

STAGES

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MESSAGE FROM THE PRESIDENT



Dear ELHS friends and colleagues:

Happy Summer, everyone! I hope you all have been managing to find some time to relax this summer season. My year-long sabbatical is coming to an end, so I am trying to savor my freedom as much as possible before school starts back in August.

I want to start by acknowledging Ana Faria and Susana Garrido for hosting an **amazing** 46th Laval Fish Conference. The conference was excellent in every respect, from the science presented to the people in attendance to the venue. I thoroughly enjoyed my conversations with old friends and colleagues, enjoyed making new friends and learning new things, and loved touring the grounds of the Calouste Gulbenkian Foundation, as well as wandering the city streets and parks within Lisbon. As usual, I left the conference, reaffirming what I already knew—Larval Fish Conferences are the best meetings around!

With that said, I encourage you to venture to Ohio for the 47th Larval Fish Conference, which I am organizing. This conference will occur during May 12-16, 2024, at Sawmill Creek Resort (<https://www.sawmillcreekresort.com/>), which is in Huron, OH on the south shore of Lake Erie. The meeting will be held in a true resort setting with access to all sorts of nearby entertainment on the resort proper (e.g., kayaking, birding, beaches, restaurants) and nearby (e.g., Cedar Point Amusement Park, Lake Erie island nightlife, charter boat fishing, minor and professional baseball). There will be a larval fish workshop, focusing on Great Lakes fishes, as well as a lot of fun excursions and social events planned. And, of course, I expect a lot of outstanding

freshwater and marine science to be presented. I hope to have a website up soon with details about the meeting. Please do consider attending!

I wish you a wonderful rest of your summer and hope you can manage to stay cool in these record-breaking temperatures. Please reach out if you have any thoughts on how to improve the ELHS section and be on the lookout for more information about the 47th Larval Fish Conference next May.

Sincerely,

Stu Ludsin

ludsin.1@osu.edu



46th Larval Fish Conference



46th Larval Fish Conference in Lisbon Portugal

Ana Faria and Susana Garrido

The 46th Annual Larval Fish Conference was held May 7-11, 2023, in Lisbon, Portugal. In the heart of Lisbon, the Calouste Gulbekian Foundation offered the most stunning venue, where participants could walk, relax and enjoy one of the most emblematic modern gardens of Portugal. The Foundation offered the beautiful auditorium, and support of their Public Relations and Audiovisual teams. Other sponsors generously contributed to the success of this conference, namely: Oceanário de Lisboa, who sponsored visits to the Aquarium, and the social dinner venue; Loligo Systems and Pyro Science, who generously contributed to students travel awards; PICES, who kindly offered the name badges made of cork (contributing to a more environmental-friendly conference, almost free of plastic!); and ScienceCom, who did such a great job with the conference logo, website and communication material. Finally, the conference had the institutional support of IPMA and ISPA, the host institutions of the local organizers, Susana Garrido and Ana Faria, respectively. The conference attracted 90 participants, from 23 countries, from the 5 continents, with a nearly gender-balanced group (57% females, 43% males). Of these, approximately 30% were students! In total, there were 84 presentations at the conference: 6 plenary talks, 52 contributed talks, and 26 posters, which were discussed thoroughly during an evening poster-viewing

session. Networking events included a welcome reception on Sunday, with a cocktail and a special concert of Classical Guitar, played by a young and very talented musician; a workshop on Fish Larval Identification, on Monday; an event organized by the Early Career committee of the Early Life History Section, on Scientific communication to a general audience, on Tuesday, followed by the poster session; a visit to the beautiful Oceanário de Lisboa, on Wednesday, and dinner at Oceanário as well. Additionally, every early morning, the organizers offered participants the opportunity to relax with yoga classes, with view to the gardens. The conference venue was staged with photographs of fish early life stages, an exhibition organized by colleagues from the Centre for Functional Ecology (CFE) of the University of Coimbra. This exhibition was associated with a photo contest – the participant who identified most of the photos, was awarded the Best Fish Larval Taxonomist 2023. During the social dinner, at Oceanário de Lisboa, several events took place, starting with a surprise organized by Susana Garrido and Ana Faria to homage four senior researchers: Catriona Clemmesen, Chris Chambers, Jeff Leis and Lee Fuiman, who have given so much to the Early Life History Section, and inspired younger generations. During the dinner, there was time to announce winners of the raffles (several items, from books, to tote bags, local souvenirs, were displayed during the conference), and the best students' presentations. Finally, this social moment could not be completed without the Flag Auction. What an amazing LFC ☺



Fig. 1: Impressions from the LFC 46 in Lisbon, Portugal.

Student travel grants and awards for best oral and poster presentations at LFC46

Hannah Murphy *ELHS Secretary*

LFC46 proved to be another fantastic Larval Fish Conference! Since 2014, the American Fisheries Society Early Life History Section (AFS-ELHS) has awarded student travel grants through the Grace Klein-MacPhee Student Travel Award program. At LFC46, sponsorships from Loligo Systems and PyroScience in addition to the Grace Klein-MacPhee Student Travel Award allowed AFS-ELHS to award generous student travel grants to applicants. We awarded 14 student travel grants (Fig. 2; two students were unable to attend), which was an increase in number compared to LFC45 and similar to pre-COVID-19 LFCs. Student Travel Grant awardees presented either an oral or a poster presentation on a wide range of research topics including larval development, variation in size-at-hatch, larval diet and prey selectivity, recruitment dynamics, aquaculture, and ocean acidification. Awarding student travel grants is a high priority for AFS-ELHS as we value the importance of researchers at all career stages attending and networking at the Larval Fish Conferences. As one student travel awardee wrote “I really appreciated the opportunity to present my research, meet other students and PIs, and hear the exciting research shared in this lovely community”. Congratulations to all the winners of this year’s Stu-

dent Travel Awards and we look forward to seeing you all next year in Ohio!

The Sally Leonard Richardson best Student Oral Presentation Award is presented by AFS-ELHS to commemorate the life and work of Sally Richardson. At the LFC46, the Sally Richardson best Student Oral Presentation was awarded to Erica Mason (Fig. 3a) for her talk entitled, “A Fish Tale As Old As Time: Larval Abundance Is Related To Spawning Stock Size - Or Is It?”. Erica is a PhD candidate from the Scripps Institution of Oceanography, UC San Diego, and she presented on her PhD research using the long-running California Cooperative Fisheries Investigations (CalCOFI) dataset to investigate relationships between larval abundance and spawning stock size and recruitment. Congratulations on your award Erica!

The John H.S. Blaxter Best Student Poster Award is presented by AFS-ELHS to commemorate the life and work of John H.S. Blaxter. At LFC46, Diogo Dias was awarded the John H.S. Blaxter Award for his poster entitled, “Using morphology and molecular techniques to describe fish larvae communities in west-African insular mangroves”. Diogo is a student at the Marine and Environmental Sciences Centre, Faculdade de Ciências da Universidade de Lisboa, and presented his research on using morphology and molecular techniques to identify the larval assemblages in two mangroves of São Tomé Island. Congratulations on your award Diogo!



Milene Guerreiro
University of Coimbra



Michaela Kolker-Ghatan
The Inter-University Institute for
Marine Sciences in Eilat



Shalanka Ranjula
University of Sri Lanka



Sarra Nasraoui
Université du Québec à
Rimouski



Neele Schmidt
Uppsala University



Luis Avila
Université du Québec à Rimouski



Sally Ehlers
Drexel University



Etienne Germain
Université du Québec à
Rimouski

Fig. 2: The winners of the 2023 Grace Klein-MacPhee Travel Award.



Fig. 3: (A) Erica Mason received the Sally Richardson Award for the best Student Oral Presentation (presented by Tony Miskiewicz). (B) Diogo Dias received the John H. S. Blaxter Award for the best Student Poster (presented by Lee Fuiman).

NEWS FROM THE REGIONS

PACIFIC RIM REGION AKINORI TAKASUKA

Outcome from a 9-month sabbatical stay at the University of Tokyo

Dominique Robert¹ and Akinori Takasuka²

¹Institut des Sciences de la Mer, Université du Québec à Rimouski, Rimouski, Quebec, Canada

²Graduate School of Agricultural and Life Sciences, The University of Tokyo

ELHS President-elect Dominique Robert spent the last 9 months on sabbatical leave as a Visiting Professor in the laboratory of Akinori Takasuka, at the Department of Aquatic Bioscience, Graduate School of Agricultural and Life Sciences, the University of Tokyo. It was a great opportunity for Dominique to initiate new collaborations within the Pacific Rim region!

Over the period of Dominique’s stay, we co-supervised two students working on the spatial and temporal variability of the relationship linking growth and feeding and on the strength of growth autocorrelation of small pelagic fish larvae (Japanese sardine *Sardinops melanostictus*, Japanese anchovy *Engraulis japonicus*, and Pacific round herring *Etrumeus micropus*) in several systems of the Pacific coast of Japan. These small pelagic fish species constitute excellent models to explore the different components of the “growth–survival” paradigm (GSP), which predicts higher survival rate in faster-growing individuals. A first student-led article has been published, in which we report, for the three species, that initial growth determines to a large extent growth rates achieved later in life (Tanaka et al., 2023, *Fisheries Oceanography*, 32: 245–254). A decrease in growth autocorrelation at older ages in sardine relative to anchovy and round herring was also revealed. This interspecific difference could be attributed to differences in sensitivity to variability of environmental factors such

as water temperature and food availability. A second manuscript on the link between growth and feeding success is currently being written and is expected to be submitted soon.



Fig. 4: Group photo of the Fisheries Biology laboratory with the Visiting Professor, Dominique Robert, taken on campus.

Dominique also took advantage of his sabbatical to complete with Akinori and several other colleagues a manuscript initiated during a symposium and workshop on the growth–survival paradigm in early life stages of fish, which was held in Yokohama in 2015. The manuscript explores the substantial proportion of studies on the GSP which reported unexpected results, such as an absence of link between larval growth and survival, or evidence for a negative relationship between these two rates. Through a modelling exercise, the conditions leading to selection against fast-growing individuals were revealed, in an attempt to revise the GSP. This manuscript is currently in review, so stay tuned!

Finally, with the objective of developing formal long-term research collaborations between the University of Quebec at Rimouski (UQAR) and the University of Tokyo, we welcomed the Director of UQAR’s Institute of marine science to discuss the potential for joint research projects and co-supervision of graduate students between the two universities. So overall, that was a very productive sabbatical leave and Dominique will return to the Northeast region with renewed energy!

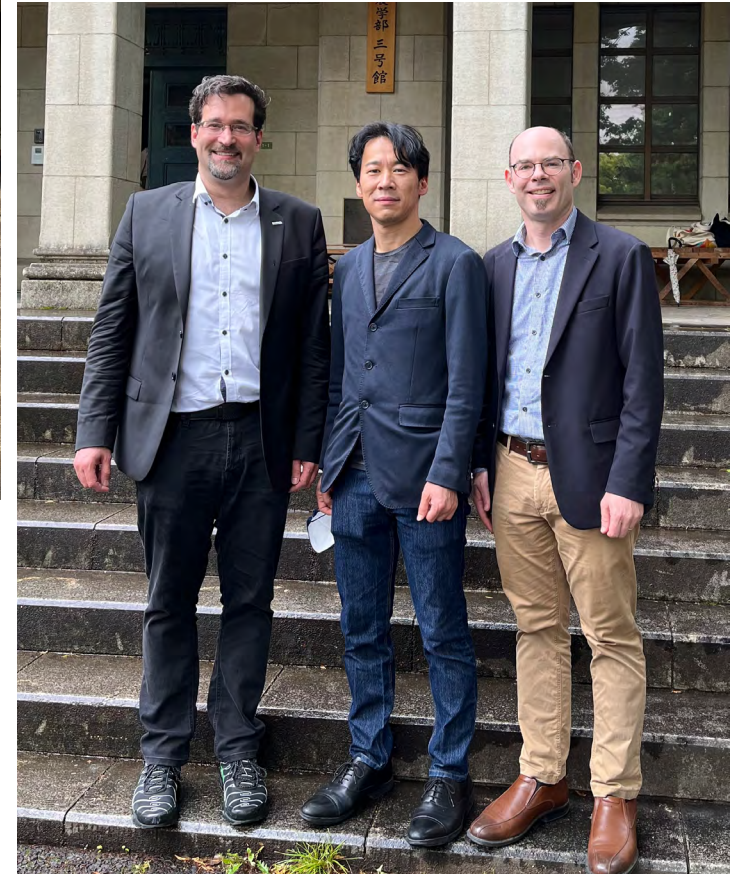


Fig. 5: The Director of UQAR’s Institute of Marine Science, Dr. Guillaume St-Onge (left), visited the campus with Akinori Takasuka (center) and Dominique Robert (right) to discuss collaborations.

EUROPEAN REGION CATRIONA CLEMMESSEN

Life-history and reproductive traits change within spawning time

Jonas Mueller and Florian Berg

Spawning time is crucial for successful recruitment of offspring. Within Atlantic herring (*Clupea harengus*) spawning is observed throughout the year, but individual populations show association with specific periods, e.g. spring vs. autumn spawning. Furthermore, Atlantic herring has a complex population structure and displays a variety of reproductive strategies. Differences in reproductive strategies among herring populations are linked to their time of spawning, as well as to their reproductive investment which can be an indicator for migratory vs. stationary behavior. These differences are reflected in the number of oocytes (fecundity) and the size of the oocytes prior spawning (Fig. 6). Here, we investigated the spawning dynamics as well as life-history and reproduc-

tive traits throughout the spring spawning season from February – April of herring on a coastal spawning ground along the west coast of Norway. We conducted three fertilization experiments and showed that fertilization success was more variable and slightly lower towards the end of the spawning season (April) than at the beginning (February) (Fig. 7A). Furthermore, the increase in size from unfertilized to fertilized eggs decreased with progression of the spawning season (Fig. 7B). Egg dry weight and larval length were positively related, and larvae hatching from the experiment in February were on average longer compared to those from April. These results are independent of the parental fish, which showed no difference in length or condition.

Furthermore, we investigated the oocyte diameter of females as indicator of reproductive investment over the spawning season in combination with life-history traits and genetic spawning time assignment. The aim was to study poten-

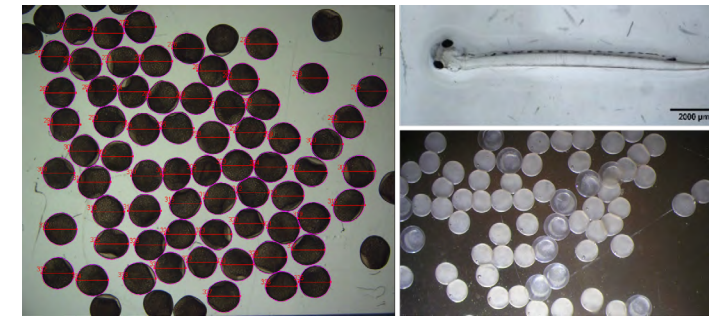


Fig 6. *Clupea harengus* oocytes and an early larval stage.

tial mixing of herring with different reproductive strategies during the spring spawning season on this coastal spawning ground. Our results indicate that mixing between ripe spring and autumn spawners occurs on the spawning ground during spring, with ripe autumn spawners being generally smaller but having larger oocytes than spring spawners (Fig. 8A-C). Within spring spawners, we found large variability in reproductive traits and a multivariate cluster analysis only including spring spawners indicated two groups with different reproductive investment. Smaller fish with smaller hydrated oocytes were separated from fish with larger oocytes, which tended to be larger but had lower body condition. Comparisons with other herring populations along the Norwegian coastline suggest that the high variability can be explained by the co-occurrence of groups with different reproductive investments potentially resulting from stationary or migratory behavior.

The complexity observed in the present study is representative for many locations along the Norwegian coast where herring with different reproductive strategies as well as mi-

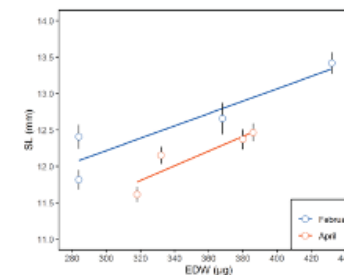
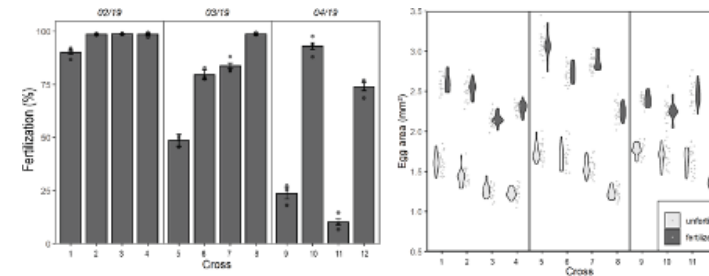


Fig. 7: (A) Fertilization rates and (B) egg size (both fertilized and unfertilized) for individual crossings conducted during three experiments in February (1-4), March (5-8) and April (9-12) 2019. (C) Larval standard length (SL) as a function of the egg dry weight (EDW) 14 days post hatching for February and April. Values present mean \pm standard deviation

gration behaviors are thought to co-occur during spawning. The diversity of reproductive strategies uncovered herein reflects a valuable resource. In conclusion, our study has revealed co-occurrence of herring with different reproductive strategies on a coastal spawning ground in western Norway. Future studies employing an extensive set of genetic markers or utilizing whole genome sequencing techniques should address the potential for population differentiation in the herein identified groups in more detail.

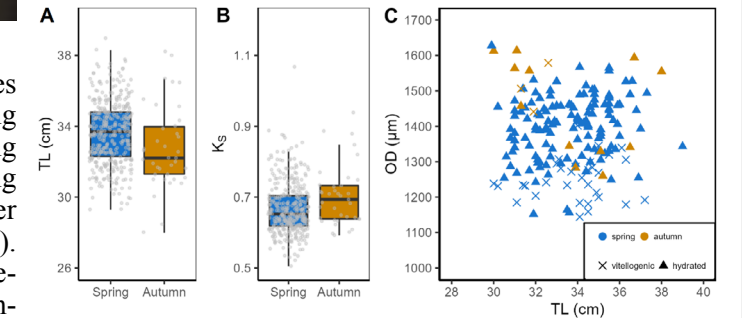


Fig 8. (A) Total length (TL) and (B) somatic condition factor (KS) in relation to genetic assignment, and (C) oocyte diameter (OD) in relation to TL. Genetic spawning season (based on the analysis of 11 spawning time associated single nucleotide polymorphisms) as well as oocyte stage are represented in different color and symbols, respectively.

Reference

Mueller, J., dos Santos Schmidt, T. C., Seljestad, G., Gröger, J., Clemmesen, C., and Berg, F. 2023. Analysis of reproductive traits reveals complex population dynamics on a small geographical scale in Atlantic herring. *Frontiers in Marine Science*, 10: 978694. Doi: 10.3389/fmars.2023.978694

Ichthyoplankton Taxonomy Workshop in Ischia, Italy

Lorenzo Ciannelli, Peter Konstantinidis and Nalani Schnell

The Stazione Zoologica of Naples (SZN) Anton Dohrn has a century-old history on the study of fish eggs, larvae, and juvenile taxonomy from the Mediterranean Sea. The monographies of Salvatore Lo Bianco (Lo Bianco et al. 1956) on fish eggs and larvae of the Bay of Naples are uniquely detailed descriptions of fish early life stages (Fig. 9). In 1962 Elbert H. Ahlstrom wrote: “*The Italians have given us the best regional monograph available on the eggs, larvae, and juvenile of teleost fishes*”. In the same article however, Ahlstrom added: “*Do not rush to the Stazione Zoologica di Napoli to study egg and larval development. Their interest in this field is now historical, as I learned on a visit in 1959*” (Ahlstrom 1962). This decrease in the study of fish early life stages during the second part of the 1900 at the SZN is a pity considering not only the century old tradition, but also the relevance and interest that there is in understanding the connectivity and distribution of fish during early life stages in this region. The Mediterranean has additional challenges due to the high endemism and the increasing success of Lessepsian migrants to establish vital populations that dilute the local fauna. In recent years, due to the lack of specialized training, personnel trained in the identification of larval fishes have become scarce, in this region and worldwide.

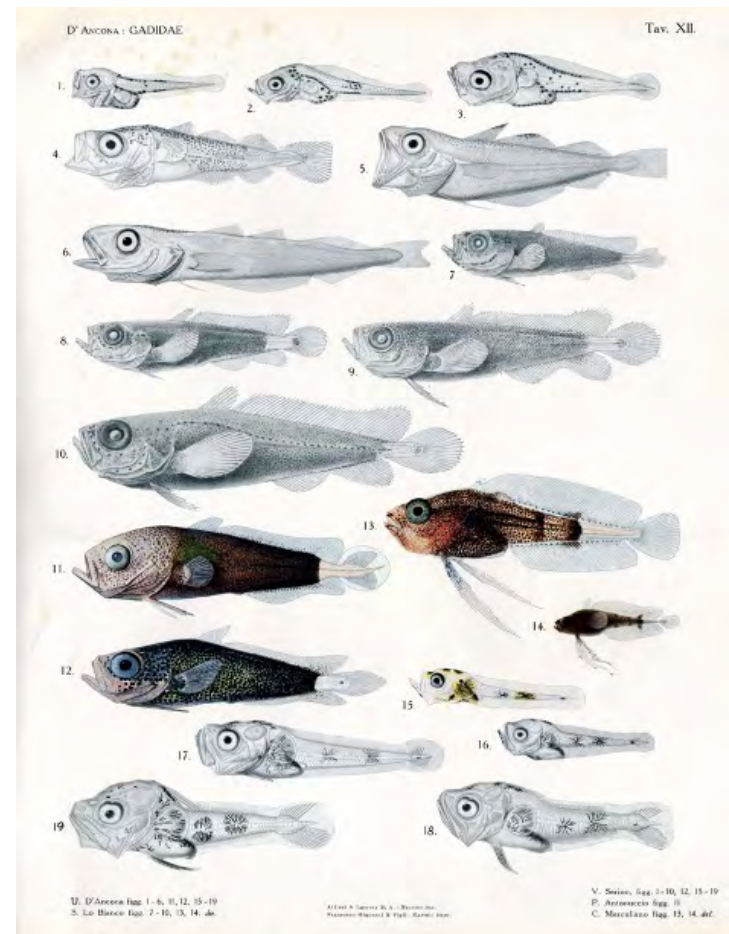


Fig. 9: Twelve different gadiforms from Lo Bianco's Monography on fish early life stages.



Figs. 10 and 11: Castello Aragonese (in the distance) on the Island of Ischia, Naples, Italy.

Recognizing the historical and ecological importance of the identification of the early life stages of fishes, the SZN conducted an Ichthyoplankton Taxonomy Workshop, from March 27th to the 31st, on the Island of Ischia (Fig. 10, 11), in the Bay of Naples. Twenty students participated in the workshop (Fig. 12), from several research and academic institutions in Italy, Spain and the Netherlands. The program included lectures in the morning, and lab practices in the afternoon. The lectures were given in the seminar room of the Biblioteca Antoniana (Fig. 13), thanks to the support of the Municipality of Ischia. The practical lab sessions were con-



Fig. 12: Workshop attendees



Figs. 13 and 14: Attendees in the Lecture Hall of the Biblioteca Antoniana, and at the MEDAS, SZN, during lab.

ducted at the nearby Marine Ecological Data Analyses and Synthesis (MEDAS) center (Fig. 14). Students practiced fish egg and larval identifications on samples collected in various regions of the Mediterranean, including the Gulf of Naples, Strait of Sicily and the Balearic Islands.

The instructors of the workshop were Dr. Peter Konstantinidis from the Oregon State University and Dr. Nalani Schnell from the Museum of Natural History, in France. Dr. Lorenzo Ciannelli (SZN and Oregon State University) gave lectures on fish larval ecology. The organization of the workshop was conducted by Dr. Lorenzo Ciannelli, Dr. Alice Mirasole, Dr. Antonia Chiarore, Dr. Rosanna Guglielmo, and Mr. Antonio Cannavacciuolo, all from the SZN. The program included basic principles for the taxonomic identifications of fish eggs and larvae, and covered detailed examples of the major taxa in the Mediterranean. The workshop attendees also engaged in several social activities including two social dinners, a visit to the Darwin-Dohrn museum from the Dohrn Foundation in Naples (<https://fondazioneDohrn.it/home/dadom/>) and a guided tour of the [Sala Affreschi](https://cosedina-poli.com/itinerari/magnifici-affreschi-dell-acquario/#) (Frescoes Room, <https://cosedina-poli.com/itinerari/magnifici-affreschi-dell-acquario/#>) in the main building of the SZN in Naples, where participants saw the original Lo Bianco Monographies on fish eggs and larvae (Fig. 9) from the Gulf of Naples, currently available at

the SZN. The visit to the newly opened Darwin-Dohrn museum was guided by the Director of the SZN Foundation, Dr. Ferdinando Boero (Fig. 15). During the visit students learned about the history of the Stazione Zoologica, which is one of the oldest marine research institutions ever built and operated. During the afternoon visit workshop participants had an opportunity to see and consult the originals of the Lo Bianco Monographies on fish early life stages. The drawings of the Monographies are exceptionally detailed (Fig. 9). The life history tables include information about the ecology and morphology of the species early life stages. These monographies currently are still a key textbook for the taxonomic identification.



Figs. 15: Visit of the Darwin-Dohrn Museum in Naples. Dr. Ferdinando Boero explaining an art piece from Ray Troll.

In sum, the workshop was a great success. Participants had the opportunity to learn and practice the important skill of taxonomic identification of fish early life stages.

The island of Ischia, with its beautiful shorelines, artisanal fishing traditions, attractive architecture, warm climate, proximity to the ocean, and excellent food, was the perfect stage for the workshop. The organizers were very excited and hope to continue fostering activities at the SZN that promotes the study and research of fish early life stages. We invite colleagues to the SZN to study fish eggs and larval development!

References

Ahlstrom E (1962) Fauna e Flora del Golfo di Napoli. Monografia 38: Uova, Larve e Stadi Giovanili di Teleostei. Monografia elaborata con l'uso del materiale raccolto e seriato da Salvatore Lo Bianco by Umberto D'Ancona, Luigi Sanzo, Antonio Sparta, Fausta Bertolini, Giuseppe Montalenti, Emanuele Padoa, Silvio Ranzi, Enrico Tortonese, Maffeo Vialli. Copeia 1962:858–860.

Lo Bianco S, Bertolini F, D'Ancona U, Montalenti G, Padoa E, Ranzi S, Sanzo L, Sparta A, Tortonese E, Vialli M (1956) Uova e stadi giovanili di Teleostei. Fauna e Flora del Golfo di Napoli, Monografie. Stazione Zoologica di Napoli, Naples, Italy.

**SOUTHERN REGION
TRIKA GERARD**

Larval growth and trophodynamics of postflexion Atlantic bluefin tuna (*Thunnus thynnus*) from two discrete spawning grounds

Otolith-derived datasets inform fisheries stock assessments and are used to back-calculate spawning sites and times, estimate survival and recruitment, as well as examine spatiotemporal dynamics. Otolith biometrics can improve the understanding of biotic and abiotic drivers that play a key role in the development of credible predictive recruitment models for Atlantic bluefin tuna (ABT) that contribute to stock assessment models. A new study generated protocols for larval tuna ageing, created companion growth curves for the 2014 ABT spawning season in the Gulf of Mexico (GoM) and Mediterranean Sea (MED) by ageing otoliths from larvae collected from the two main spawning grounds (Fig. 16). This

study identified significant population differences between the two regions, with differential growth strategies. Larvae from the GoM grew faster when compared to the MED (0.41 vs. 0.26 mm SL d⁻¹) and faster-growing larvae from the GoM had higher trophic position, δ¹⁵N, and δ¹³C values. Although prey-field biomasses are an important element of the ABT environment, the quality of the prey field was a more important driver of larval growth and should be incorporated in subsequent larval modeling efforts. Combining otolith biometrics with stable isotope signatures captures habitat qualities for fast-growing larvae and can play a key-role in ongoing management efforts of this important fishery resource.

For more information, contact Estrella Malca at emalca@miami.edu

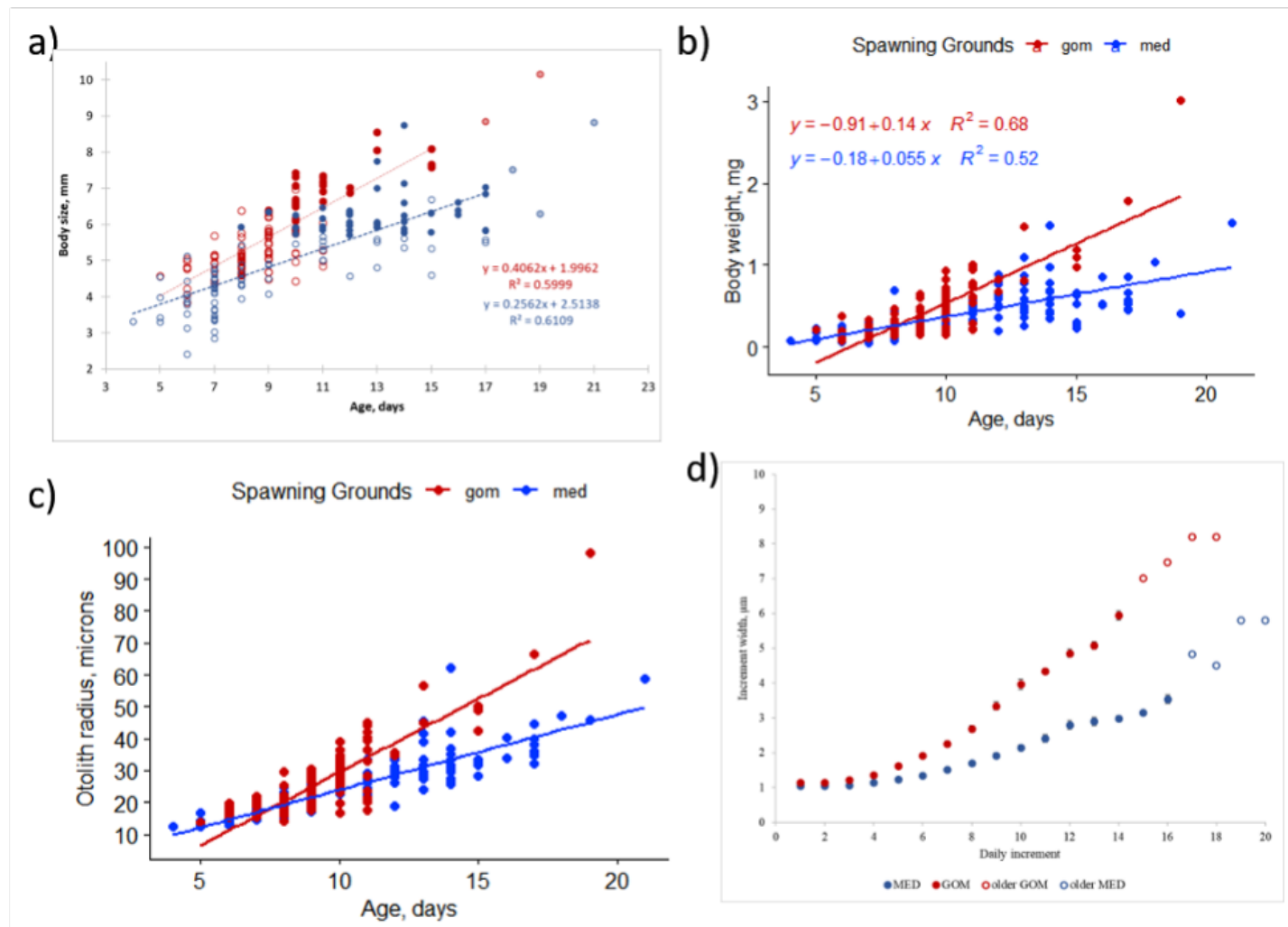


Fig. 16: Age at length and (A) body weight (B) and otolith radius, µm (C) for 228 larval bluefin tuna (*Thunnus thynnus*) aged from the Mediterranean Sea (MED) and Gulf of Mexico (GoM) during the 2014 spawning season. Developmental stages (preflexion and postflexion) are indicated in panel (A) with an open symbol (blue and red, respectively). (D) Mean daily increment size at-age for the corresponding larvae, with standard error bars. Open symbols indicate less than three observations at each given age.

**NORTHCENTRAL REGION
ED ROSEMAN**

NOAA Great Lakes Environmental Research Laboratory

Ed Rutherford (NOAA)

Maddie Tomczak (University of Michigan Cooperative Institute for Great Lakes Research)

Thermal Bar Project: coauthors Yifan Zhang, Sara Adlerstein Gonzalez, David Wells (University of Michigan); Joann Cavaletto, Paul Glyshaw, Henry Vanderploeg, Doran Mason (NOAA GLERL)

*presented at the larval fish conference in Portugal as a poster

*plan to present updated presentation at the National American Fisheries Society

Thermal bars form in spring in nearshore waters of deep temperate lakes, and may structure horizontal distributions of temperature, nutrients, phytoplankton, zooplankton and larval fishes. Despite this, little is known of the effects of the thermal bar on distribution, density and growth of fish larvae, their spatial overlap with preferred temperatures and prey, and ultimately recruitment. In spring of 2015, 2018 and 2019, we sampled the environmental conditions and biota (including larval fishes) inshore, offshore, and at the thermal bar from April to June. We used Niskin bottles to collect water for nutrient analysis and chlorophyll a, and nets to estimate zooplankton and fish larval densities. We tow-yo'd a laser optical plankton counter and MOCNESS to get continuous measures of temperature, light, chlorophyll, zooplankton and larval fish densities around the thermal bar. In 2015 and 2019, chlorophyll a and zooplankton biomass were significantly higher inshore than offshore of the thermal bar. Zooplankton biomass, nutrients and chlorophyll were retained inshore of the thermal bar in all years. In 2018 and 2019, larval fish densities peaked in mid-May, with deepwater sculpin *Myoxocephalus thompsonii*, burbot *Lota lota*, and yellow perch *Perca flavescens* dominating the catch. Highest densities of deepwater sculpin were found offshore of the thermal bar, whereas high burbot and yellow perch densities were found inshore and close to the thermal bar. Continued work will investigate how retention of zooplankton by the thermal bar may influence larval fish growth.

Larval Alewife Tracking Project and Field Work:

A major bottleneck to larval survival and potential recruitment in the Great Lakes is the effect of temperature and wind-generated lake currents on spatial distributions and survival of larvae and their zooplankton prey. For Alewife, a key prey fish of salmonine fishes in Lake Michigan and Lake Ontario, warm spring-summer temperatures and low salmon predation are known to influence recruitment (Madenjian et al. 2005), but specific mechanisms are poorly known. Upwelling events are known to displace larvae from warmer, more productive nearshore environments to colder, less productive offshore environments (Heufelder et al 1982, Höök et al 2006), potentially leading to high mortality, but their ultimate fate is un-

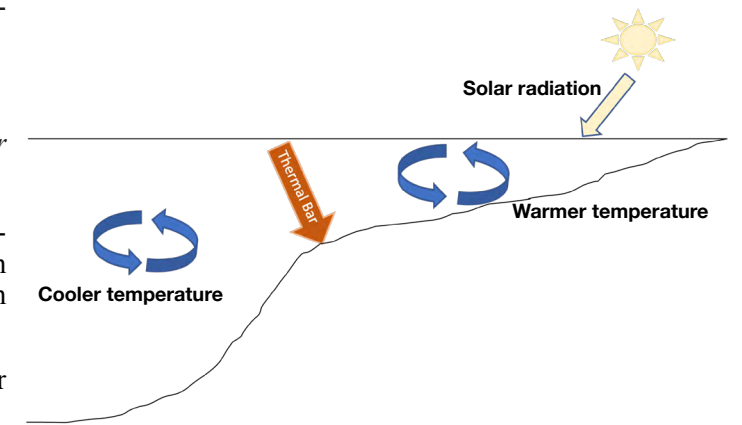


Fig. 17: Thermal bars formation diagram in the spring. Figure inspired by Tsydenov, B. O. (2019). A numerical study of the thermal bar in shallow water during the autumn cooling. Journal of Great Lakes Research, 45(4), 715-725.

known. Few studies have tracked larvae or their zooplankton prey from nearshore to offshore environments to assess their fate. We hypothesize that smaller fish larvae hatched early in June in nearshore waters will be more vulnerable to advection by strong, coastal jet currents and experience higher mortality than those larvae hatched later in July after the lake thermally stratifies, and when prevailing currents are weaker and tend to cycle from nearshore to offshore. In 2023-2024, we will use hydrodynamic model outputs of lake currents and temperature to conduct back trajectory simulations of larval fish and zooplankton collected during prior years of strong, weak and intermediate year class strength in Lake Michigan. We will compare distributions, growth and survival for different cohorts of alewife larvae – those hatched early in the season, and those hatched later. In particular, we will focus on the role that lake currents, temperature, and upwelling events may have played in affecting distributions (Fig. 17), growth and survival of larvae that we and others have sampled in southeast Lake Michigan. In summer 2023, we will use nets, drifters, eDNA/RNA, remote sensing, fisheries acoustics, and a larval advection model (Rowe et al. 2022) to track newly hatched and older alewife larvae, their zooplankton prey and predators in southeast Lake Michigan to investigate the potential influence of wind-generated currents and upwellings on larval alewife distributions, growth and survival.

LARVAL FISH COLLECTION OF THE ISSUE

Museum of Comparative Zoology Larval Fish Archive

¹ Andrew D. Williston

Curatorial Associate, MCZ (awilliston@oeb.harvard.edu)

² Karsten E. Hartel

Harvard OEB Associate, Ichthyology Collection MCZ

The Museum of Comparative Zoology (MCZ) Ichthyology Collection dates from the early 1860s and holds over 176,000 cataloged lots with roughly 1.6 million individual specimens. The collection was initially built around adult fishes, but today larval specimens hold an important place in the collection. There are approximately 34,000 larval and early juvenile lots, totaling 206,228 individual specimens from 281 different families. The strengths of the larval holdings are midwater and pelagic larvae (Figs. 18 - 20, as most of the larval collection came to MCZ in the transfer of the Woods Hole Oceanographic Institution (WHOI) fish collection to the MCZ in late 1978. While the adult fishes from WHOI were well sorted and recognized, it was a year after the collection's transfer that visits from Dave Johnson and John Olney set the larval collection into use. Four years later many of the MCZ's larval collection specimens, some not yet cataloged at

MCZ, would be used in the landmark Ahlstrom Symposium and would be cited and illustrated for the resulting 1984 "Ontogeny and Systematics of Fishes".



Fig. 19: MCZ:Ich: 76771 *Neobythites marginatus* (38 mm). Image is copyright President and Fellows of Harvard University.

While the collection was gaining interest in the early 1980s, substantial parts of the collections were challenging larvae and small juveniles of epipelagic and mesopelagic species. Large parts of the collection were sorted by Woods Hole Oceanographer James E. Craddock. With support from the National Science Foundation (NSF grants BSR85-01268 and 86-17845 to Curator Karel F. Liem) Sally L. Richardson and then David G. Smith were hired at MCZ to continue to sort and identify specimens and truly establish the larval specimens as an active larval archive. Under the guidance of Karsten Hartel, larval records from this period are completely databased and the collection is available and fully searchable online: mczbase.mcz.harvard.edu.



Fig. 18: MCZ:Ich:61454 *Mola mola* (6.4 mmTL). Image is copyright President and Fellows of Harvard University.

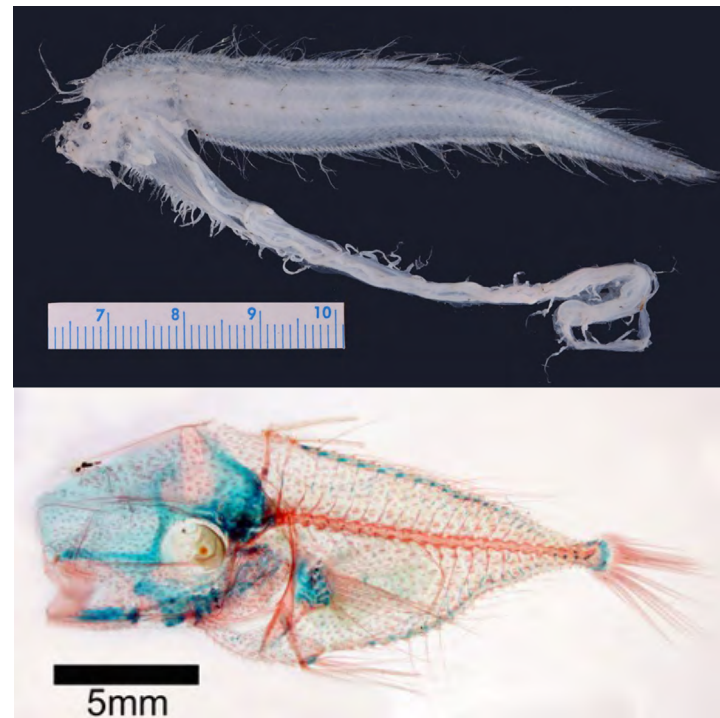


Fig. 20: (Upper image) MCZ:Ich:165928 *Lamprogrammus shcherbachevi* (110 mm); (Lower image) MCZ:Ich:60721, cleared and stained *Luvarus imperialis* (19.2 mm). Images are copyright President and Fellows of Harvard University.

While the bulk of the archive from Woods Hole Oceanographic Institution and largely represents Atlantic mid-water larvae, there are additional significant regionalized contributions from the Gulf of Maine (Hugh DeWitt, University of Maine Orono), the Bahamas (P. Major), the Coral and

Solomon seas as well as worldwide blue water SCUBA collections (G.R. Harbison, WHOI), and Mid-Atlantic Bight voucher specimens (Michael P. Fahay, NOAA) all give the collection breadth. There is some remaining work to be done. While most of the collection is sorted and databased, there are large holdings of Myctophidae (Fig. 21), Gobiidae, and Leptocephali that wait for additional specialist examination.

The larval fish archive still has hopes to grow in the future and will consider contributions of specimens, especially those relating to unique projects. The museum staff of today is thankful for the endless hours spent collecting, sorting, and curating, and the collections that are available for study.

The collection is open to visitors and will also make loans to other qualified institutions.

References:

Moser, H.G., 1984. Ontogeny and systematics of fishes. *Amer. Soc. Ichthyol. Herpetol. Spec. Pub.*, 760.



Fig. 21: Partially sorted and vialled, uncatalogued lots of Myctophidae spp. Image is copyright President and Fellows of Harvard University.

LARVA(E) OF THE ISSUE

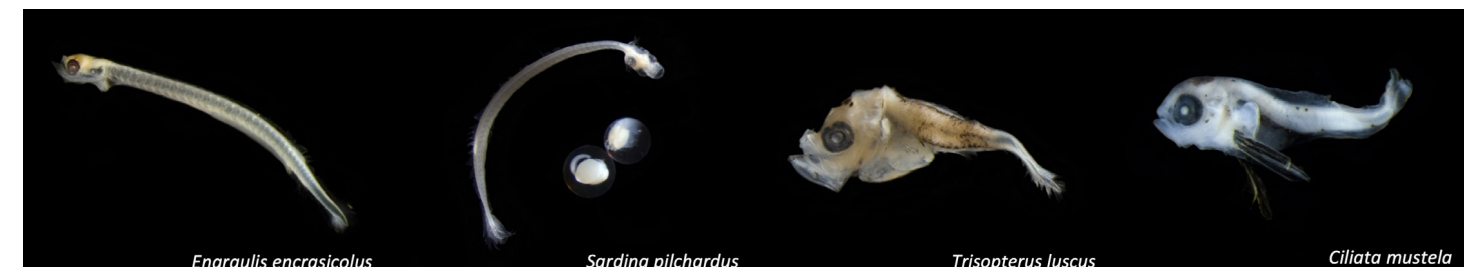
Photographic exhibition: "Planktonic life-stages of fish from the Portuguese coast"

My name is Milene A. Guerreiro, and I am a PhD student at the Centre for Functional Ecology – Science for People & the Planet and Department of Life Sciences of the University of Coimbra, in Portugal. I am one of the authors of the photographic exhibition "Planktonic life-stages of fish from the Portuguese coast", together with my supervisors Ana Lúcia Primo, Filipe Martinho and Miguel Pardal. Since my Master's degree, I have been studying the larval fish communities of the Portuguese coast. It was at that time, in 2019, that the idea of this photographic exhibition was born, which aims to show the most sensitive stage of the fish life cycle and to educate about the transformations that some fish species undergo before they reach the adult stage. This exhibition comprises a collection of 22 photographs of fish larvae found in the Portuguese coast. Some of the species are well-known and have a high commercial value, while others, despite their low commercial value, play a fundamental role in coastal ecosystems.

The first presentation of the exhibition took place at the municipal fish market in Coimbra, where visitors and customers

were encouraged to find the corresponding adult species using a dedicated label of each photo that contained a QR code linking to Fishbase. The exhibition was a success and has been displayed since then in diverse venues including universities, schools, and environmental interpretation centres. More recently, the photo collection was presented at the 46th Larval Fish Conference in Lisbon, but this time challenging participants to identify the species of fish larvae. For those of you curious on this topic, here are the photos of the exhibition and their respective identification. I hope you enjoy the exhibition!

In my laboratory, the Marine Research Lab at the Centre for Functional Ecology - Science for People & the Planet, we have been studying the ichthyoplankton communities of the Mondego estuary and the adjacent coastal zone (Northeast Atlantic) since 2003. Our research focuses on analysing the structure and composition of larval fish assemblages and understanding their relationship with environmental factors and climate change. You can find out more about our work at @marineresearchL (Twitter), @marineresearchlab (Facebook and Instagram). For any other questions, please contact me: milene.guerreiro@uc.pt.



RAMBLE ON

Ali Deary

Nalani and Peter suggested that I ramble on about my recent career change. Since 2017, I had been working with the Fisheries Oceanography Coordinated Investigations (FOCI) team at the National Oceanic and Atmospheric Administration's (NOAA) Alaska Fisheries Science Center as their Ichthyoplankton Team Lead. As of March 2023, I transitioned to a position still within the US Federal Government but with the US Fish and Wildlife Service as the Center Director of the [Abernathy Fish Technology Center](#).

It is still strange talking about the transition because working for NOAA had been my dream since my first year in college and if you had asked a younger version of me if I would leave NOAA after accomplishing the dream, I would have said "Never!"

So, what changed? I did. As the pandemic restrictions eased, I reflected on the past couple of years and the aspects of my

job that brought me the greatest satisfaction. What amazed me was I discovered that the aspects of my job related to science administration were now the most inspiring. The transition to my current position with the US Fish and Wildlife Service afforded me the opportunity to grow into a science administration role, stay connected with early life history research, and learn about new ecosystems, species, and a conservation agency. I departed a great team at NOAA and I have joined another amazing team of researchers at the US Fish and Wildlife Service. For the early career researchers in our Section, I would encourage you to never fear change or a pivot in your career. What you will learn by talking to us mid- and late-career members is that not many of us are doing the job we envisioned for ourselves in graduate school. I hope you enjoyed this issue of STAGES and I look forward to seeing you at the 2024 meeting!



Fig. 22: Fish larvae used in the fishquiz matching those with their adult congeners

Announcement

Dr Ed Roseman and Stacey Ireland (USGS Great Lakes Science Center, Ann Arbor, MI) will instruct Introduction to Sampling and Identification of Freshwater Fish Eggs and Larvae, a workshop held at Ohio State University's Stone Lab on South Bass Island in lake Erie July 30th, 2023. This workshop is intended to introduce participants to sampling and identification of freshwater fish early life history stages, with an emphasis on fishes of the Great Lakes and a special module about early life history of Bighead, Silver, Black, and Grass Carps. The workshop will include a discussion of sample processing protocols, larval fish morphological features useful for identification, and a procedure for using dichotomous keys to identify specimens. To register, please follow this [link](#).

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