highly troglomorphic and diminutive swamp eel from Costa Rica, notable for being one of only three species on the world to not live in water. Comparative anatomical and mitogenomic data support the distinctiveness of the new species and its placement in the genus *Ophisternon*. The new species is unique among Neotropical congeners in having: 1) a greatly elevated number of precaudal vertebrae, 2) proportionally longer and larger premaxillary, dentary, palatine, and ectopterygoid teeth, 3) palatine and ectopterygoid teeth in a single row, and 4) a small, narrow, and crescent-shaped gill membrane opening. A novel phylogenetic hypothesis of synbranchid relationships proposed herein, derived from comparative mitogenomic data, adds to a body of evidence demonstrating that *Ophisternon* is not monophyletic (with respect to *Synbranchus*). This phylogeny, however, strongly supports the monophyly of Neotropical *Ophisternon*, with the new species resolved as sister to a clade consisting of *Ophisternon infernale* + *Ophisternon aenigmaticum*. A pattern of northwestern lineage dispersal and cladogenesis within the Neotropical clade of *Ophisternon* after its divergence from *Synbranchus* is inferred from our phylogenetic results and present-day species distributions. The findings also reinforce the notion that the classification of synbranchid fishes is in dire need of a systematic and comprehensive revision, particularly with respect to the limits and composition of the genera with presence in the Neotropics.

Jessica Clemens

Mussel Metabolomics: In Pursuit of a Biomarker for Population Success in Marine Mussels Exposed to Contaminants

With over five million people living in its watershed, Puget Sound is highly impacted by anthropogenic activities and is regularly exposed to a myriad of contaminants through the inflow of stormwater and wastewater effluent. While a number of these contaminants have been detected at potentially harmful levels, there are gaps in our understanding of the potential impacts these substances have on aquatic organisms. One approach to bridge this knowledge gap is to utilize metabolomic data from exposed organisms to relate chemical occurrences to biological outcomes. Marine mussels are ideal for this work, given that they accumulate chemicals through their filter-feeding behavior and, in Puget Sound, are already used in long-term water quality monitoring efforts.
The comparative analysis of endogenous metabolites, termed metabolomics, shows promise as a method for identifying impacts as it is highly sensitive to exposures, and it captures more minute biochemical changes compared to assessments at higher levels of biological organization. Metabolite studies can provide insights into the impact that contaminants have on organisms as the changes are related to larger organism health outcomes. Given the importance of reproductive success to maintaining stable populations, identifying metabolites that could serve as biomarkers of impact on reproductive functions has been a key focus of this work. Here, we describe the results of a pilot study meant to characterize the metabolic changes in mussels due to exposure to wastewater and present a suite of metabolites related to energetics as potential indicators of the effects of contaminant exposures on population health through reproduction.

Jessica Rodger

The Core Rivers Programme

The importance of catchment restoration for wild Atlantic salmon has been highlighted in recent decades, with fisheries managers implementing restoration projects which will benefit populations of wild salmonids. With the decline in the abundance of wild salmon across the UK and Ireland, restoring degraded habitat to a more natural state has become a priority.
Understanding the effectiveness of these management or restoration actions on Atlantic salmon populations can only be achieved through multidisciplinary approaches. The Core Rivers Programme aims to do this by establishing monitored river systems for fish and invertebrate communities, as well as the broader ecosystem. Through partnership projects across the UK and Ireland, the Core Rivers Programme aims to identify and understand the primary factors, or pressures, limiting wild Atlantic salmon populations, deliver targeted management actions to restore Core River systems at a landscape scale and test the effectiveness of those management actions.

Josh Roland

Investigating the Distribution of Spawning Atlantic Salmon (*Salmo salar*) within the Margaree Watershed, Nova Scotia.

Atlantic salmon are a prized species, valued for both recreational angling and historic commercial fisheries in the North Atlantic. However, their populations have drastically declined globally over the past several decades, primarily due to poor at-sea survival. Despite widespread declines, populations are not equally affected; in Nova Scotia, the Margaree Watershed is unique as the only salmon population in the province that consistently meets the minimum conservation requirement for returning adults. The reasons for this stability remain unclear. Given that all Nova Scotian salmon populations are believed to share similar marine migratory routes, the Margaree River's freshwater habitat may play a critical role in the population's stability relative to other populations. A significant portion of the Margaree watershed is designated as a sanctuary for Atlantic salmon, where angling is prohibited, allowing salmon to spawn undisturbed. Despite this, the distribution of spawning Atlantic salmon within the Margaree has not been studied, nor has the contribution of the sanctuary to salmon productivity been evaluated. This research aims to address these gaps by investigating the distribution of adult Atlantic salmon in the Margaree watershed. This study will focus on three key phases: holding behavior before spawning, spawning distribution, and kelt departure timing. To accomplish this, 20 adult salmon were fitted with externally attached radio transmitters (Lotek MCFT2) between July and October 2024 to monitor their spatial distribution. An additional 50 radio transmitters are planned to be deployed in 2025. The findings will enhance our understanding of salmon movement during their freshwater migration and inform future conservation strategies to protect critical spawning habitats within the Margaree watershed.

Joshka Kaufmann

Anthropogenic Pressures: Shaping the Past and Future of (Irish) Atlantic Salmon

Anthropogenic pressures can dramatically alter the demography and phenotypic composition of natural fish populations. Evolutionary dynamics can also be affected, but we currently lack understanding of patterns and drivers of contemporary evolution at a genomic genetic level (i.e., the scope for future evolutionary responses). Without these insights, we cannot accurately predict future vulnerabilities. In order to understand the complex processes of adaptation to anthropogenic impacts in Atlantic salmon (*Salmo salar*), we are using a multidisciplinary approach to identify evolutionary responses of natural populations to climate change, overfishing and introgression with cultured fish. Our specific aim is to evaluate the relative contribution of climate to historical population-level genetic and demographic changes in freshwater and marine environments. Using ecological genomics and quantitative genetics on a six-decade long sampling programme from migrating Atlantic salmon in Ireland, we work towards providing timely and critical insights into the past and future evolutionary dynamics of Atlantic salmon.

Dreissenids for Dinner? Lough Neagh Fish Spill Their Guts

Liam Brennan

Freshwater ecosystems face increasing threats from eutrophication, climate change, and invasive species, posing significant risks to their biodiversity and ecosystem services. Lough Neagh as the UK's largest freshwater lake, is a vital resource supporting commercial fishing and providing drinking water to 40% of Northern Ireland's population.
In 2023/2024, Lough Neagh experienced unprecedented harmful algal blooms (HABs), dominated by the toxic cyanobacterium *Microcystis aeruginosa*. These blooms are linked to multiple drivers, including the recent, rapid proliferation of zebra mussels (*Dreissena polymorpha*). Given the importance of this species, having a greater understanding of their importance to potential predators is needed. This study seeks to understand if Lough Neagh fishes; eel, brown trout, pollan, tench, bream and roach are utilising this novel food resource post invasion. qPCR and metabarcoding will be used to assess the contribution of zebra mussels to the diets of the fishes of the Lough, and we will also determine if fish morphometrics relates to overall mussel consumption.
A greater understanding of the trophic links between *Microcystis aeruginosa, Dreissena polymorpha* and their predators is crucial for managing the lake's ecosystem and addressing the many environmental challenges faced, including recurring algal blooms and potential shifts in nutrient cycling due to invasive species. This deeper understanding of the trophic links within Lough Neagh is fundamental for addressing its ecological challenges, safeguarding its vital resources, and ensuring its long-term health and sustainability.

Loeva Martin-Podevin

Zooming into recreational fishers: monitoring their catches and waste using AI
Recreational fishing is a popular pastime in New South Wales, bringing $3.4 billion to the state annually. In NSW, fishers are obligated to land their catch. To facilitate this, fish cleaning tables have been installed. Cleaning fish generates waste, such as fish frames that wildlife scavenge on. The ecological impact of supplemental feeding depends on its frequency and quantity. However, we have little information on this in a recreational fishing context, as its monitoring is limited to a biennial telephone-diary survey with a 0.3% participation rate. Our research aims to improve catch monitoring and investigate the quantity of waste produced at fish cleaning tables. To do this, we combine artificial intelligence and fisher interview analysis. We will deploy a stereo camera system for half a year and use image recognition models to identify and estimate the length of fish cleaned at a fish cleaning table. The system first detects if a fish is present in the footage, it then tracks each fish and takes photos which are later uploaded to the cloud to be classified with a machine learning model. In addition, we are using interviews and questionnaires to help investigate the use of fish cleaning tables to better estimate the quantity of waste produced. This will also allow us to know fishers' opinions on the use of artificial intelligence devices to monitor their catch. Overall, this research will help develop future management practices, benefiting both wildlife and recreational fishing within New South Wales, that may apply to other areas.

Mari Kuroki

Beyond Otolith-Based Methodology: Advancing the Understanding of Diadromous Fish Migration

The migration of diadromous fish between the ocean and rivers, two vastly different environments, has long intrigued scientists. Recent advances in otolith analyses have deepened our understanding of these complex migratory phenomena. Regarding anadromous salmonids, the analysis of otolith Sr:Ca ratios in salmon and charr from rivers across different latitudes revealed more diverse and flexible migration patterns than previously recognised. Furthermore, the latitudinal differences in ocean and river dependence suggest that climate change, including global warming, may lead to a decline in migratory diversity. We applied a Dynamic Time Warping (DTW) method to classify the migration patterns in amphidromous seabass, which exhibits partial migration across broad salinity gradients based on the otolith Sr:Ca ratios of adults collected from both the ocean and rivers. This study revealed that individuals with low growth during the early juvenile stage migrated upstream to rivers to achieve higher growth and that early life experiences shaped subsequent seasonal migrations. These findings highlight the developmental constraints on the migration of this species. For catadromous eels that undergo long-distance oceanic migrations spanning thousands of kilometers, we employed otolith stable oxygen isotope analysis to reconstruct experienced water temperatures, thereby elucidating their oceanic migration. We revealed the relationship between experienced temperature and recruitment areas in juvenile glass eels using otolith stable oxygen isotope analysis. The otolith stable oxygen and carbon isotope analyses were used to distinguish between wild and stocked individuals in an urban river in the Tokyo metropolitan area, where eels are stocked for conservation purposes, thus clarifying the contribution of stocked eels. This study provides critical data for evaluating the effects of stocking and for informing future conservation strategies. Our approach demonstrates the potential of otolith-based methods to uncover previously unknown aspects of fish ecology and offers a promising tool for advancing the study of fish migration.

Richard Hedger

Using dynamic population modelling to improve salmonid management in regulated rivers experiencing climate change

Within regulated rivers, there is the potential to control aspects of the flow regime (temperature and discharge) to partially ameliorate adverse effects of climate change on instream fish populations. However, for planning fish-friendly flow regimes, it is necessary to have a full understanding of the complex response of the fish population to changes in flow properties – a response that is governed by lags, feedback mechanisms, and non-linearities. We aimed to examine uncertainties in how salmonid populations respond to instream processes to allow us to determine exactly how flows in regulated rivers could be modified to compensate for climate change. We used dynamic modelling – coupling a population model (InSTREAM) with predicted flow conditions from a hydrodynamic model – to explore the response of a

salmonid population to flows expected under future climate regimes, allowing us to identify bottlenecks in survival. We found that future climate conditions could detrimentally impact salmonid populations through multiple phenomena including scouring of spawning redds, and increased parr mortality from heat stress and stranding. Dynamic modelling allowed us to identify how individual mortality events associated with extreme episodes under a future climate – for example, several days of stress-inducing high temperatures – may impact upon overall population abundance. We found that the ability to modify the flow regime within regulated rivers – managing discharge and water temperature through release of reservoir water – could be used to ameliorate climate change-induced effects on salmonid populations. We concluded that dynamic population modelling allows for investigation of the complexity of how instream fish populations respond to changes in flow conditions, and that knowledge of this complexity can be used in planning fish-friendly flow regimes that compensate for adverse conditions brought about by future climate regimes.

Stefano Mari

Habitat complexity and sexual behaviour selects for more neurons number in brown trout (*Salmo trutta*)

Fish brain exhibit high plasticity in response to environmental pressures. The relative sizes of brain regions, rather than overall brain size, can change in response to selection pressure on specific cognitive skills, such as those related to sexual behaviour or habitat complexity (i.e., mosaic theory of brain evolution). Brain size and the sizes of its regions is widely used as proxies for cognitive skills, but the accuracy of this metric is highly debated, as animal cognition also depends on other structural properties of the brain.
The isotropic fractionator technique allows for precisely estimation of the number of neurons in the whole brain and its respective regions. For example, in laboratory lines of guppies artificially selected for overall brain size, IF revealed a negative scaling relationship between neuron density and brain size. However, this relationship has never been tested in non-model species from natural habitats, where neuronal proliferation is influenced by environmental context.
In this study, we used brown trout *Salmo trutta* as a study species and we tested the correlation between the size of brain and its regions and their neuronal numbers. We then compared these metrics them across individuals of different sexes, habitats, and populations of origin to understand the role of selection pressures in shaping the brain properties in the wild. Trout were collected from two pairs of natural streams: granite and groundwater, the latter having higher habitat complexity due to limestone dissolution, creating niches, textures, and varied substrates.
We expected a negative scaling between the mass of brain and its regions and their neuronal densities. Additionally, we expected that brain regions involved in sexual behaviour, such as telencephalon, will differ between males and females. Finally, we posited that trout from groundwater streams would have higher neuronal density in brain regions associated with navigation in complex habitats, such as cerebellum and telencephalon.

Virginia Gilliland

Understanding indirect effects of fishing on non-target reef associated fishes in Australia's Great Barrier Reef Marine Park

Marine protected areas and zoning are well-known tools for fisheries management and biodiversity conservation across Australia's Great Barrier Reef. While studies generally focus on commercially targeted species, there is less research focused on non-commercial fish communities and fishing effects. Remote sensing offers the ability to further explore these relationships by covering larger areas and reaching deeper depths than divers. Here we use remotely operated vehicles (ROVs) to identify differences in reef-associated fish assemblages between fished and unfished reefs to understand indirect effects of fishing across the Great Barrier Reef. We examined differences in diversity and abundance of non-target fishes between Habitat Protection Zones, where fishing is permitted, and Marine National Parks, where fishing is not allowed. We also assessed relationships between fish assemblages, habitat type, and structural complexity. Results of surveys encompassing 26,660 m2 over a five-degree latitudinal gradient confirm differences between zones, with higher abundances of non-target fishes in non-fishing compared to fishing zones. This was mainly driven by increased abundances of Acanthurids, Balistids, Labrids and Pomacentrids. Other factors driving these differences included increased visibility and the percentage of macroalgal mat habitat type within each transect. Managers should consider ROVs as a valuable technology for future assessment and management of species and habitats.

Yolaine d'Hoop de Synghem

Priority Fishing Areas amid climate change and constraints from Marine Protected Areas and Offshore Renewable Energy.

Marine environments provide many essential services, including food production, coastal protection and cultural significance. In Ireland, the seafood plays a major economic role, contributing respectively €1.3 billion to the GDP.
Growing human pressure is expected to cause major changes to the marine ecosystems in Ireland. Under its Offshore Renewable Energy (ORE) Development Plan, the Irish government intends to develop 37GW of wind energy by 2050. Meanwhile, the EU Biodiversity strategy seeks to protect 30% of EU waters by 2030 through increasing the Marine Protected Areas (MPAs) network. Effective Marine Spatial Planning (MSP) is essential to manage interaction between ORE, MPAs and industries like fisheries.
This study investigates the overlap between the different marine uses by using advanced modelling techniques such as VAST and sdmTMB to map fishing zones, identify hotspots, and assess the overlap with ontogenetic species distributions. By combining these approaches, the project hopes to improve knowledge of spatial competition, encourage the growth of sustainable ORE, and provide guidance for MPA implementation. This study emphasises how managing marine resources requires a balanced strategy that maintains ecological health alongside economic growth. The

results will give policymakers important information on how to balance the rise of offshore renewable energy with marine conservation initiatives.