FishBase Symposium 2023

Tracking Fish!

Programme
Speaker Presentations and Abstracts

Monday 16 October 2023
Main auditorium, Swedish Museum of Natural history, Stockholm

Spåra fisk!

Program
Presentation av talare samt abstracts

Måndag 16 oktober 2023
Stora hörsalen, Naturhistoriska riksmuseet, Frescativägen 40, Stockholm

FishBase Sweden
Naturhistoriska riksmuseet
Box 50007
104 05 Stockholm
fishbase@nrm.se
08-5195 40 00

FishBase Symposium 2023 — *Tracking Fish!*

Programme

09:00 - 09:30	Registration, coffee and sandwiches
	Moderator: **Gustav Hellström**, SLU
09:30 - 09:35	Opening, **Michael Norén**, FishBase Sweden
09:35 - 10:20	**Jordan Matley**, Flinders University, Australia: *Global perspectives on tracking fishes with telemetry.*
10:20 – 10:50	Fruit break
10:50 – 11:35	**Naiara Rodríguez-Ezpeleta**, AZTI, Spain: *Tracking Fishes through their DNA.*
11:35 – 12:20	**Christopher Jerde**, UCSB, USA: *The critical role of data science in tracking fishes and monitoring global biodiversity using environmental DNA.*
12:20 – 13:20	Lunch break
13:20 – 14:05	**Brian R. MacKenzie**, DTU Aqua, Denmark: *The return of a large migratory predator, bluefin tuna, to northern European waters - why did it come back, and how can we keep it coming back?*
14:05 – 14:50	**David Righton**, CEFAS, UK: *The long slow road: tracking European eels across the Atlantic Ocean.*
14:50 – 15:20	Coffee break
15:20 – 16:05	**Robert J. Lennox**, Ocean Tracking Network, Dalhousie University, Canada: *Studying predation with electronic tagging and tracking technology - fundamental knowledge and applications to conservation.*
16:05 – 16:50	**Lucas P. Griffin**, University of Massachusetts, USA: *Unraveling the Migratory Mystery of the Atlantic Tarpon: A Call for Conservation.*
16:50 – 17:00	Symposium Close

Time: Monday, 16th October 2023, 09:00 – 17:00.

Place: Main Auditorium, Swedish Museum of Natural History, Frescativägen 40, Stockholm.

GUSTAV HELLSTRÖM

Moderator, Swedish University of Agricultural Sciences (SLU), Sweden

Gustav Hellström is an Associate professor at the Department of Wildlife, Fish and Environmental Studies, Swedish University of Agricultural Sciences. His research revolves around behaviour and migration of aquatic species in their natural habitats, primarily using modern tracking technology to study fish in rivers, lakes, and oceans. His studies encompass a diverse range of species, from the small goby and the delicate roach, to the formidable Bluefin tuna and the mysterious Greenland shark.

While a substantial portion of his work is conducted in Sweden, encompassing the Baltic Sea and the Northeast Atlantic, his research also extends to other parts of the world, including Mongolia, Iceland, and North America.

*Round goby (*Neogobius melanostomus*), Photo: M. Norén. CC BY-SA*

JORDAN MATLEY

Flinders University, Australia

Jordan Matley is a Research Associate with the Southern Shark Ecology Group (SSEG) at Flinders University in Australia and Adjunct Assistant Professor at the University of Windsor in Canada. His research currently focuses on how shark populations are influenced by human activities. Throughout his career, Jordan has worked in marine and freshwater environments across temperate, tropical, and polar regions of the world, studying the behaviour of fishes, sea birds, seals, whales, sea turtles, and sharks. When off the water, Jordan enjoys hiking, running, cycling, and playing soccer/football, as well as trying to keep his 3-year-old dog, Bilbo, out of trouble.

GLOBAL PERSPECTIVES ON TRACKING FISHES WITH TELEMETRY

Why do animals move? What factors influence their decisions? How do we study fish movements? What happens when a shark meets a cow?
These are the key questions that my presentation aims to address using existing theory as well as applying findings from my own research. We will travel from the Great Barrier Reef to the Great Lakes (and many places in between) exploring the dynamic relationships between fishes and their environment, as well as impacts humans have on the behaviour of fishes. The presentation will also look at developing trends in tracking research and discuss how big datasets can help bridge gaps in research and inform management priorities across the world.

NAIARA RODRÍGUEZ-EZPELETA

AZTI, Spain

Naiara Rodríguez-Ezpeleta (BSc. in Biology from the University of Basque Country, Spain; PhD in Biochemistry from the University of Montréal, Canada) has over 20 years of experience in molecular ecology and evolution, population genomics, large-scale sequence data generation and analysis, and bioinformatics. After several postdoctoral stays in UK and Spain working in a variety of projects, since 2011 she works at AZTI, where she currently leads the Biotechnology and Molecular Ecology research area. Dr. Rodríguez-Ezpeleta has participated in numerous international and national projects dedicated to the application of genetics for improving marine management and is an active member of several expert groups of the International Commission for the Exploration of the Sea (ICES) and the International Commission for the Conservation of Atlantic Tunas (ICCAT), chairing some of them. She has been invited to speak at international conferences and seminars and is advisor of the environmental DNA expeditions in UNESCO World Heritage Marine Sites. Dr. Rodríguez-Ezpeleta has published articles in high impact journals and books and is editor of *Molecular Ecology* and *Molecular Ecology Resources*.

TRACKING FISHES THROUGH THEIR DNA

Achieving a sustainable fisheries management relies on an appropriate assessment of fish resources which, in turn depends on the accuracy and completeness of scientific information. Yet often the appropriateness of the information collected is compromised by economical or technological limitations. Thus, there is a need to explore alternative or complementary approaches that can improve fisheries management. Genetics-based approaches offer the most promising alternatives as they allow the capture of information that cannot be measured otherwise and provide cost-effective alternatives to traditional approaches. Yet, despite this potential, the uptake of genetic methods by the fisheries assessment process in general is not a reality.

Here we examine the power of genetics to assist fisheries management and conservation focusing on commercial fish species with a range of distributions, having different reproductive behavior, and presenting unique assessment challenges, and on still pristine but with exploitation potential ecosystems such as the deep sea. Genome-wide based information has revealed conservation and management important phenomena such as mismatches between administrative and natural populations, reproductively isolated stock mixing, interspecific hybridization, mislabeling and genetic adaptation; I will discuss the potential impact of these new findings on species conservation. Additionally, we have proven alternative sampling approaches such as environmental DNA as promising avenues for marine conservation as they allow to study marine ecosystems in a non-invasive cost-effective manner; I will discuss the advantages and challenges of this new approach in the next generation marine monitoring era.

CHRISTOPHER JERDE

Marine Science Institute, University of California, USA

Christopher Jerde grew up fishing and camping among the prairie pothole lakes of the United State's Great Plains and completed his B.Sc. (1998) and M.Sc. (2002) at Montana State University, surrounded by wild spaces and trout. While Montana cultivated a keen interest in ecology, his experiences studying *Bison bison* population dynamics in Yellowstone National Park motivated him to build a broader quantitative background. Christopher migrated north to the Centre for Mathematical Biology at the University of Alberta, Canada, where he completed his Ph.D. (2008). As a postdoctoral fellow and a research assistant professor at the University of Notre Dame, USA, his workgroup developed an environmental DNA surveillance program for invasive species, most notably Bighead and Silver Carp. As an Associate Researcher and Lecturer at the University of California's Marine Science Institute and Bren School of Environmental Science and Management, Christopher's research program emphasizes using novel quantitative, data science, and sampling approaches, such as environmental DNA metabarcoding, to assess pressing environmental problems and the management of freshwater biodiversity.

THE CRITICAL ROLE OF DATA SCIENCE IN TRACKING FISHES AND MONITORING GLOBAL BIODIVERSITY USING ENVIRONMENTAL DNA

Over the last 15 years, the use of environmental DNA (eDNA) for single species and community surveys has grown in reliability, emerged as a useful tool to assess biodiversity, and gained recognition as an established survey technique aiding fisheries management. However, much of the proof-of-concept development has been conducted in the most well-studied fisheries, which have reliable species lists, considerable genetic sequencing information, and detailed risk assessments for potentially invasive fish. But what of the other fisheries that are of variable diversity, relatively understudied, and neglected?

I conceptualize a data science workflow for eDNA-based research that emphasizes the critical role of databases, such as FishBase, for addressing many of the knowledge gaps to broaden the application of eDNA metabarcoding of communities and the emerging '-omics' revolution. I will discuss the importance of sharing and updating species occurrence records, linking fish characteristics to whole genome sequencing efforts, communicating measures of data reliability and use, and identifying some of the infrastructure needed to support the big data limitations we are experiencing for using molecular tools for global fisheries conservation and management.

BRIAN R. MACKENZIE

DTU Aqua, Denmark

Brian R. MacKenzie is a professor of fisheries oceanography at the National Institute for Aquatic Resources, Technical University of Denmark. His main research interests are temporal dynamics of fish populations, fish biodiversity and food webs/trophic interactions, especially in response to climate variability and change, and to fishing. He is particularly interested in processes by which climate variability/change and exploitation affect the productivity and distributions of fish populations and species. Most recently he has been investigating the population and historical ecology of bluefin tuna in northern European waters, regime shifts near SE Greenland and historical baselines of swordfish ecology in the Mediterranean Sea. He received his Ph.D. from McGill University (Canada) in 1992 and has been working in Denmark since then, as postdoctoral scientist, research scientist and since 2007 as professor. He is active within ICES and is the Danish member of the ICES Science Committee (SCICOM).

THE RETURN OF A LARGE MIGRATORY PREDATOR, BLUEFIN TUNA, TO NORTHERN EUROPEAN WATERS - WHY DID IT COME BACK, AND HOW CAN WE KEEP IT COMING BACK?

One of the world's most charismatic, largest and valuable bony fish species, bluefin tuna *Thunnus thynnus*, has returned to habitats in northern Europe, including the North Sea, Norwegian Sea, Skagerrak, Kattegat and Øresund. Its return has excited and stimulated scientists, local royalty and the general public, many of whom were not even aware the species used to be present in these waters 50 - 60 years ago. Now it is possible to see this fish jump and splash again close to our shores. Its disappearance represented a classic case of Daniel Pauly's "shifting baseline" syndrome in our local waters. But why did it come back, and what can we do to ensure that it keeps coming back in the future? Is its presence here only due to the vagaries of the movements and migrations of wild animals, or are other processes involved?
In this talk, I will discuss the hypotheses for the disappearance and return, and the types of methods (historical data compilation and analyses, new field studies of tagging and diets, new migration modelling approaches, citizen science contributions) we are using to investigate these hypotheses and to learn more about the biology of this species.

DAVID RIGHTON

CEFAS, UK

David Righton has thirty years experience in marine and fisheries science in temperate and tropical marine environments, including 25 years in the UK government as a research scientist and advisor on fish behaviour and ecology. David is recognised internationally for research into the behaviour and ecology of marine fish with over 100 publications in top ranking scientific journals. He has led significant research projects on important commercial or conservation species within Europe (Atlantic cod, porbeagle sharks, Atlantic bluefin tuna), including 'the eeliad', which focused on the migrations and life-history of the European eel.

THE LONG SLOW ROAD: TRACKING EUROPEAN EELS ACROSS THE ATLANTIC OCEAN

Exactly a century ago, the Danish biologist Johannes Schmidt demonstrated that eels reproduced in the Sargasso Sea, ending two millennia of speculation over how and where eels reproduced. Schmidt's published work was based on surveys for larval eels, but despite his great efforts at the time and afterwards, he was not able to find any spawning adult eels.

In the century since, much time and effort has been invested in ocean surveys to do so, with no success. In recent years however, the development of electronic tracking technology has permitted scientists to look at the problem in a different way: rather than search the expanse of the Sargasso Sea for spawning eels, they can now tag and track eels as they make their journey across the Atlantic to spawn.

In this talk, I will discuss the development of methods for tracking European eels in the marine environment, and how the study of eel behaviour in the marine environment has developed from, at first, tracking eels for a few hours or days over a few km, to more recent studies that have tracked eels for several months over thousands of km, including all the way to the Sargasso Sea.

ROBERT J. LENNOX

Ocean Tracking Network, Dalhousie University, Halifax, NS, Canada

Robert J. Lennox was born in Ottawa, Canada, where his family cottage inspired a love of the underwater world, which he explored by fishing and snorkeling. Family trips to Florida provided exposure to the vast marine realm and the fragile diversity of co
astal reefs and sand flats. An interest in organismal biology led to a B.Sc. in marine biology at Dalhousie University (2008-2013). He then began a PhD program at Carleton University focused on Atlantic salmon migration ecology, where his work became integrated with OTN, including co-chairing the ideasOTN committee.

Robert's work has largely focused on fundamental and applied ecological questions with an objective of informing animal conservation. Robert has published more than 120 peer reviewed papers and his passions are mostly aligned with understanding where, when, and why animals move and how this behaviour is changing in a world full of anthropogenic stressors.

Robert worked from 2018-2022 as a senior researcher in Norway at NORCE Norwegian Research Centre in the Laboratory for Freshwater Ecology and Inland Fisheries. Along with Knut Wiik Vollset, Robert helped establish the Bergen Telemetry Network, a research infrastructure in western Norway focused on tracking salmon, sea-run brown trout, European lobster, spiny dogfish, Atlantic cod, and other species in the iconic fjords. Robert maintains a scientific advisor role at NORCE.

In 2023, Robert started as an associate professor in the biology department at Dalhousie University with an appointment as incoming scientific director of OTN—transitioning to full scientific director by the end of 2023. Robert's lab at Dalhousie focuses on using movement ecology to evaluate animal performance in a changing world. At OTN, Robert aims to enhance the value of animal tracking data in policy and conservation of aquatic habitats and species.

STUDYING PREDATION WITH ELECTRONIC TAGGING AND TRACKING TECHNOLOGY - FUNDAMENTAL KNOWLEDGE AND APPLICATIONS TO CONSERVATION

The fate of wild animals is one of the most challenging aspects of biological research and for fisheries this is the rate of natural mortality, which drives many fisheries models. Predation is a major component of natural mortality, but predation may drive compensatory or additive mortality depending on the condition of animals that are eaten. Recent advances in telemetry have opened new avenues to study the fate of animals in higher resolution, including novel predation sensors that can detect predation events and confirm the fates of fish with tools including acid- or tilt-based sensors. Using Atlantic salmon, as a focal species, we demonstrate how novel insights can be revealed about the nature of predators and their prey in aquatic ecosystems using aquatic telemetry and some of the new tools available for tracking. We additionally provide an overview of considerations for designing predation studies using electronic tags and illustrate how these data can contribute to defining and resolving conflicts between people and predators.

LUCAS P. GRIFFIN

University of Massachusetts, USA

Lucas P. Griffin is a marine biologist and post-doctoral fellow at the University of Massachusetts Amherst (USA). Specializing in movement ecology, Lucas examines how marine life, from fish to sharks and sea turtles, use their habitats and adapt to various disturbances, be it tourist-wildlife interactions or the impacts of climate change. Understanding the need for a balance between marine life and human activity, his research prioritizes developing effective species management programs and protecting ecologically valuable habitats while supporting sustainable livelihoods. Much of his current research focuses on the sustainability of recreational fisheries globally with diverse partners and communities. Outside of researching fish Lucas is, most likely, found fishing.

UNRAVELING THE MIGRATORY MYSTERY OF THE ATLANTIC TARPON: A CALL FOR CONSERVATION

The Atlantic tarpon (*Megalops atlanticus*), also known as the Silver King, is revered for its fighting ability, acrobatic leaps, and sheer size (140 kg, world record!). Despite being one of the most sought-after catch-and-release game fish in the USA, little is known about the spatial ecology of this migratory marine species. Moreover, there are growing concerns about declines in this culturally and economically valuable fishery.

To fill these knowledge gaps, we launched a multi-year tarpon acoustic telemetry project in collaboration with hundreds of recreational anglers and guides and in partnership with a diverse array of state and federal agencies, NGOs, and research institutions. Spanning the Gulf of Mexico and southeastern USA, we tagged 200 tarpon with 5-year battery life acoustic transmitters. Using this collaborative tracking network, we discovered that tarpon undertook far-ranging migrations, often surpassing 1000 km, during which they encountered multiple threats from anglers to sharks to toxic human-driven algal blooms. Tarpon also displayed much consistency in their seasonal migration routes, with high levels of repeatability from year to year. Our research also revealed the complex dynamics between these game fish and their shark predators, climate change, and their primary foods across their migratory range. In the face of declining tarpon populations and continued threats, coordinated efforts are needed to improve angling behavior, protect key habitats, and better manage the harvest of tarpon prey.