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FishBase–SeaLifeBase Symposium

September 5–6, 2022

WorldFish CGIAR FishBase SeaLifeBase

FishBase–SeaLifeBase Symposium

Citation

This publication should be cited as: WorldFish. 2023. FishBase–SeaLifeBase Symposium. Penang, Malaysia: WorldFish. Proceeding: 2023-03.

Acknowledgments

The FishBase and SeaLifeBase symposium 2022 was organized and funded as part of the CGIAR Research Initiative on Aquatic Food and funded by CGIAR Trust Fund donors. We would like to thank all funders who support this research through their contributions to the CGIAR Trust Fund: https://www.cgiar.org/funders/. We are very grateful to the WorldFish organizing committee, to presenters for showcasing their work, and to attendees for supporting an engaging and interesting symposium.

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Introduction

FishBase–SeaLifeBase Symposium

Fishbase and SeaLifeBase are publicly accessible online information systems on aquatic species. They are used by specialist researchers and hobbyists worldwide for information such as data, illustrations and bibliographic references on more than 40,000 species. Species can be searched for by common name, genus, species, geography, family, ecosystem, literature reference, tools and more in many foreign languages.

FishBase is linked to other databases, such as the Catalogue of Fishes, GenBank and LarvalBase, as well as to a partner journal, *Acta Ichthyologica and Piscatoria*. Mirror sites are available in English, German, French, Spanish, Portuguese, Swedish, Chinese and Arabic.

Welcome speech by Essam Yassin Mohammed, interim director general and acting senior director of aquatic foods systems.

FishBase was started in 1990 by WorldFish in collaboration with the Food and Agriculture Organization (FAO) and other partners. Since 2000, it has been run by the FishBase Consortium, comprised of globally renowned museums, universities and nongovernmental organizations (NGOs).

The FishBase–SeaLifeBase Symposium was an opportunity to illustrate the different uses of the two information systems in the fields of ecology, biogeography, fisheries, taxonomy and aquariology. The symposium highlighted the contribution of each system to the knowledge of biodiversity and the sustainable use of aquatic ecosystems, and those from various other databases.

Organizing committee members (WorldFish)

1. Alex Tilley, senior scientist
2. Aniss Khalid, communications officer – events and media monitoring, communications
3. Daniel Purba, senior IT engineer, management information systems
4. Edward Allison, acting director sustainable aquatic foods systems
5. Emily Khor, portfolio manager, project management unit
6. Essam Mohammed, interim director general and acting senior director of aquatic foods systems
7. Florine Lim, interim global communications lead, communications
8. Kalah Devi Muniandy, procurement specialist, procurement
9. Muhammad Hafizullah Mirhassan, research program specialist, cross-cutting
10. Patric Lim, lead, management information systems
11. Pauline Michael, office administrator, project management unit
12. Shng Shng Sam, digital media manager, communications
13. Salina Ariffin, executive secretary, administration
14. Sean Lee, science communications specialist, communications
15. Siew Hua Koh, administrative executive, administration

List of papers/presentations

The symposium was held on September 5–6, 2022, at WorldFish Headquarters in Penang, Malaysia. There were 23 presentation sessions divided into six different themes—fisheries and nutrition, data approaches, growth and morphology, growth and morphology/biogeography, aquatic biodiversity, and partnerships—with the following topics and presenters:

Keynote presentation

The expanding application of FishBase and SeaLifeBase in aquatic food systems research and governance
Eddie Allison, WorldFish

Eddie Allison (WorldFish) talks about the expanding application of FishBase and SeaLifeBase in aquatic food systems research and governance.

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Alex Tilley, WorldFish

1.3. Small-scale fisheries of the Ganga River with special reference to nutritional indices
Basanta Kumar Das, Central Inland Fisheries Research Institute, Indian Council of Agricultural Research (ICAR-CIFRI)

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Austin Humphries, University of Rhode Island

4.3. More on the gill-oxygen limitation theory
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Md Moshiur Rahman, Universiti Malaysia Terengganu

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Ariadna Burgos, Institute of Research for Development and WorldFish

3.2. Aquatic biodiversity research using environmental DNA tools in addressing sustainability management in Malaysia
Subha Bhassu, University of Malaya

3.3. Genetic diversity of Indian major carps from four riverine ecosystems
Bijay Kumar Behera, ICAR-CIFRI

3.4. The origin of highland fishes: Hypothetical propositions
Zarul Hazrin Hashim, Universiti Sains Malaysia

Theme 6: Aquatic biodiversity: Partnerships

6.1. Declining population sizes and loss of genetic diversity in commercial fishes: A simple method for a first diagnostic
Celia Schunter, The Swire Institute of Marine Science (SWIMS)

6.2. Fish diversity studies in Central and Eastern Africa: From morphology to genomics
Jos Snoeks, Africa Museum

6.3. Assessing why and how aquariums and FishBase can work together to improve the knowledge and conservation of fish. What's next?
Fabrice Teletchea, Université de Lorraine

6.4. Leveraging Web3 to explore sustainable financing of FishBase and SeaLifeBase
David Davies, AG Unity

FishBase–SeaLifeBase Symposium. September 5–6, 2022. FishBase Consortium group photo.

Theme 1: Fisheries and nutrition

1.1. FishNutrients: Data innovations supporting improved human nutrition

By Sitilitha Masangwi, Lilongwe University of Agriculture and Natural Resources

Sitilitha Masangwi talks about data innovations that improve human nutrition.

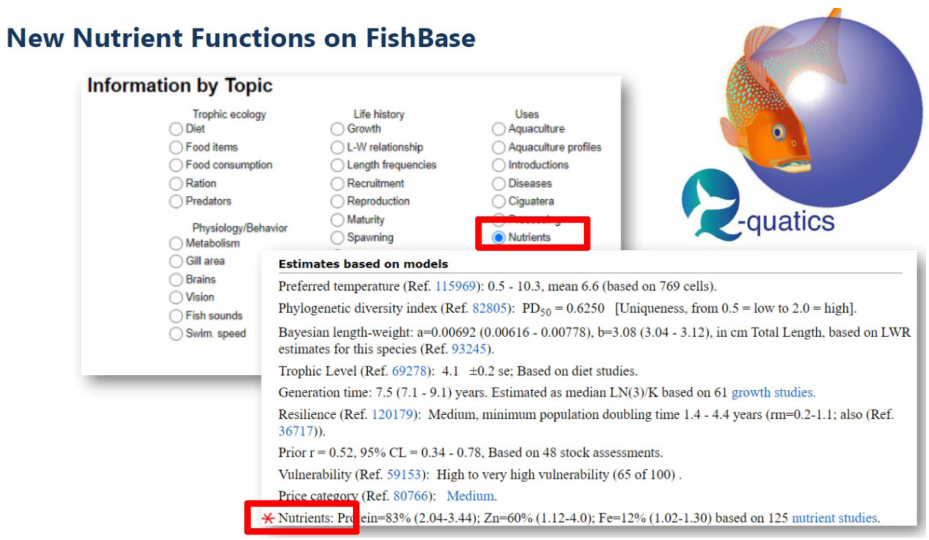
Abstract

The nutrients that fish contain, particularly micronutrients and essential fatty acids, make them an incredibly valuable food for addressing undernutrition—especially among nutritionally vulnerable groups like women as well as children under the age of 5. But not all fish are nutritionally equal; different species vary in their nutrient composition.

Existing databases reporting reliable, accessible, accurate and up-to-date data contain only a fraction of the fish species people consume, and data on the nutrient composition of foods is prohibitively expensive to collect. So, wherever data is available their careful compilation into global and openly accessible databases is an important and valuable undertaking to help guide integration into nutritional programs and policies.

A small cross-institutional team (spanning FishBase, WorldFish, Lancaster University, Dalhousie University, FAO, Lilongwe University of Agriculture and Natural Resources) has worked together to improve access to information about the quality of the nutrient composition of marine and freshwater finfish.

The team used a four-stage approach. First, data was drawn from the FAO/INFOODS biodiversity database. Second, a systematic search of literature drew together more recently published analytical data from 2016 to 2022. Third, expert solicitation was used to identify other high quality and reliability gray literature and databases. The final step was to combine these empirical measures



Sources: Hicks et al. 2019; MacNeil et al. in prep.

Figure 1. New nutrient functions on FishBase.

of nutrient composition with species-specific ecological and life history data from FishBase to build a Bayesian hierarchical model that accurately predicted the nutrient content of species whose data was missing.

The team collated 4547 measures of 14 different nutrients from 424 finfish species and predicted nutrient measures for 5000 finfish species. In June 2021, the team launched new nutrient profile functions on FishBase, adding predicted and empirical measures to species profiles. In August 2022, a further 848 data points, data for an additional 128 species and refined predicted measures for over 5000 species were added to FishBase alongside a new application called ShinyApp to aid online data exploration and user experience. In addition to these new openly accessible data tools, the team has used this data to support five global analyses that deliver new insights on the potential of fisheries to address global nutrient deficiencies.

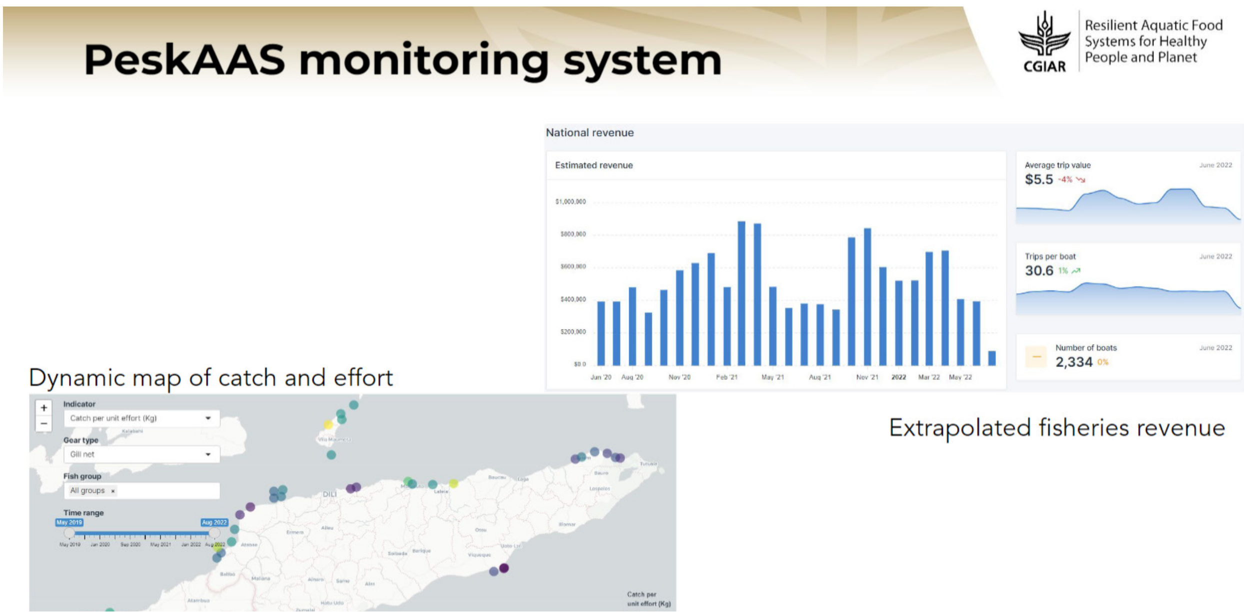
This innovative way of using existing data has expanded the global knowledge on nutritional values of fish, providing more analytical power and insights that can benefit global nutrition security goals. The initiative is a powerful exemplar of interdisciplinary, cross-institutional collaboration and data innovations at the ecology and human health nexus—and has inspired a new wave of data innovations.

1.2. Near real-time nutrition-sensitive fisheries management

By Alex Tilley, WorldFish

Abstract
Global deaths attributable to poor diets have grown 15% since 2010, and malnutrition in all its forms contributes to childhood mortality and early death. Micronutrient deficiencies are prevalent and arise through poor diet quality and insufficient intake of minerals like iron and vitamins. With

Alex Tilley (WorldFish) discusses near real-time nutrition-sensitive fisheries.



Related links:
https://www.peskas.org/
https://www.worldfishcenter.org/project/peskaas-automated-analytics-system-small-scale-fisheries-timor-leste

Figure 2. PeskAAS monitoring system.

increasing pressure on global food systems and rising costs, this is expected to worsen. Fisheries hold potential to reverse this trend in coastal areas through nutrition-sensitive fisheries management (NSFM)—in contrast to maximizing yields. Yet how to do this in practical terms, where consumer access to fish is constrained by poverty, awareness and supply chains, to name a few, remains unclear.

Here the study combined two new digital innovations to model scenarios for NSFM in Timor-Leste, one of the world's most undernourished countries. The Fish Nutrients Tool of RFishBase was applied to the digital catch monitoring system PeskAAS to generate near real-time nutrient composition values for catches across the country. The study used a 3-year time-series of high-resolution fisheries data to explore nutrient profiles over time and space. The results suggested that small pelagics such as mackerels and scads provide the highest nutrient potential of fisheries easily accessed by nearshore fishers with non-mechanized gear. These findings support recent work to enhance small pelagics in coastal catches with nearshore fish aggregating devices, and suggest that key national policies combined with increased awareness in rural areas could leverage fisheries for nutrition outcomes in Timor-Leste.

Basanta Kumar Das (ICAR-CIFRI) explains small-scale fisheries in the Ganga River, specifically nutritional indices.

1.3. Small-scale fisheries of the Ganga River with special reference to nutritional indices

By Basanta Kumar Das, ICAR-CIFRI

Abstract

The Indo-Gangetic plains cover several hundred kilometers across Indian states including Uttar Pradesh, Bihar and West Bengal, ultimately extending to the Bay of Bengal. The Ganga basin is one of the most populated areas and is considered to be the largest groundwater depository on Earth. Diverse fisheries have developed in riverine, estuarine and floodplain waterbodies, and the fisheries of the Ganga River harbor the richest freshwater fish fauna of India, including Mahseers, Gangetic carps (rohu, catla and mrigal) and hilsa as well as other economically important species.

This study aimed to identify the nutrient profile of 31 indigenous fish from the Ganga River for amino acids, fatty acids and mineral composition, toward improving the use of fish as nutritious food for human health. A total of 190 fish species (182 native and 8 exotics) belonging to 133 genera, 62 families and 23 orders were recorded in catch sampling throughout the study between the areas of Harshil and Fraserganj. Cyprinidae was the most

Small scale fisheries which involves small input cost, small fishing vessel, small fishing hours mainly comprising traditional fisheries.

This sector contribute

- **Food**
- **Poverty alleviation**
- **Trade**
- **Secure livelihood**
- **Provide nutrition**

Related links:
http://www.cifri.res.in/nutrifishin/

Figure 3. Small-scale fisheries in relation to the Ganga fisheries.

species-rich family (28 spp., 14.3%), followed by Danionidae (19 spp., 9.7%), Sisoridae (10 spp., 5.1%) and Bagridae (9 spp., 4.6%). Among the studied fish fauna, fish species like brown spinecheek gudgeon (*Eleotris fusca*), monsoon river prawn (*Macrobrachium malcomsonii*), chaunda gizzard (*Anondostoma chacunda*), cyprinid fish (*Securicola gora*), morari (*Cabdio morar*) and gangetic mystus (*Mystus cavasius*) were found to be nutrient-rich. Consumption of these small indigenous fish, as part of a healthy diet, can fulfill 70%–100% of the recommended daily intake of amino acids, fatty acids and mineral supplements on daily basis.

Artisanal fishers of the Ganga are economically vulnerable. The average monthly income of the fishers was INR 7283 in the lower, INR 5866 in the middle and INR 4345 in the upper part of the river, indicating moderately poor to critically poor conditions of the fishers. Ganga riverine fisheries have low input costs, with small fishing vessels and short fishing hours. The sector contributes food and nutrition security and income to millions of households. Fish are an inexpensive source of animal protein, and essential amino acids play a vital role in fulfilling the nutritional requirements of human beings. Including nutrient-dense indigenous fish in a regular diet can be a good strategy to target specific malnutrition objectives in India.

Keywords: the Ganges, artisanal fisheries, nutrient-dense fish.

Theme 2: Data approaches

2.1. Choosing how to consume data from FishBase and SeaLifeBase: Database, website, R package, API, WoRMS

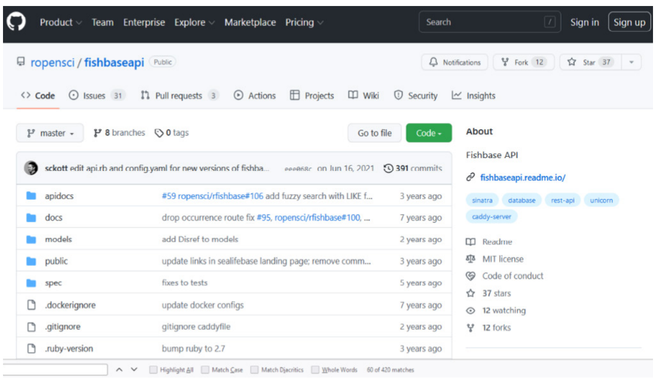
By Nicolas Bailly, Beaty Biodiversity Museum, and Sea Around Us, Institute of Oceans and Fisheries, UBC

Abstract

FishBase and SeaLifeBase users have multiple ways to get ("consume") data. The first way is to ask the team to extract datasets directly from the master database where data is entered in. Although it is the surest way for users to get what they want, expressed in natural language, without knowing the database structure, from the most up-to-date daily version, this is not scalable, so the team is not infinitely extensible. As such, 3¼ inch floppy disks, CD-ROMs, web, DVDs, R packages, SQL-based API (Standard Query Language; Application Programming Interface) have been used successively, the two last options being developed by third parties. In addition, some information is disseminated through aggregators such as the World Register of Marine Species, Catalogue of Life, and the Global Biodiversity Information Facility.

With disks, users can choose to use predefined queries or to directly reach the tables through self-made SQL queries. On the web interface, only predefined queries can be used, as well as the R , but in a more extended way. The API allows direct access to more/all (simplified) tables. Requirements, pros and cons were discussed to show that all these approaches are complementary, but for a cost.

Nicolas Bailly (QQuatics) talks about various ways to "consume" data from FishBase and SeaLifeBase..



Related links:
https://www.fishbase.ca/api/readme.txt
https://aws.amazon.com/opendata/?wwps-cards.sort-by=item.additionalFields.sortDate&wwps-cards.sort-order=desc
https://registry.opendata.aws/gbif/

Figure 4. Managing the database using the SQL-based programming interface.

2.2. Wielding data from citizen scientists: A showcase in Hong Kong

By Cheuk Ho Wu, SWIMS

Abstract

Data collected by citizen scientists can be vital to researchers. As a highly developed metropolitan area with 7.6 million people, Hong Kong has only a tiny marine area (1651 km^2). Yet it is home to about 6000 marine species, which is on par with the Baltic Sea or a quarter of Chinese waters. Such conditions offer a wonderful opportunity to promote citizen science programs and enhance ocean literacy. Under rigorous travel restrictions during the pandemic, scuba diving activities have thrived in Hong Kong, and numerous photographs taken during this period have led to the discovery of at least 25 species of fish.

Cheuk Ho Wu (SWIMS) talks about citizen scientists in Hong Kong and the data they have accumulated.

A collective effort by FishBase and SeaLifeBase to engage citizen scientists in data collection, particularly photos, could enhance the quality of both databases by illustrating morphological variations and providing background habitat information. Such enhancements to the databases, in turn, would improve the information available to citizen scientists and the wider public, promoting ocean literacy.

Related links:
https://www.114ehkreeffish.org/

Figure 5. Photographs taken by citizen scientists during an underwater fish survey in 2018–2021.

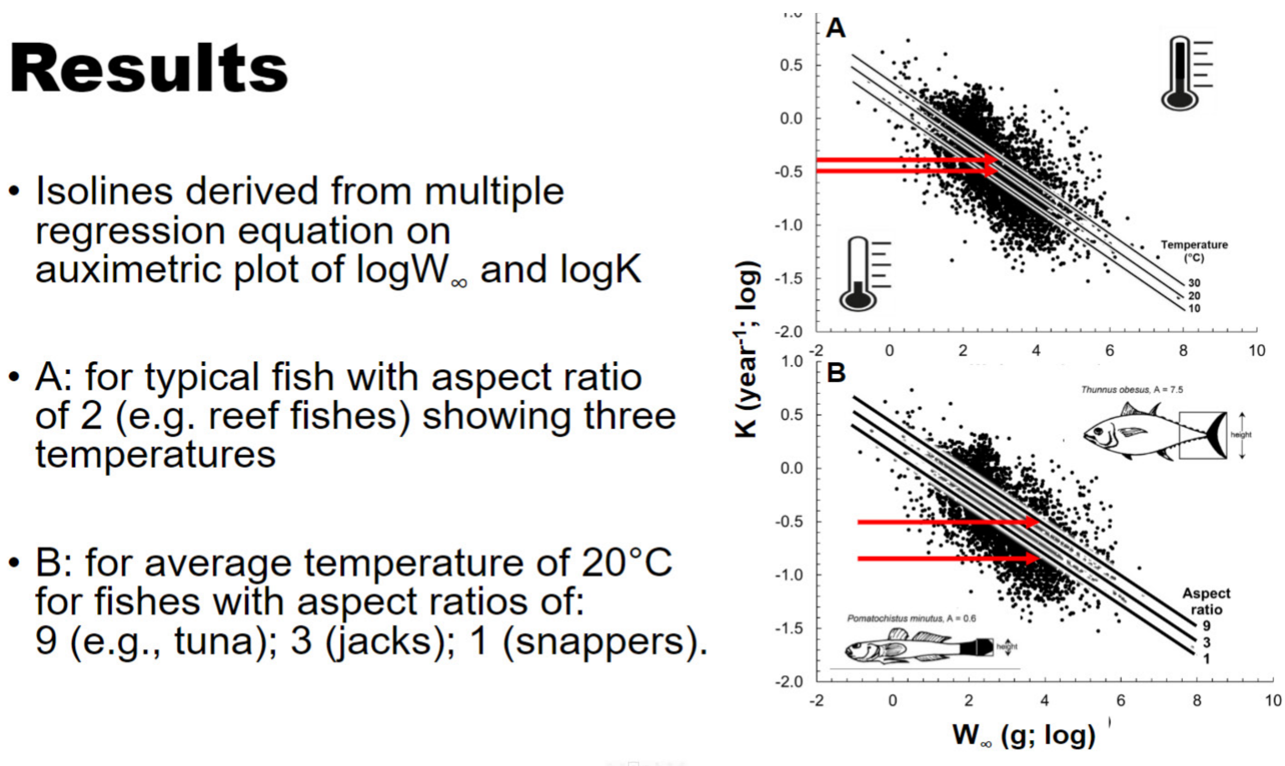
2.3. Impact of activity level and temperature on fish growth

By Deng Palomares, Sea Around Us, IOF, UBC

Abstract

This study, published in April 2022 in the peer-reviewed journal *Environmental Biology of Fishes*, presented a multiple regression of the parameter K. This is the rate at which the asymptote of the von Bertalanffy Growth Function (VBGF) is approached versus the asymptotic weight ($W\infty$), environmental temperature (T') and an index of activity level (the aspect ratio of the caudal fin, or (A) in 4251 populations and 1155 fish species extracted from FishBase. The resulting model explained 57% of the variance in the dataset, with all partial slopes significantly different from zero ($p < 0.01$). Here the study showed that temperature decreases the asymptotic size of fish, but increases their parameter K, and thus decreases traits associated with K, such as longevity. Also, the model suggested that A correlates with K values. This implies that active fish have large gill areas that supply the oxygen required for both a high level of activity and rapid growth, both supported by a high feeding rate, which is what we know of these fish.

Deng Palomares (UBC/SAU) explains how activity and temperature impact fish growth.



Related link:
https://link.springer.com/article/10.1007/s10641-022-01261-5

Figure 6. The graph shows a correlation between fish growth and water temperature.

Theme 3: Growth and morphology

3.1. Remodeling somatic growth space in fish

By Athanassios Tsikliras, Laboratory of Ichthyology, School of Biology, Aristotle University of Thessaloniki

Abstract

Somatic growth is an important biological characteristic of fish, and their main components, growth parameters and maximum age are all key factors in stock assessment models. Somatic growth in fish is mainly modeled using the von Bertalanffy growth curve, which is based on (mean) length-at-age data and estimates asymptotic length (Linf, cm), the rate at which asymptotic length is approached (K, 1/y) and the age at zero length (t0, y). The mean somatic length of exploited marine populations has been declining because of overfishing and/or climate change, which has implications for fecundity and future stock biomass.

In the present work, we provide a method for estimating the area corresponding to the von Bertalanffy growth curve, when the growth parameters (Linf, K, t0) and maximum age (tmax) are known, aiming to create a single metric of growth potential that incorporates both fish length and age. This metric can be used to measure the effect of historical anthropogenic forces on fish populations, specifically the proportion of growth potential that is lost when somatic lengths (and ages) shrink either from overfishing or because of low oxygen/high temperature levels. The area under the growth curve is calculated using the definite integral of the growth function with limits t1 and t2 where t1 < t2, set as lower and upper limit, respectively.

To calculate the area, the lower limit t1 is set at 0 or t0, and the upper limit t2 is set at tmax. Here, the study presented the area under the growth curve that has been calculated for all Mediterranean marine fishstocks for which growth data is available (n=186). Also calculated was the proportion of growth potential that is lost in a hypothetical scenario in which maximum somatic length and age declined from overfishing or other factors. This

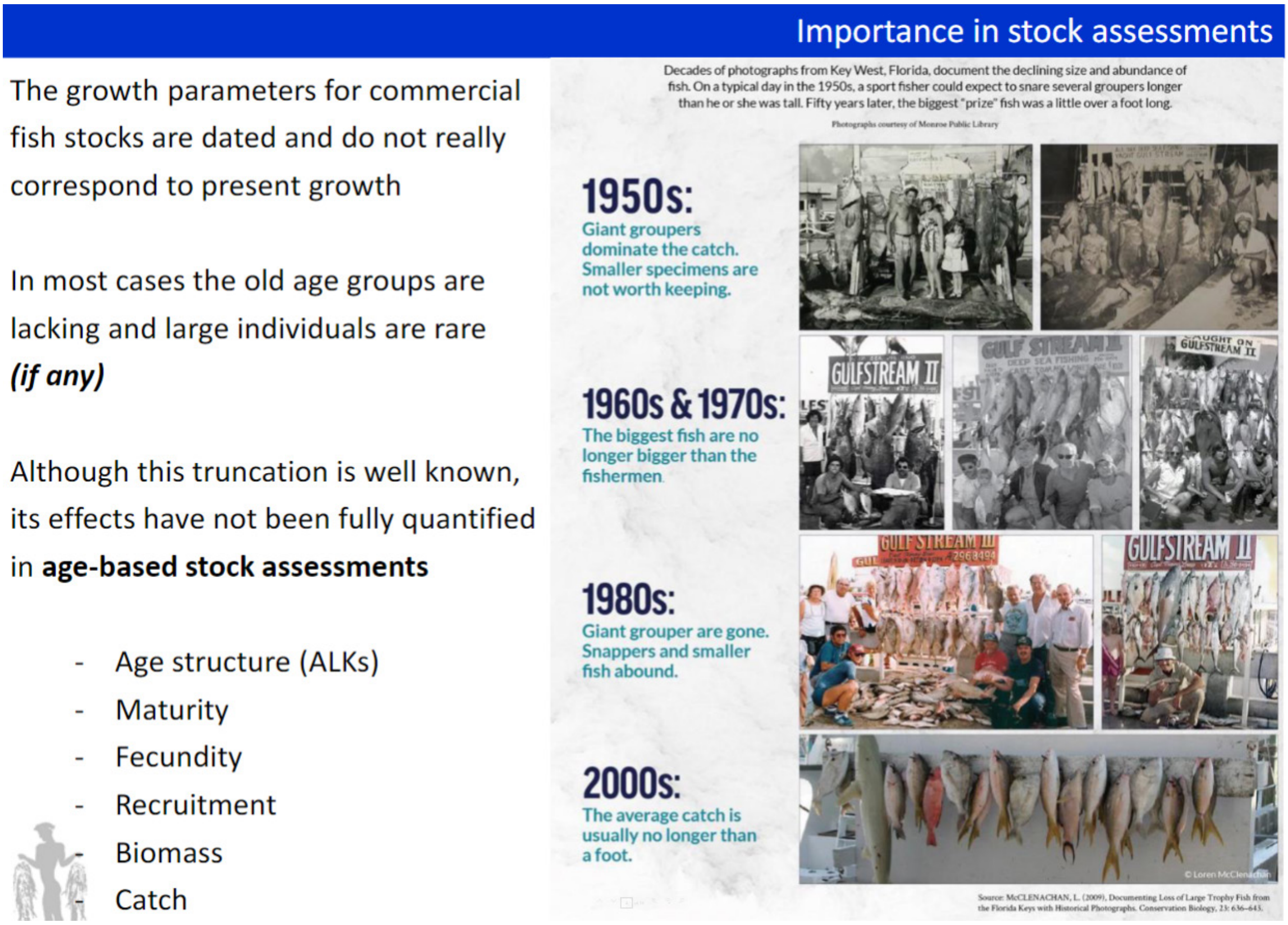


Figure 7. Importance of stock assessments over time.

method will allow scientists to quantify the effect of the loss of growth potential and the effects it might have on individual and population fecundity as well as on future population recruitment and biomass, and thus on future catch.

3.2. Otolith morphology and relationships of common pandora (*Pagellus erythrinus*) captured off the East Libya Mediterranean coast

By Eman Salem Alfergani, Omar Al-Mukhtar University

Abstract

This paper aimed to establish the morphometric parameters of common pandora (*Pagellus erythrinus*) otolith and to determine the relationship of these parameters to fish size. A total of 37 fish collected from the Benghazi shore in eastern Libya during the winter of 2021–2022 were used in the study. Total length (TL) and total weight (TW) were measured for individual fish.

Mean TL and TW were 18.568±0.6404 (13.9–26.8 cm) and 90.967±9.824 (33.3–267.8 g), and the length-weight relationship (TL–TW) indicated Isometric growth ($TW=0.013TL^{2.99}$ R2=0.98). Otolith weight (OW), length (OL) and height (OH) were measured. Because differences between parameters of left and right otoliths were statistically insignificant, only values on the left were used to calculate the shape parameters. The otolith was pentagonal, with margins crenate, and the ostium and the cauda were distinguishable.

The ostium length (OSL: 2.921±0.140) was funnel-like and shorter than the caudal length (CUL: 3.793±0.147), which is tubular. Percentages of sulcus acusticus SAL/SL%, OSL/SAL%,CUL/SAL%,%, standard height SH/, standard length SL % and otolith relative size (O_R) were calculated, and the power model was used to determine relationships between OL, OH, OW and fish size. Values of the coefficient of determination (R^2) were TL–OL ($TL=0.36\ SL^{1.035}$, $r^2=0.85$), TL–OH ($TL=0.29\ SH^{1.00}$, $r^2 = 0.86$), TL–OW ($TL=2.57\ SW^{2.74}$, $r^2 = 0.95$), TW–OL (TW=1.62 SL 0.347, $r^2=0.86$), TW–OH (TW=1.23 SH 0.34, $r^2=0.87$) and TW–OW (TW=0.001 SW0.91, $r^2=0.95$). The results suggest that otolith dimensions are good indicators for fish size.

3.3. Estimating somatic growth from maximum age or maturation

By Rainer Froese, GEOMAR

Abstract

Growth in size is a key life-history trait that has co-evolved and is interlinked with maturation, maximum age, mortality, generation time, and the intrinsic rate of population growth. Growth parameters are required inputs in the majority of stock assessment models used in conservation or fisheries management. However, growth is unknown for most species in FishBase and SeaLifeBase because of the difficulty of getting accurate age readings. This study presents a simplified method to estimate growth parameters, one that can be applied to fish as well as invertebrates, such as crustaceans and mollusks. Publication of such growth estimates would be accepted by the journal *Acta Ichthyologica et Piscatoria* if they were the first for a fish species. Other journals might follow that example.

Relationship	Power Equation		R^2
	a	b	
TL-OL	0.3632	1.035	0.85
TL-OH	0.2891	1.00	0.86
TL-OW	2.570	2.740	0.95
TW-OL	1.623	0.347	0.86
TW-OH	1.236	0.337	0.87
TW-OW	0.0010	0.915	0.95

statistically significant ($p< 0.05$)

Figure 8. Relationship between otolith dimensions and total length.

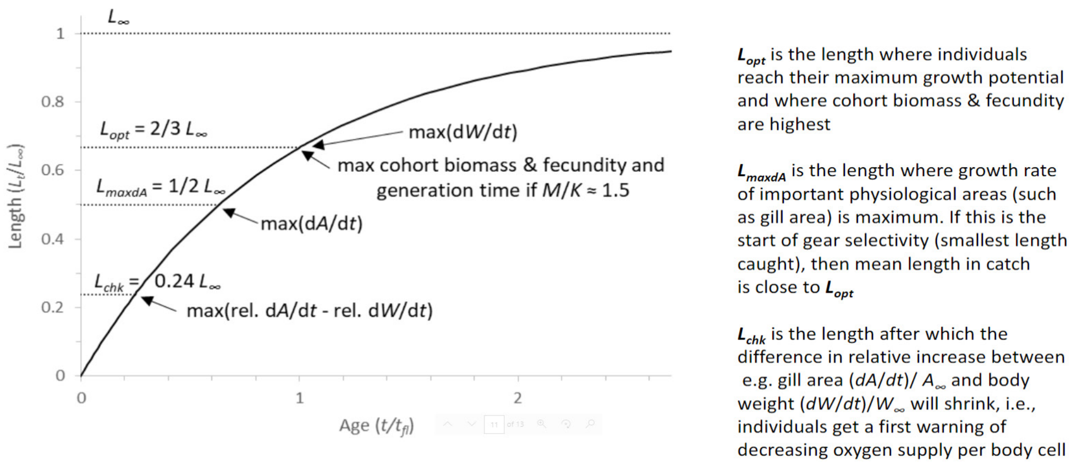


Figure 9. Application of a growth parameters assessment model used for fisheries conservation and management.

3.4. A fisheries and aquaculture ontology

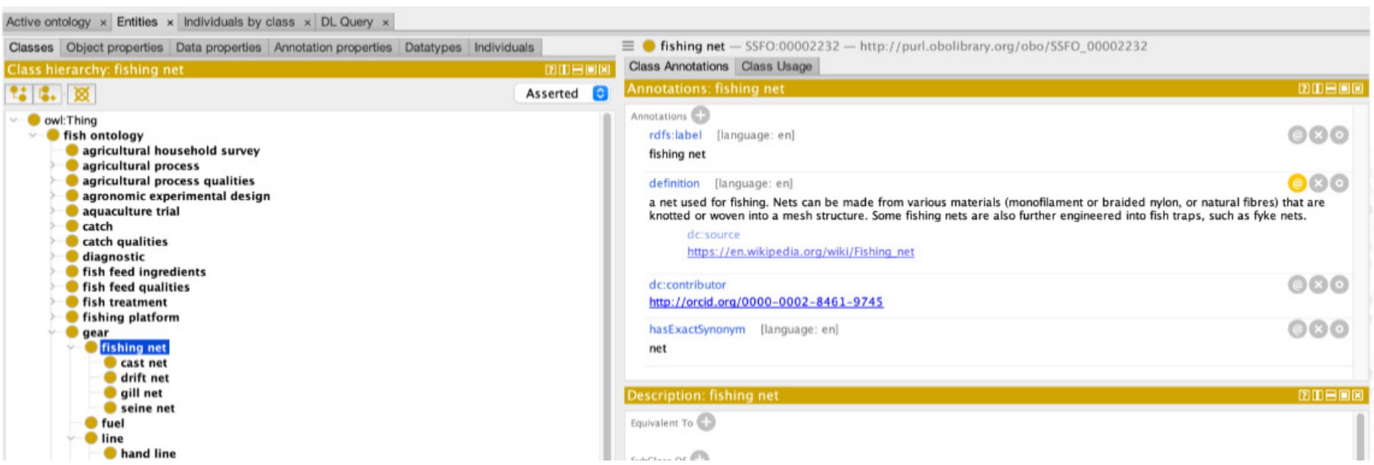
By Elizabeth Arnaud, Alliance Bioversity-CIAT

Abstract

Research on sustainable global agriculture and agri-food systems has generated heterogeneous and multidisciplinary data that is analyzed and often integrated into predictive models for climate change tools or decision-making tools for fisheries management and aquaculture production. However, our ability to aggregate this data and analyze it collectively to improve knowledge of complex issues is hindered by its lack of connectivity, integration and hierarchical relationships according to key terms or indicators.

An ontology is a standardized representation of the definitions and relationships of data from a specific discipline. Ontologies provide a common language for different kinds of data to be easily interpretable and interoperable, allowing easier aggregation and analysis.

WorldFish, as part of the Fisheries and Aquaculture Ontology Working Group formed in 2019, aimed to improve the sustainability, productivity and resilience of aquatic food systems by harmonizing the labeling of aquatic foods data with controlled vocabularies to enable easier data aggregation, interpretation and analysis. To this end, we compiled, updated and contributed fishery-related terms to existing controlled vocabularies. The objective was to improve the interoperability of WorldFish data into the various projects, databases and repositories by three means: (1) addressing inconsistent use of fisheries- and aquaculture-related terms across the datasets, (2) highlighting the missing terms in the main semantic resources, and (3) connecting and collaborating with the CGIAR Community of Practice for Ontology.



Related links:
https://github.com/WorldFishCenter/fish-ontology
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0234760

Figure 10. A screenshot of the small-scale fisheries and aquaculture ontology tree structure.

Theme 4: Growth and morphology: Biogeography

4.1. Introduction to aquadata: A work package of the Aquatic Foods Initiative

Cristiano Rossignoli, WorldFish

Over 3 billion people worldwide rely on aquatic food systems for income and nutrition.

But a lack of reliable data and information affects the social, economic and environmental sustainability of aquatic food systems in the face of climate change, pollution, overfishing and competing demands for water.

AquaData is a work package that aims to create a place where people can find data, stories and tools to use in their own contexts to make positive changes. This effort involves:

1. identifying and filling data gaps through partnerships and collaboration
2. deriving new data from emerging technologies and approaches
3. turning data into knowledge to catalyze action in aquatic food systems.

This 3-year program of work is part of the CGIAR Research Initiative on Aquatic Foods and will focus on Bangladesh, Cambodia, Ghana, India, Myanmar, Nigeria, Solomon Islands, Timor-Leste and Zambia.

4.2. Implementing a collaborative data collection system to update Lmax values for more 100 species in Indonesia

By Austin Humphries, University of Rhode Island

Abstract

Deep demersal fisheries in Indonesia yielded close to 90,000 t of snapper and grouper in 2019, landed by a fleet of approximately 10,000 fishing boats. Prior to this study, information on these multispecies, dispersed, small- to medium-scale fisheries was scarce, and reliable species-specific data on catch and effort was non-existent. This data deficiency made stock assessments and design of harvest control rules impossible.

To fill this void, a new data collection method, the Crew Operated Data Recording System (CODRS), was developed to collect verifiable species- and length-composition data from catches across all segments of the fleet. CODRS engaged crews of 627 fishing vessels to take photos of each fish in their catch, in combination with the deployment of a tracking device on their boats. Using more than 3.5 million images of fish, life-history parameters were updated for over 100 species in the fishery. The parameters were based on the maximum observed length-frequency distribution of the catch, namely asymptotic length, size at maturity, optimal fishing length, total mortality and spawning potential ratio. It is hoped that the results can be uploaded to FishBase as a contribution of my group as part of our consortium membership.

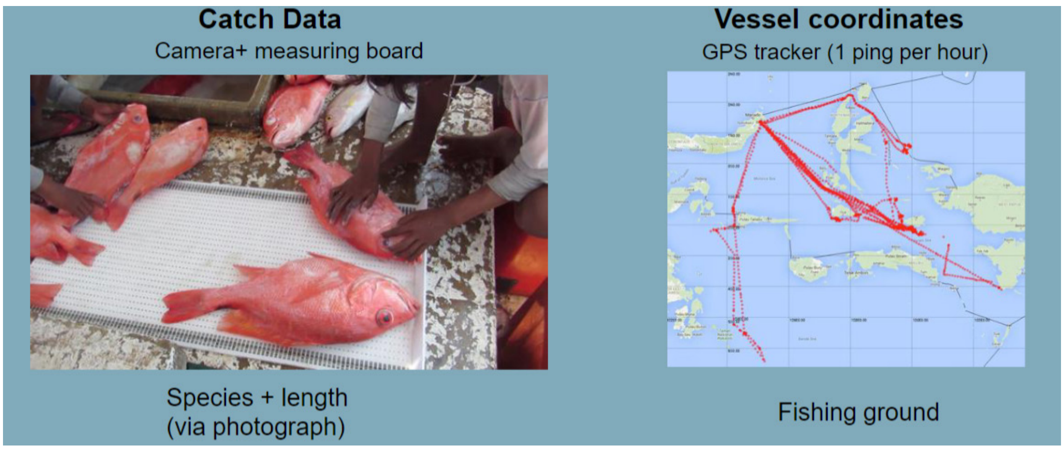


Figure 11. Crew Operated Data Recording System (CODRS).

4.3. More on the gill-oxygen limitation theory

By Daniel Pauly, Institute for the Oceans and Fisheries, UBC

Daniel Pauly (UBC) talks about the gill-oxygen limitation theory.

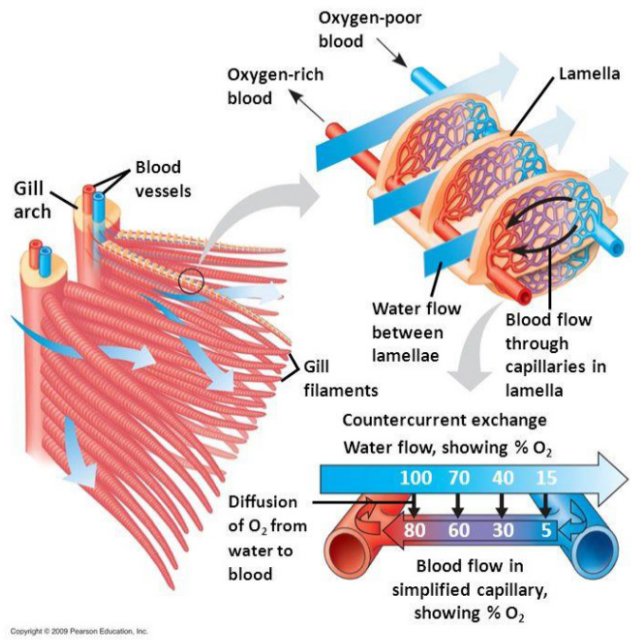


Figure 13. How much sense would it make to put more gil lamellae behind the first set of lamellae that water encounters?

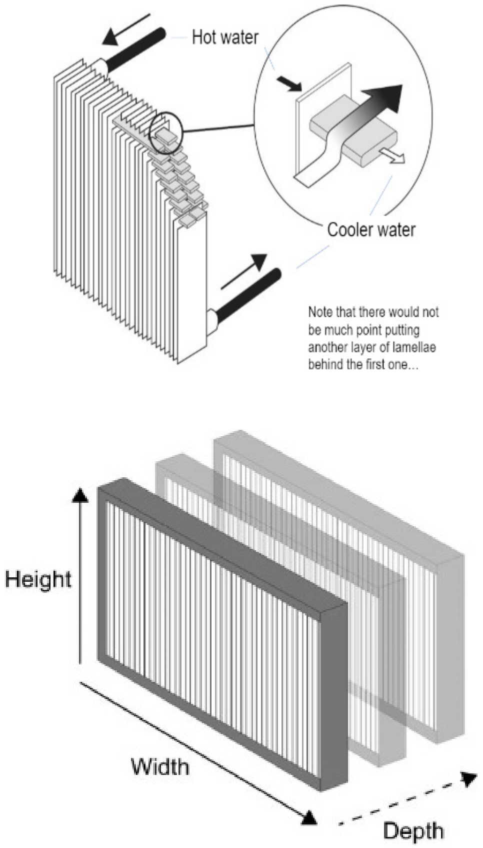


Figure 12. To make bigger radiators, you can increase their width and height, but not their depth. Or, put differently, radiators can grow in only two dimensions. The same principle is essentially the same for gills, which are also "designed" to exchange in a flowing medium.

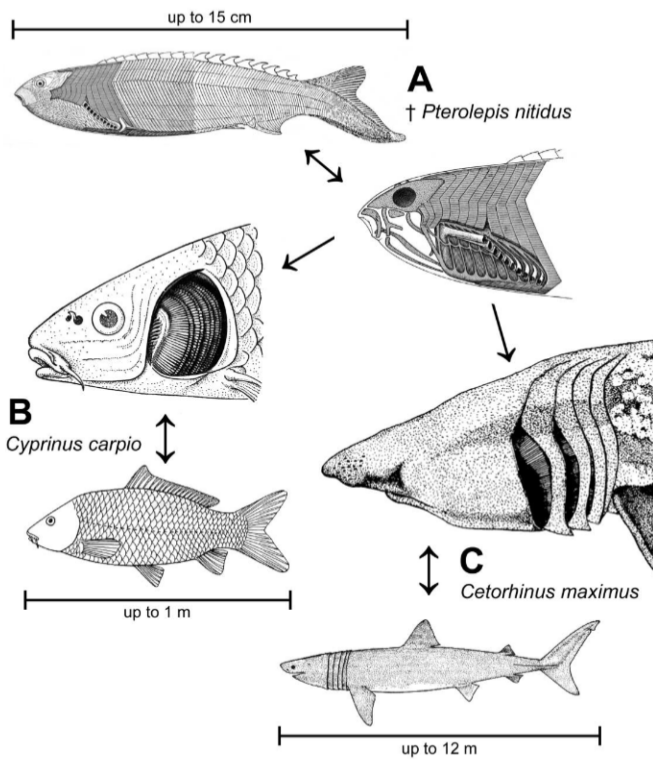


Figure 14. To deal with these constraints, fish have, over time, evolved large gills, especially big fish.

4.4. Bright spots for research and conservation of the largetooth sawfish in Colombia and Panamá

By Juliana Lopez Angarita, Talking Oceans

Abstract

Sawfish are considered one of the most endangered families of fish globally. Their diadromous ecology and vulnerability to fishing nets have brought most populations to the brink of collapse, and limited knowledge of historic and contemporary distribution hinders conservation of surviving populations.

Colombia and Panamá are two of 22 countries considered high priority for the development of species-specific national legal protection of the critically endangered largetooth sawfish (*Pristis pristis*). To construct a baseline for the temporal and spatial distribution of the largetooth sawfish in the two countries, the study collected historical records from museum databases and literature over the past century, analyzed available small-scale fisheries landings databases, and conducted interviews with fishers in 38 locations. The study found 248 records of sawfish occurrences across both countries between 1896 and 2015, with 69% of the records from before 2000. The declining frequency of observations was corroborated by fishers, who reported fewer sawfish sightings and catches over the past 20 years. Results from a regression model of total length and observed date suggested that the maximum size of observed sawfish has also declined over time.

The study used location data from sawfish records to identify potential “bright spots” that could foster remaining populations. Records broadly characterized the locations of sawfish as remote areas with high mangrove forest cover. Given the length and cultural diversity of the Pacific coastlines of Colombia and Panamá, the findings provide important guidance to implement rapid conservation and fisheries interventions in these priority areas and highlight geographical gaps in knowledge for further work.

Juliana Lopez Angarita (Talking Oceans Foundation) list some bright spots for research and conservation of the largetooth sawfish in Colombia and Panamá.

Results

- Largetooth sawfish were widely recognized by fishers
- 66% reported a decrease in the abundance of sawfish in their lifetimes
- In most locations sawfishes had not been seen in more than 10 yr
- Reported captures were perceived as accidental

Figure 15. Results of a sawfish study in Colombia and Panama.

4.5. Length-weight relationships and reproductive aspects of the new species of snapper, *Lutjanus xanthopinnis*, in the waters of Terengganu, Malaysia

By Md Moshiur Rahman, Universiti Malaysia Terengganu

Abstract

This study reported for the first time the length-weight relationships (LWRs) and reproductive aspects of the newly identified snapper species *Lutjanus xanthopinnis* collected from the Pulau Kambing fish landing port in Terengganu, Malaysia. Samples were collected monthly from March 2022 to July 2022. A total of 170 fish specimens (65 females and 105 males) were identified to species level morphologically based on Iwatsuki et al. (2015) and were then measured.

Md Moshiur Rahman (Universiti Malaysia Terengganu) describes a new species of snapper found in Malaysian waters.

Total length ranged from 15.8 to 24.1 cm (mean ± SD: 18.55 ± 1.74 cm) and weight from 59.5 to 217.7 g (mean ± SD: 102.17 ± 31.74 g).

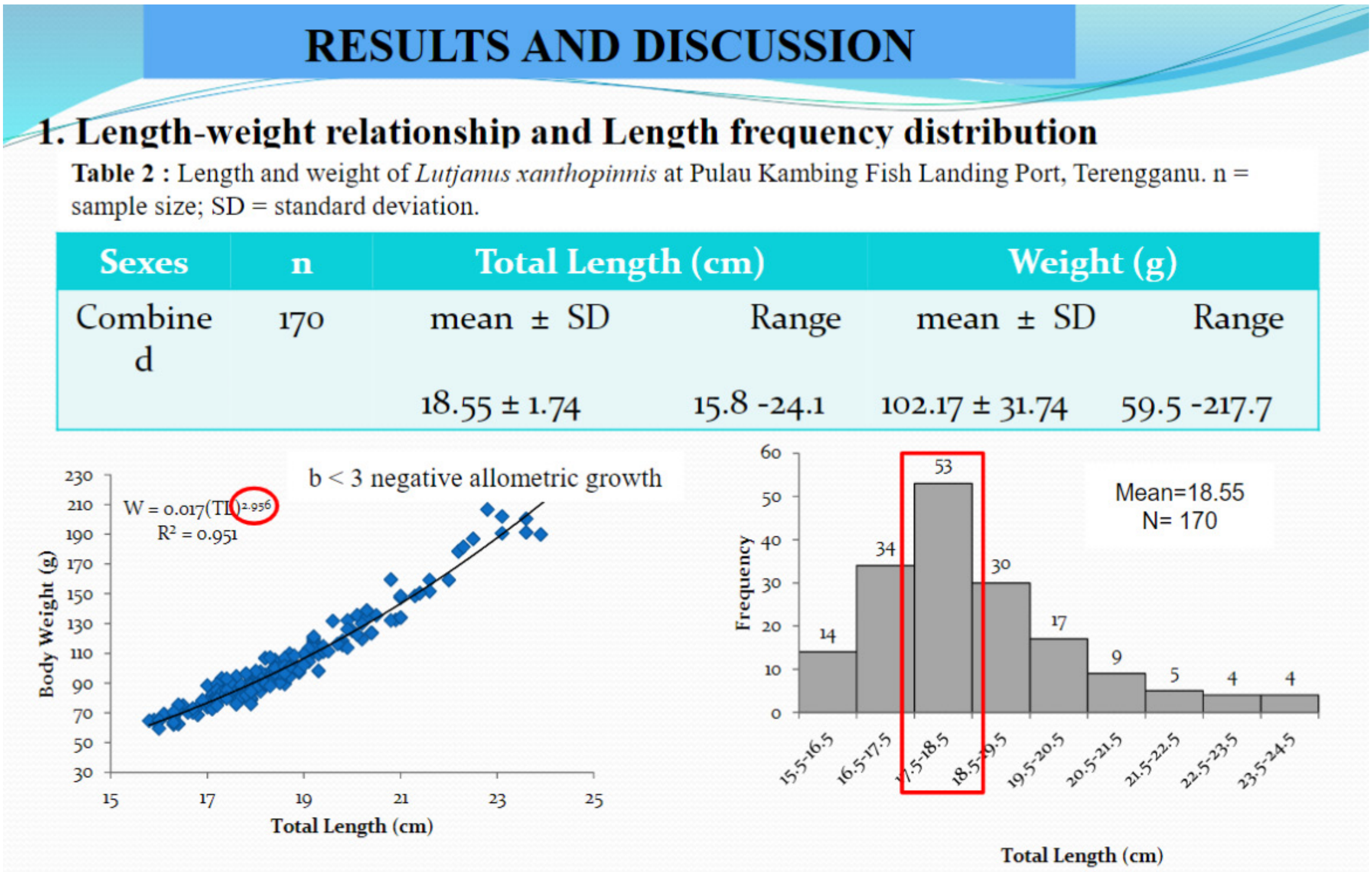


Figure 16. The LWRs and reproductive aspects of the newly identified snapper species *Lutjanus xanthopinnis*.

In LWRs, the allometric coefficient b value was 2.956 (negative allometric) and the value of determination coefficients r^2 was 0.951, respectively. Sex ratio, gonadosomatic and hepatosomatic index, spawning period, fecundity, condition factor K, and the gonadal maturation stage were assessed for reproductive biology study. Males were significantly overrepresented in the sex ratio of 1.61:1 (male:female). The condition factor K peaked in March (1.63), while its lowest value was in July (1.49). Monthly deviation of the gonadosomatic index (GSI) was highest in March and then gradually declined in the months that followed. The assessment of the relationship between the condition factor (K) and the hepatosomatic index revealed that liver energy mobilization aids in gonad development. The fecundity of 29 mature females ranged from 16.3 to 22.8 cm, with body masses ranging from 70.5 to 206.7 g, yielding 10,803 to 43,802 ova. Fecundity increases with gonad weight in comparison to length and weight, and so five gonad stages were determined based on the ovary's maturity. As of now, the results of this study offer vital information about LWRs and the reproductive characteristics of *L. xanthopinnis*, which will serve as a baseline for future fishery management in this region.

Keywords: length-weight relationships (LWRs), yellowfin snapper, *Lutjanus xanthopinnis*, reproductive biology, Malaysia.

Theme 5: Aquatic biodiversity

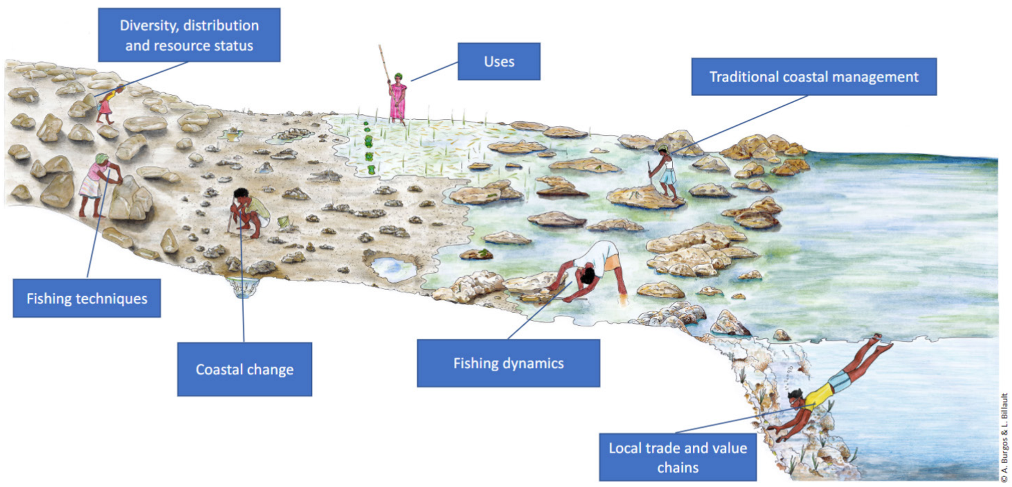
5.1. Lingua franca: Ethnoecological challenges in sampling aquatic invertebrate species

By Ariadna Burgos, French Research Institute for Sustainable Development

Abstract

Ethnoecology is a field of research that takes into account the interaction of local and indigenous peoples with their environment through knowledge, know-how, perception and innovations. Although ethnoecological approaches are widely used by social scientists to survey and assess social-ecological systems, biologists and ecologists rarely apply these approaches to undertake research and collect data in the field.

This presentation focused on the complementarity of local and scientific knowledge to assess invertebrate aquatic diversity, species ecology and uses, and highlighted the challenges that researchers might encounter while undertaking the approach. Drawing from case studies carried out in the Asia-Pacific region, the study examined how local fisherwomen and fishermen who target aquatic invertebrates for food and/or ornamental purposes are particularly knowledgeable of species diversity, lifestyles, distribution and abundance, as well as local fishing dynamics and fishing pressure on species. In parallel, the study pointed out the ethical and scientific challenges of incorporating this data into larger research datasets and analysis.



Related link:
https://science.mnhn.fr/institution/mnhn/collection/im/item/list?recordedBy=burgos

Figure 17. Local ecological knowledge unveils interdisciplinary methods to integrate local knowledge in fisheries research.

5.2. Aquatic biodiversity research using environmental DNA tools in addressing sustainability management in Malaysia

By Subha Bhassu, University of Malaya

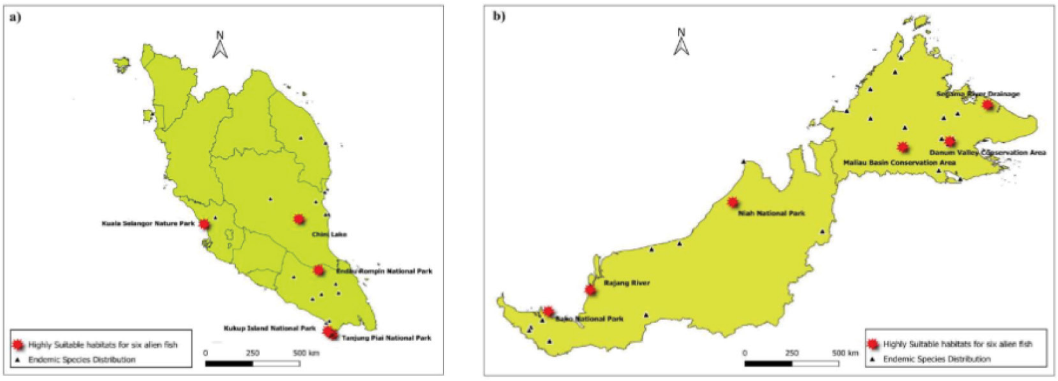
Subha Bhassu (University of Malaya) discusses biodiversity research that uses DNA tools for sustainable management in Malaysia.

Abstract

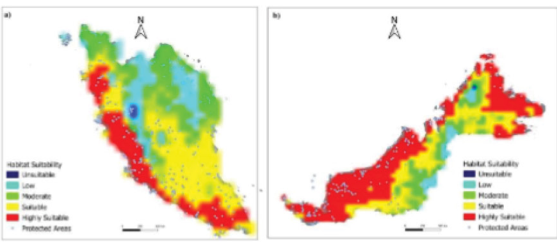
Malaysia is a country with diverse species of aquatic flora and fauna. It is home to various species of freshwater and saltwater aquatic organisms such as lampam (*Barbonymus gonionotus*) and haruan (*Channa striata*). However, the introduction of non-native fish, better known as invasive alien fish, has led to a biological invasion that threatens the population of native species—through competition, predation, or transmission of pathogens, as well as damage to the ecosystem.

Invasive alien fish prey upon, or out-compete, native species, or modify natural ecosystems, causing the extinction of native species. Although various agencies have undertaken efforts to identify invasive species, much work remains to be done. The ability to detect invasive alien fish is poorly developed, as it relies upon visual identification of these invasive species. This has proven to be highly tedious and inaccurate because of their similar morphology with other fish. Thus, molecular testing can be a practical alternative to help identify invasive fish. Conservationists are working hard to determine the extent of damage these species have on the natural environment and how this can be prevented in the future.

Keywords: aquatic biodiversity, EDNA and sustainability.



Highly suitable habitats for six alien species in (a) Peninsular Malaysia and (b) East Malaysia and distribution of endemic species



Distribution of potential suitable habitats for *Cichla occellaris* in (a) Peninsular Malaysia and (b) East Malaysia

- Many protected areas are in **HIGH RISK** of an invasion
- Potential to invade 8 states in Peninsular and whole of Sabah, Sarawak
- Sungai Kinabatangan & Sungai Johor
- Isothemality & Minimum Temperature influence the distribution of IAS
- Only *Pterygoplichthys pardalis* different invasion pattern

Figure 18. Habitat suitability of six invasive fish in Malaysia.

5.3. Genetic diversity of Indian major carps from four riverine ecosystems

By Bijay Kumar Behera, ICAR-CIFRI

Abstract
The wild stock of Indian major carps (IMCs) is declining in major rivers of India because of pollution, overexploitation and inbreeding. In this study, the comparative population structure, genetic diversity and historical demographics of IMCs, rohu (*Labeo rohita*), catla (*Labeo catla*), and mrigal (*Cirrhinus mrigala*) were characterized by analyzing partial 307bp sequences of the cytochrome b gene of 357 fish collected from seven geographically isolated sites from Indian river basins and two culture zones. The study implicated the occurrence of 35 haplotypes with haplotype diversity (Hd) of 0.7333 in rohu in the Brahmaputra basin showing allelic richness, while no nucleotide diversity (π) 0.000 was observed among catla at two geographically isolated locations in the Ganga and Narmada rivers. The analysis of molecular variance (AMOVA) revealed the genetic diversity of IMCs is very low (9.40%) within the species, as compared to among the three species (80.76%). The study provided the first report on genealogical biogeography, evolutionary divergence and expansion of the three IMCs, which would help formulate strategies for conservation of fisheries biodiversity in the Indian riverine ecosystems.

Keywords: Indian major carps, conservation, Cyt b, mtDNA, population structure.

5.4. The origin of highland fish: Hypothetical propositions

By Zarul Hazrin Hashim, University Sains Malaysia

Abstract
During a trip to Sungal Kooi, located within the Royal-Belum Forest Complex in Perak, Queen Danio (*Devario regina*) and snakehead fish (*Channa striata*) were the only two species found above the shower-like waterfall, which is 65 m high with a 90°slope. This indicates that fish do exist above waterfalls.

However, these two species have no special adaptations to climb or jump over barriers, so to explain their existence above the waterfall, the study proposed three hypotheses: (1) the world was once flooded and there were no limitations

Zarul Hazrin Hashim (Universiti Sains Malaysia) explains how fish could have originated in the highlands.

List of Cytochrome *b* gene of IMC submitted in NCBI GenBank and their Accession Numbers

Name of the fish species	NCBI GenBank Accession No.		
L. rohita (129 Nos.)	KC506120-KC506148, KC196775-KC196802, KC196770-KC196797, KC294391-KC294397,	KC294409, KC294413, JQ912091-JQ912092, KC294387-KC294390, JQ912089-JQ912090,	KC506104-KC506119, KC294398-KC294403, KC294414, JQ912093-JQ912096
L. catla (166 Nos.)	JX912541-JX912556, KC506086-KC506097, KC294324, JQ912082-JQ912085, KJ467572-KJ467581, KJ486609-KJ486620, KJ443668-KJ443672,	JX986910- JX986917, JX860848-JX860852, JQ912086, KJ513060-KJ513089, KC223602-KC223617, KC506098-KC506101,	JQ912087-JQ912088, KC294329-KC294335, KJ486631-KJ486649, KJ486621-KJ486630, KC294336-KC294339
C. mrigala (62 Nos.)	KC294350-KC294351, KC294373-KC294374, KC122393-KC122396,	JX986918-JX986953, JQ912098-JQ912101, KC294352-KC294354,	KC294375-KC294376, JQ912102-JQ912110

Related link:
https://www.ebi.ac.uk/Tools/msa/clustalw2/

Figure 19. List of the cytochrome b gene of IMCs.

to fish distribution, (2) fish species assemblages were separated by land uplifting, and (3) there are other stream branches that enable fish to move into the respective stream. The first hypothesis is the strongest from looking at the timeline of events for (i) the phylogenetic tree for the two species, (ii) a revelation that freshwater lineage goes back to marine species, (iii) land uplifting in Asia that had occurred millions of years ago, and (iv) the historical flood event during the era of the Prophet Noah.

Queen Danio can be found in India, Myanmar and the Mekong basin, whereas snakehead can be found from Pakistan to Thailand and South China. If other populations of these species exist above a substantial waterfall somewhere else, what is the probability of their original ancestor populations having the same species? If this assumption is correct, there might be an embedded template that led to these fish populations having the same species in our time. Nonetheless, further studies are required to confirm these hypotheses/suggestions.

Hypotheses

1. The world was once flooded and there were no limitations to fish distribution

2. The fish species assemblages were separated by land uplifting

3. There are other stream branches enabling fish movement into respective stream

Figure 20. The study requires more evidence to prove the following hypothesis.

Theme 6: Aquatic biodiversity: Partnerships

6.1. Declining population sizes and loss of genetic diversity in commercial fish: A simple method for a first diagnostic

By Celia Schunter, SWIMS

Abstract
Exploited fish species may have experienced or are experiencing declines in population sizes coupled with changes in their environmental conditions owing to global change. Declining populations might lead to a decrease in genetic diversity, which in turn could produce losses of adaptive potential to face current and future environmental changes. With this in mind, this study aimed to answer a simple, even naive question, given the complexity of the subject: Could we use a simple method to obtain information on the loss of genetic diversity in exploited fish species?

The study investigated the use of the levels of genetic diversity in the widely used genetic marker cytochrome C oxidase subunit I (COI) mitochondrial gene. Estimates of genetic diversity in COI were obtained for populations of seven fish species with different commercial importance from the East China Sea. These estimates were contrasted against large datasets of genetic diversity in COI for fish species (East Asian N=118; worldwide N=1425), and six control species with known biology and history. The study found that estimates of genetic diversity in COI match the expectations from theoretical predictions and known declines by fishing pressures. As such, the answer to the above question was affirmative. The study concluded that estimates of genetic diversity in COI provided an effective first diagnostic of the conservation status of exploited fish species.

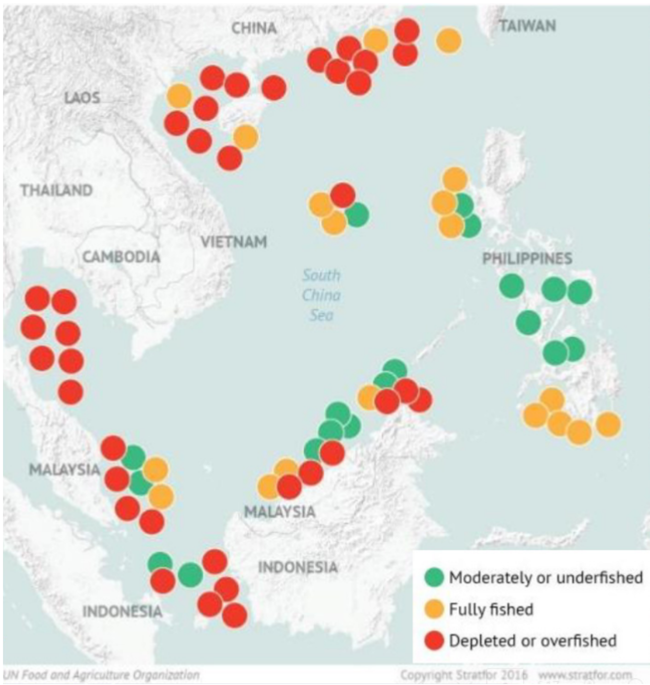


Figure 21. Status of fisheries in the South China Sea.

6.2. Fish diversity studies in Central and Eastern Africa: From morphology to genomics

By Jos Snoeks, Royal Museum for Central Africa and the KU Leuven

Jos Snoeks (Africa Museum) outlines studies on fish diversity in Central and Eastern Africa.

Abstract

The Royal Museum for Central Africa is a founding member of the FishBase consortium. It is responsible for information on African freshwater and brackish water fish, and interactions with ongoing studies on the diversity of African fish have proven beneficial for all teams involved.

Through a combination of mostly morphometrics, genetics and genomics, new insights have been acquired for several target groups, especially in the Congo Basin and lakes in the East African Rift Valley. Both regions harbor unique and highly endemic fish faunas. Two case studies were presented.

The evolutionary history of the endemic haplochromine cichlids in the African Great Lakes Region resulted in numerous cases of convergent evolution. To fully understand this phenomenon, it is necessary to unravel the species diversity. As such, the diversity of endemic cichlids in Lake Edward is being assessed. It went from 28 before this study to about 56 species, with 17 new species already described in the past 3 years. Because of their recent speciation, standard genetic techniques fail to uncover the phylogeny of these fish, so whole genomic approaches are necessary.

The study discovered a large amount of cryptic diversity in Enteromius, a genus of small cyprinids in the Congo Basin and the northern lakes of the Rift Valley. These fish appear to represent the opposite of the better-known endemic cichlids. The study found large genetic divergences coupled with small morphological differences and an apparent lack of ecological or reproductive specialization between lineages that probably represent new species. This means that a whole genome approach is necessary.

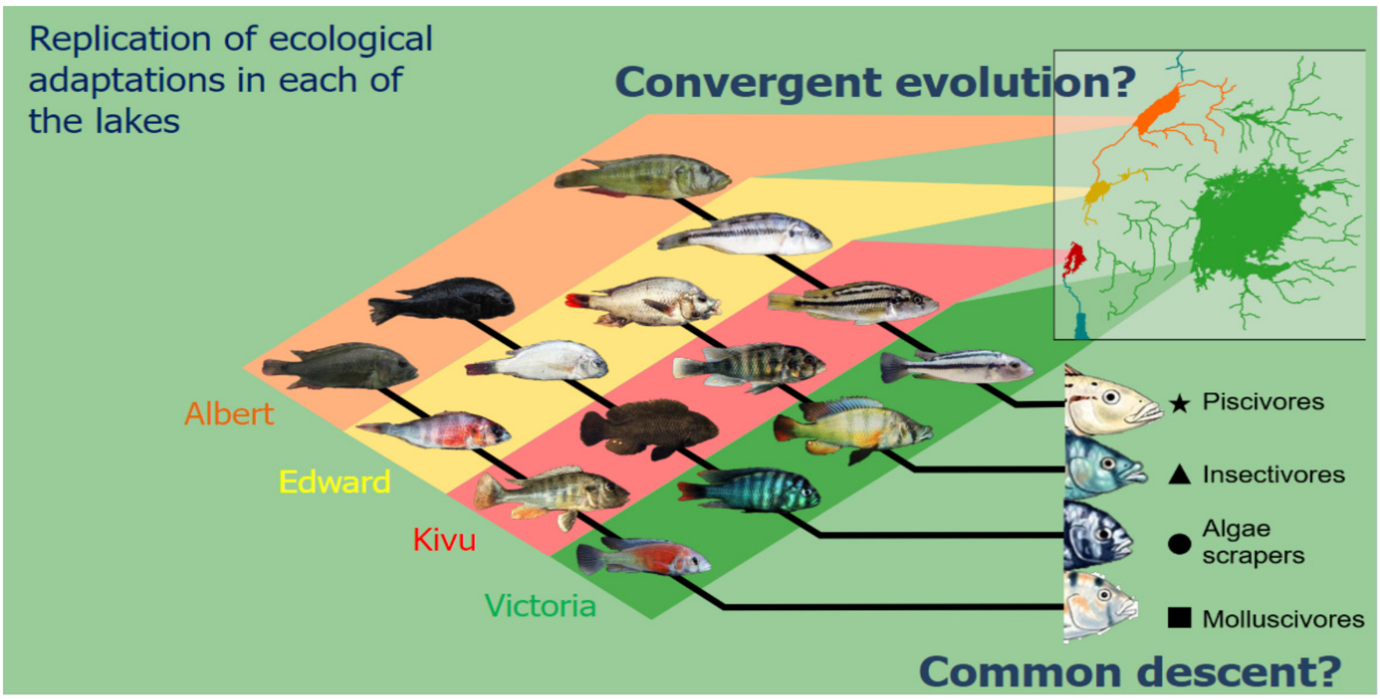


Figure 22. Common descent or convergent evolution?

6.3. Assessing why and how aquariums and FishBase can work together to improve the knowledge and conservation of fish. What's next?

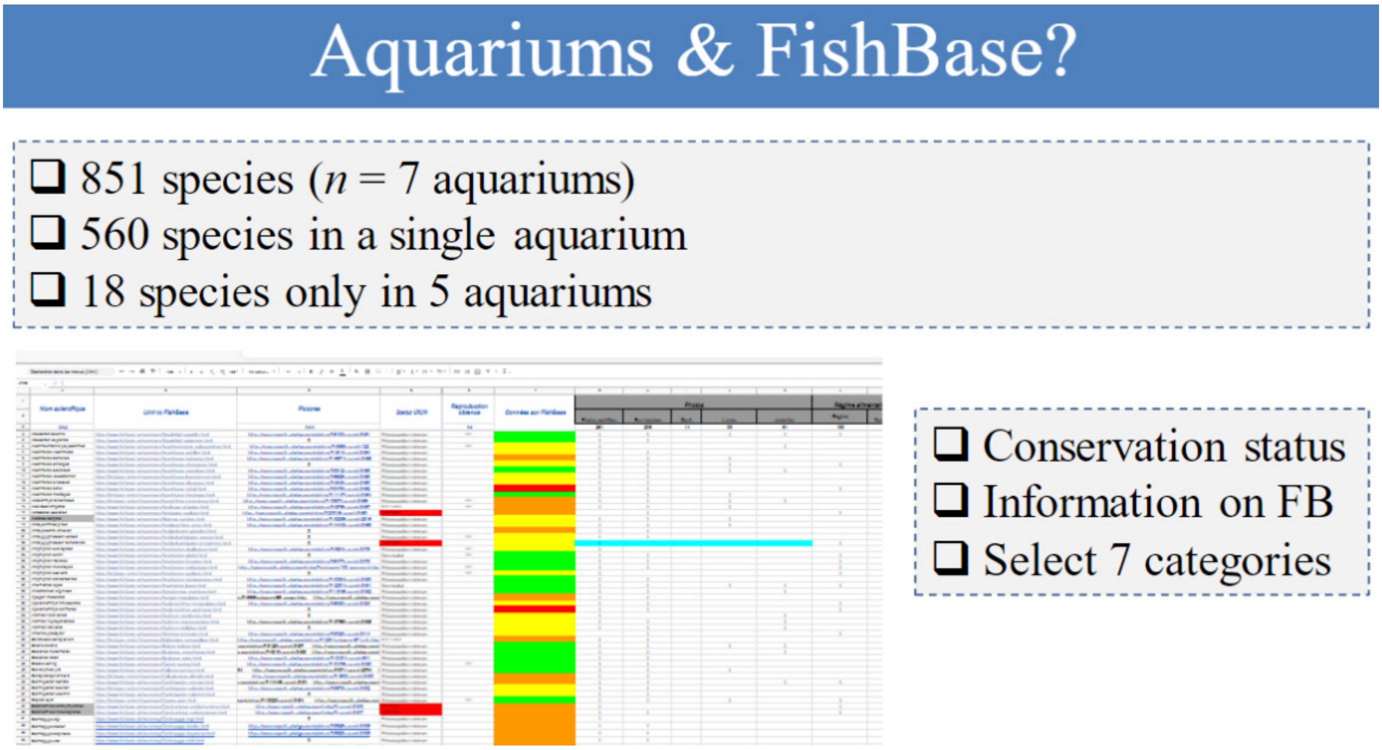
By Fabrice Teletchea, Université de Lorraine

Abstract

Aquariums have evolved from exhibiting animals primarily for public enjoyment to conservation organizations whose missions are to inspire and contribute significantly to wildlife conservation. Despite significant implications in conservation and research programs, the French Association of Aquarium Curators' (UCA) contributions to scientific articles remain low. One possible solution to highlight the contribution of UCA members to the knowledge and conservation of fish could be to develop a strong and sustainable partnership with FishBase/SeaLifeBase. The main goal of the present project was to develop such a partnership.

After 4 years, 18 curators agreed to spend some time on this project and shared their list of species ($n = 7$) and photos ($n > 200$) on FishBase. Fifteen agreed to appoint a FishBase representative, whose main missions would be to collect and curate data in each aquarium. Overall, 851 species are hosted within the seven aquariums for which we obtained the list of species, among which less than 10% are well known in FishBase. We also found that UCA members have successfully close to 120 shark/ray and teleost species. The increasing number of species maintained and reproduced in aquariums allows a lot of data to be produced, such as egg diameter, larval size and length/weight, and holds potential for developing fruitful research collaborations.

The sustainable development of this new partnership will rely chiefly on the implication of FishBase representatives and dedicated personnel in FishBase. To be successful in the long term, this new partnership will also require strengthened collaborations among aquariums, as well as collaborations between aquariums and academia, and hobbyists. It is anticipated that new aquariums could join this project.



Related links:
https://www.mrgoodfish.com/en/ or https://www.fishbase.ca/report/AquariumsList.php

Figure 23. Species hosted within the seven aquariums.

6.4. Leveraging Web3 to explore sustainable financing of FishBase and SeaLifeBase

By David Davies, AgUnity

Abstract

AgUnity is a fintech innovator that is developing and deploying low-cost, blockchain-based technology solutions to build efficient digital supply chains, from farmer to consumer. And the team at AgUnity is always on the lookout for innovations that can positively impact our planet and its people. Our next project is using Web3 to reimagine conservation by decentralizing one of the greatest repositories of knowledge on Earth.

In partnership with the FishBase consortium of impact-driven organizations, we will support WorldFish's mission to reduce hunger, malnutrition and poverty by minting non-fungible tokens tied to every marine species in the organization's database. Imagine being the sole, official global custodian of the data for the great white shark or the clownfish—or any of 34,000 other unique marine creatures, while also contributing to the expansion of knowledge about it and its sustainability.

David Davies (AG Unity) explains how Web3 can be used to sustainably finance FishBase and SeaLifeBase.

Related link:
https://www.agunity.com/

Figure 23. The partnership between Planet Neo, WorldFish, AgriUT and Greater Outcomes.

About WorldFish

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving aquatic food systems, including fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world.

The WorldFish headquarters is in Penang, Malaysia, with regional offices across Africa, Asia and the Pacific. The organization is a member of CGIAR, the world's largest research partnership for a food secure future dedicated to reducing poverty, enhancing food and nutrition security and improving natural resources.

For more information, please visit www.worldfishcenter.org