FishBase Symposium 2019

Fishes In Motion! / Fiskar i rörelse!

Swedish Museum of Natural History
21 October 2019

Summary

FishBase

Naturhistoriska riksmuseet

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FishBase Symposium 2019 – Fishes In Motion!

Introduction

The theme for the 17th annual FishBase Symposium, held at the Swedish Museum of Natural History in Stockholm on the 21st of October 2019, was *Fishes In Motion / Fiskar i rörelse*. As always with the FishBase symposium the theme was intended to be interpreted freely, and our six invited experts gave lectures on different aspects of *Fishes In Motion*: Zeehan Jafaar talked about mudskippers and the evolution of terrestriality; Leo G. Nico introduced us to a selection of invasive fish species and their mechanisms of dispersal, with special focus on swamp eels; Lise Comte discussed how climate change affects freshwater fishes; Håkan Westerberg explained how new monitoring techniques have given new insights into the spawning and larval migrations of eels; Ana T. Silva showed how fishes interact with their medium and how this can be used to inform conservation; and Philipp E. Hirsch talked about how understanding the movement of fish may be used to create species-specific barriers to stop invasive species.

233 participants listened to six invited experts who gave talks on different aspects of fishes in motion. Videos of the lectures are available at FishBase Sweden's YouTube channel, FishBase's Facebook page, and the homepage of the Swedish Museum of Natural History.

Moderator: Cathy Hill

Ministry of Enterprise and Innovation, Government Offices of Sweden, Sweden

Cathy Hill is a marine biologist who works with fisheries management in the Government Offices of Sweden. Cathy is an Australian with a Ph.D and an M.Sc. in Zoology (ecology) from Stockholm University. She has conducted research on freshwater fish and benthic communities in lakes in northern Sweden, and on benthic communities on deep, muddy bottoms in the Baltic Sea. She has worked with environmental issues at several Swedish authorities and NGOs, including the Swedish Medical Products Agency, the Stockholm County Administrative Board, the Swedish EPA, the Institute of Freshwater Research in Drottningholm and WWF Sweden. Her interests include marine biodiversity and Invasive Alien Species.

Zeehan Jaafar

National University of Singapore, Singapore

Zeehan Jaafar is an ichthyologist at the Department of Biological Sciences, National University of Singapore. Her research interests lie in the ecology and evolution of crypto-benthic marine fishes and the conservation of the habitats in which they are found.

After completion of postgraduate degree on the systematics and phylogeny of gobiid fishes in Singapore, she continued as a postdoctoral researcher at the National Museum of Natural History, Smithsonian Institution USA, where her work focused on the adaptations to terrestriality in mudskippers and allied taxa. She is an editor for *Fishes Out of Water: Biology and Ecology of Mudskippers* and an author of *Endangered Forested Wetlands of Sundaland: Ecology, Connectivity, Conservation*.

A keen conservationist, she is also the lead editor for *The Singapore Blue Plan 2018*, a policy recommendation proposal towards a ten-year conservation plan for marine areas in Singapore.

FISHES OUT OF WATER: MUDSKIPPERS AND THE EVOLUTION OF TERRESTRIALITY

Mudskippers are a group of enigmatic fishes, capable of complete emersion for considerable time. These amphibious fishes range throughout the Indo-Pacific and Eastern Atlantic, and inhabit shallow coastlines with muddy substrate. Forty-three species in ten genera are recognized, exhibiting varying degrees of emersion tolerance.

During the ebb tide, mudskipper species are most active—foraging, or engaging in territorial displays and courtship behaviour. This talk introduces the biology of mudskippers that includes unique strategies to counter desiccation during emersion. Novel hypotheses on the relationships between mudskipper genera are advanced, with character support from comparative morphological analyses. Anatomical adaptations to terrestriality within the different mudskipper clades are discussed.

Leo G. Nico

United States Geological Survey, USA

Dr. Leo Nico is an ichthyologist with the Wetlands and Aquatic Research Center of the United States Geological Survey located in Gainesville, Florida. His MSc (1982) and PhD (1991) research focused on the trophic ecology of Neotropical freshwater fishes in South America. Leo has co-authored original descriptions of six fish species new to science. Three new species of South American fishes have been named in his honor. In 1993, Leo was hired by the US government to conduct research and serve as an expert on introduced, non-native fishes. In that position—over the past 25 years—Leo has led or participated in a wide range of investigations, mostly in North America, although he has also worked on invasive fishes in Asia, South America, and various Pacific Islands. Since 2000, Leo has been surveying live-food markets in North America as part of an assessment of the live-food trade as an introduction pathway of fishes and other aquatic animals. In 2008, he led a team that successfully eradicated introduced tilapia from 'El Junco', a crater lake in the Galapagos. A current project is aimed at developing methods and strategies to eradicate invasive fishes inhabiting Hawaiian brackish-water anchialine pools. He has co-authored two books on non-native fishes. He currently has in press a large manuscript on Asian swamp eels, linking their introduction to the live-food trade and prayer-release rituals. Lastly, Leo is a husband, proud grandfather, and a struggling, part-time musician.

HERE, THERE, AND EVERYWHERE: ALIEN FISHES IN MOTION

Throughout history, humans have contributed to the movement of animals—intentionally or accidentally introducing species into habitats well outside known natural ranges. The scale is global. Most introductions of fishes have occurred over the last 150 years and new introductions are commonly documented every year. They include a large and diverse array of taxa, with representatives from nearly every region of the world. Invaded environments include both natural and artificial systems, ranging from small streams and isolated ponds to entire river and lake basins.

Many introduced fish species have formed established, non-native populations and many of these have subsequently spread (naturally or with the aid of humans), radically and irreversibly changing freshwater fish assemblages and aquatic communities. This presentation focuses on invasions pathways of introduced fishes, geographic distribution of non-native established populations, and dispersal patterns of highly-invasive forms. Beyond certain historical accounts, much of the information and examples given are tied to my own research. Details are provided on several different groups of invasive fishes and an assortment of invaded environments to highlight the variation and complexity of invasion pathways, as well as to reveal how and why introductions occur.

Lise Comte

University of Tennessee, Knoxville, USA

Lise Comte is a Research Associate at the University of Tennessee, Knoxville (USA). Her research explores the patterns and processes shaping biodiversity dynamics, with an emphasis on the conservation of freshwater systems. Driven by the growing concerns about human-mediated biodiversity loss, she is particularly interested to understand how and why species respond to global environmental changes, such as climate change and biological invasions.

Her research integrates macroecological and macroevolutionary approaches to ask questions ranging from "why species occur where they do" to "which species will be the most vulnerable to future climate change". Lise's work focuses principally on freshwater fishes, but occasionally expands to include other taxonomic groups and systems as well.

SOME LIKE IT HOT (AND SLOW): HOW VULNERABLE ARE FRESHWATER FISHES TO CLIMATE CHANGE?

As climate changes across already heavily human-altered streams and rivers, there is no doubt that aquatic organisms will be affected. Essentially, species are faced with three main alternatives, either stay put and adapt, move to track shifting climates, or die – potentially resulting in substantial community-wide reshuffling. Freshwater fishes are thought to be particularly vulnerable because of their dependence on water temperature and flow and constrained distribution within river networks. Yet, to what extent and which fish species or areas are the most vulnerable is still uncertain.

In this talk, I will provide several lines of evidence regarding the vulnerability of freshwater fishes to climate change. First, I will present the results of a global-scale vulnerability assessment based on a combination of physiological estimates of thermal sensitivity, future climate change exposure and adaptive capacity of species. I will then introduce clear cases of climate-induced alterations in fish distribution ranges and community composition and discuss the value of long-term monitoring efforts to better inform the management of freshwater resources.

Håkan Westerberg

Institute of Freshwater Research, Sweden

Håkan Westerberg has a background as physical oceanographer, specialized in small-scale mixing processes. This proved useful when he turned to questions of how fish orientate in the dark, low visibility environment of the ocean. He became member of ECRO and studied the properties of chemosensory orientation cues. He was a pioneer in using the new acoustic telemetry technique to study fish behavior in the field. As a researcher at the National Board of Fisheries the field of study broadened to fish behavior in general, including effects of sound and electromagnetic fields and the sounds generated by fish. Later he became involved in fisheries management and worked on the EU eel recovery plan. His most cherished award is the Ig Nobel prize in biology 2004, for showing that herring communicate by farting. He retired as deputy director of research when the Fisheries Board was dismantled 2011, but has remained active in several international research projects studying eel.

EEL MIGRATION

The life cycle of the eel was finally mapped by the Dane Johannes Schmidt in the 1920's. It proved to be a 20 000 km roundtrip, between the breeding area in the Sargasso Sea and the continental, freshwater growth area, which spans from Iceland to north Africa. Most of this movement takes place in the open ocean, and studies have been few since the time of Schmidt. The last 3-4 decades has seen a dramatic decline in the recruitment of the eel. The cause is unclear, which has initiated a new interest in what is happening in the ocean – both regarding the adult migration and the larval transport back to Europe. New technology has given opportunities to track migrating eels for long periods and distances and more refined ocean circulation models make it possible to follow the larval transport. This has led to new insights as well as new questions.Regarding the adult migration it appears to be slower and possibly more dangerous than what was expected. Typically, the migration starts from Europe in the autumn to early winter. The breeding activity – as seen from the presence of very small larvae – starts in February-March. With the observed migration speed the majority of the adult eels will be unable to reach the Sargasso during the nearest breeding season. It was also found that a large fraction of the eels became predated. In the western Mediterranean 70% of the eels were eaten by toothed whales before reaching the Strait of Gibraltar.An analysis of historic surveys of larvae from Schmidt's to the present indicates that the abundance of larvae in the breeding area follows the size of the total catch of adult eels in the continental distribution area – which can be seen as a measure of the size of the spawning stock. The arrival of glass eels on the European shores has declined much faster after 1980, however. This indicates an increased mortality during the drift between Sargasso and Europe, or possibly a shift in where the glass eels arrive.

Ana T. Silva

Norwegian Institute for Nature Research, Norway

Ana is a researcher at the Norwegian Institute for Nature Research (NINA) in Norway. Originally from Portugal, she completed her PhD in 2010 at the University of Lisbon (UL). She then moved to Canada to pursue her interests of fluid mechanics and fish physiology, and worked as postdoctoral at the University of Manitoba (UofM) and at Carleton University. After her period in Canada she took on the opportunity to work on fish conservation at NINA. Ana´s research is based on an interdisciplinary approach to fish conservation and river restoration that draws from the fields of ecology, physiology, biophysics, biomechanics, eco-hydraulics and fluid dynamics. She has been working with different fish species and in several projects that aim to mitigate the impact of anthropogenic changes on aquatic systems and biodiversity, all from an eco-ethological conservational perspective,. Among her interests are fish passages, hydraulics, fish behaviour, fish biomechanics, bio-robotics, hydropower plants and dams and river restoration. She is currently leading a work package on fish migration at the Norwegian Research Centre for Hydropower Technology. The project aims at the development of a new model to predict migratory movement of salmon smolts, based on the interplay of fish-fluid motion.

FISH IN A HYDRODYNAMIC WORLD: A CONSERVATION APPROACH

Dish movement is a complex phenomenon that results from the interaction between fish morphology/physiology and the surrounding environment. When swimming, fish are exposed to complex three-dimensional flows that condition its movement. How fish adapt and respond to variations in the water and the surrounding environment, in time and space, is a topic of considerable interest for a broad audience. This involves fundamental insights on physiology, kinematics, hydrodynamics and fish locomotion. Worldwide rivers are split up by the presence of human-made structures that interfere with natural flows. Such modifications can affect the interplay between water and fish, disturbing fish swimming ability and performance. Drastic changes in fluid motion might lead to severe behavioural changes in fish, as they try to adapt to new conditions. This might involve high levels of energy expenditure and stress levels that can reduce fish survival. Fish travel considerable distances for different purposes, such as finding food or places to reproduce. These migratory movements are strongly mediated by the interplay of fish-fluid motion. Migratory movement is a fundamental characteristic of fish, with strong impacts on their ecology and population sustainability. To understand how fish associate with natural and man-made perturbation of the water movement is especially timely and important given the fast growth of human population and the state of fisheries worldwide. In this talk, I will address the interaction of fish-fluid motion, and its applicability to fish conservation, from an eco-ethological perspective. In the first part of the talk I will introduce some theoretical aspects of fish fluid motion and fish migration. A second part will address examples on how to apply such knowledge to fish conservation and river management.

Philipp E. Hirsch

University of Basel, Switzerland

Philipp Hirsch is a German limnologist, who received his PhD from Uppsala University in 2011.
He currently works as a post-doctoral fellow at the Program Man-Society-Environment and as a junior lecturer in the Master of Sustainable Development at the University of Basel, Switzerland. His research work focuses on fish invasions. A special emphasis lies on interdisciplinary approaches. He is fascinated by the opportunity to advance both ecological and socio-economic research on an ongoing invasion of Ponto-caspian gobies in the River Rhine in Switzerland.

UNAUTHORIZED ENTRY PROHIBITED! RESEARCH TOWARDS SPECIES-SPECIFIC MIGRATION BARRIERS TO STOP THE UPSTREAM DISPERSAL OF INVASIVE GOBIES

Man-made barriers in rivers are a major conservation issue in fish biology because they impede fish migrations to upstream spawning grounds. Most research focuses on how such barriers can be re-designed to facilitate fish migrations e.g. via fish ladders. Invasive gobies, native to the Ponto-caspian area, are currently spreading into upstream river at both sides of the Atlantic. In this situation, the re-design of the barriers could give reasons for a re-think: wouldn't it be ideal to keep the blocking function for the invasive species, whereas native species would be able to overcome the barrier?
To answer this question, we conducted research aimed at exploring the possibilities of a species-specific migration barrier.
In this talk, I will present data on recent research towards a species-specific migration barrier. We conducted swimming speed experiments in a swimming chamber using the invasive round goby (*Neogobius melanostomus*) and two native species: the bullhead (*Cottus gobio*) and the gudgeon (*Gobio gobio*). Based on these experimental data, we constructed a barrier-prototype to be applied in a vertical-slot fish pass. We tested this barrier in dispersal experiments at different flow velocities in a life-sized model of such a fish pass and monitored the behavior and the dispersal success of all three species. The results show that the native gudgeon could pass through the barrier at the highest tested velocities, whereas the round goby, but also the native bullhead could not.
These results highlight the need for more research and point towards a promising avenue for finding novel solutions to invasive species management.

Photos from the Symposium

Coffee break mingle

Coffee break mingle

Fruit break mingle

In line for lunch

Organizers and speakers of FishBase Symposium 2019. *From left: Andrea Hennyey, Zeehan Jaafar, Sven Kullander, Håkan Westerberg, Lise Comte, Philipp E. Hisrsch, Michael Norén, Ana T. Silva, Cathy Hill, Leo G. Nico*

FishBase Sweden would like to thank all speakers and participants for making FishBase Symposium 2019 a success, and hope to see you all again next year at FishBase Symposium 2020!

FishBase Symposium 2019 — *Fiskar i rörelse!*

Program

09:00 - 09:30	Registrering, kaffe och smörgås
	Moderator: **Cathy Hill**, Näringsdepartementet
09:30 - 09:35	Inledning, **Michael Norén**, FishBase Sverige
09:35 - 10:20	**Zeehan Jaafar**, National University of Singapore, Singapore: *Fishes out of water: mudskippers and the evolution of terrestriality.*
10:20 – 10:50	Fruktpaus
10:50 – 11:35	**Leo G. Nico**, United States Geological Survey, USA: *Here, there, and everywhere: alien fishes in motion.*
11:35 – 12:20	**Lise Comte**, University of Tennessee, Knoxville, USA: *Some like it hot (and slow): how vulnerable are freshwater fishes to climate change?*
12:20 – 13:30	Lunch
13:30 – 14:15	**Håkan Westerberg**, Sötvattenslaboratoriet, Sverige: *Eel migration.*
14:15 – 15:00	**Ana T. Silva**, Norwegian Institute for Nature Research, Norge: *Fish in a hydrodynamic world: a conservation approach.*
15:00 – 15:30	Kaffepaus
15:30 – 16:15	**Philipp E. Hirsch**, University of Basel, Schweiz: *Unauthorized entry prohibited! Research towards species-specific migration barriers to stop the upstream dispersal of invasive gobies.*
16:15 – 16:30	Avslutning

Tid: Måndag 21:a oktober 2019, 09:00 – 16:30.
Plats: Stora hörsalen, Naturhistoriska riksmuseet, Frescativägen 40, Stockholm.

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