STAGES

VOLUME 45 (3) December 2024

INSIDE THE ISSUE

ELHS Back in the Days

10 years ago: Grace Klein-McPhee passed away in September 2014

35 years ago: New record for newsletter: 56 pages! special 10 Year anniversary issue.

MESSAGE FROM THE PRESIDENT

Hi everyone!

As I am writing these lines, there is a snow forecast in Rimouski for the weekend. This is a reminder that 2025 is just around the corner, and good timing to reflect on the Section's activities over this past year.

The main highlight in a given ELHS year generally corresponds to the Larval Fish Conference, and this year was no exception! I would like to thank again outgoing President Stu Ludsin and Jenny Pfaff for hosting a well-organized meeting in Huron, OH. I was part of the so-called "Northern contingent", a group of 15 driving in convoy from the province of Quebec, Canada to the state of Ohio, USA, just like a catadromous juvenile American eel swimming upstream the St. Lawrence system from its maritime estuary over a distance of >1,500 km. The only difference is that unlike American eel, we made it past the Niagara Falls into Lake Erie. I can confirm that this long, demanding migration was definitely worth it! The meeting was really nice and well-balanced between excellent scientific talks and posters, networking time, and social activities. It was great to catch up with old friends and meet new ones. That's what makes the Larval Fish Conferences so special every time!

For those who have never attended the Larval Fish Conference, or have not participated in recent years, I consider you are missing out! The good news is that you will have the chance to join us in Québec City in June 2025. Check for the announcement and first call for abstracts on the next page of this issue!

In 2024, there has been changes within the Executive Committee and larger governance team of the Section. I cannot thank enough outgoing ExComm members Stu Ludsin (President), Hannah Murphy (Secretary) and Jeff Buckel (Treasurer) for investing much time and energy for the Section over the past years, and for being so available and helpful in facilitating the transition to new ExComm members. Thanks! I would also like to thank former STAGES editor Peter Konstantinidis for his key role in keeping the newsletter alive during the difficult period marked by the COVID pandemic, and former North Central regional representative Ed Roseman for serving the Section for so many years.

I would like to remind everyone that the Early Life History Section needs more engaged scientists that are willing to contribute their time for the benefit of our community. In autumn 2025, we will run an election for the next President-elect and Secretary-elect. Moreover, the ELHS Logo committee will soon start its work on updating our current logo to include the new AFS visuals. If you would like to get involved in that committee, within ExComm, or in any other capacity, please don't hesitate to contact me.

I will conclude my editorial by wishing you all Happy New Year! I hope you have a relaxing and fun holiday season and an excellent start to 2025.

Sincerely, Dominique Robert

ANNOUNCEMENT OF THE 48th LARVAL FISH CONFERENCE

First Call for Abstracts – 48th Annual Larval Fish Conference: June 15-19, 2025

Greetings from Québec City! The Convening Committee of the 48th Annual Larval Fish Conference invites you to save the date and submit an abstract!

The conveners of LFC48 are working hard to plan what will be a memorable edition of the Larval Fish Conference! We invite you to join us in beautiful Québec City, where freshwater and saltwater of the St. Lawrence system meet. Hosted at Hôtel Le Concorde (Fig. 1), located in the historical district of the city, the conference will be the perfect occasion to network with great colleagues and share your work through 7 diverse thematic sessions. Moreover, we are planning high-profile keynote talks and entertaining social activities.

LFC 48 at a glance:

- Venue: The 48th Larval Fish Conference will be held at the Hôtel Le Concorde, located near the center of downtown Québec City. It is the landmark hotel of the mythical Grande Allee Avenue, with the "Le Ciel! Bistro-Bar", a spinning restaurant perched on its top floor and offering a stunning, panoramic view of the city and St. Lawrence River. The hotel is located at walking distance from main tourist attractions including the Battlefield Park. This strategic location will give you the opportunity to sample the amazing restaurants, bars and terraces, which have made Québec City's gourmet reputation.

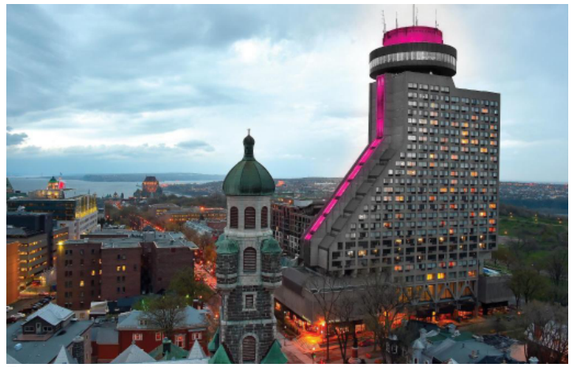


Fig. 1: Hôtel Le Concorde, venue of LFC48.

A program composed of 7 exciting topical sessions:

1- Moving north: effects of anthropogenic disturbances and global change on early life stages of native and non-native species

2- Laboratory experimentation to inform ecological and physiological processes in early life stages

3- Larval and Juvenile feeding, growth and survival: towards an improved conceptual framework of the Growth-Survival Paradigm

4- Early life-history traits in diadromous fishes: implications for biodiversity conservation in a changing climate

5- Feeding Connections: trophic interactions between zooplankton and larval fish in aquatic ecosystems

6- Exploring biodiversity through the taxonomy and morphology of larval fish

7- Contributed papers: Any other contribution of high quality not fitting the above-mentioned sessions will be considered here

Exciting social activities:

- Sunday June 15th, 5PM to 8PM: The Icebreaker cocktail will be served on a cruise! Get to Québec City early and don't miss the opportunity to board the M/V Louis Jolliet (Fig. 2) for a discovery of the St. Lawrence River, including a stunning view of the Old Québec City waterfront.

- Poster session and social on Tuesday June 17th.

Fig. 2: M/V Louis Jolliet

- Wednesday June 18th: LFC Banquet at "Le Parlementaire", the gorgeous restaurant of the National Assembly of Québec (Fig. 3)! The event will start at 5:30 with a reception in the Main Hall, which will give you the time to explore this historical building.

Fig. 3: "Le Parlementaire", restaurant of the National Assembly of Québec

We are looking forward to welcoming you in Québec City!

Dominique Robert, on behalf of the convening committee

ELBERT H. AHLSTROM LIFETIME ACHIEVEMENT AWARD

Call for nomination for the Elbert H. Ahlstrom Lifetime Achievement Award

The Ahlstrom selection committee is currently accepting nomination packages!

The purpose of the Ahlstrom Award is to recognize sustained scientific excellence through research, teaching, administration or a combination of the three involving the early life history of fishes. Please consider nominating a deserving colleague! Nomination packages can be submitted to President-elect Susana Garrido. Further information can be found here: https://earlylifehistory.fisheries.org/awards/ahlstrom/

EARLY CAREER COMMITTEE

The Early Career Committee update & perspectives from the LFC47 survey results

Kelsey Swieca, Kelia Axler, Emma Siegfried

The Early Career Committee (ECC) is an ad-hoc committee that aims to recruit and engage the next generation of larval fish researchers in the Early Life History Section (ELHS) of the American Fisheries Society (AFS). Every year the ECC typically plans and facilitates an Early Career Workshop in coordination with the AFS ELHS Executive Committee (ExComm) to increase engagement of early career scientists, share relevant professional skills, and provide networking and community-building opportunities not only at the annual Larval Fish Conference (LFC), but also at the Section level. The current ECC includes Kelsey Swieca (NOAA), Kelia Axler (NOAA), and Emma Siegfried (UConn). We always welcome more ECC members. Please email afs.elhs@gmail.com if you are interested in joining the ECC and haven't done so already.

Another responsibility of the ECC includes facilitating the post-conference survey. In 2024, 34 individuals participated in the survey and provided essential feedback on attendee demographics, interests, and experiences that will help the Section tailor future events to better meet our member's needs.

Demographics

Nearly 44% of the 2024 survey participants were first-time attendees of the LFC. A variety of career stages were also represented by this year's survey participants, with 38% working in the field for less than 5 years, 12% working in the field for 6-15 years, 12% working in the field for 16-24 years, and 24% working in the field for 25+ years. About 41% of the responders were faculty researchers or agency professionals, 3% were post-doc-

toral scholars, and roughly 47% were graduate students. Most participants traveled to LFC47 from Canada, followed by the USA. This year's survey indicated that the vast majority of responders identify as white (85%) and male (65%).

Membership & funding

Similar to previous years, the finances associated with AFS ELHS membership and conference attendance were at the forefront of survey results. Approximately 68% of survey participants were full members of AFS ELHS, 18% were affiliate members, and 15% were neither full nor affiliate members of the AFS ELHS. Nearly 70% of survey participants said that finances were the main obstacle to LFC47 attendance. Project budgets (50%) and external grants (44%) contributed to the funding of most conference attendees, but 27% of respondents supplemented their travel with personal funds. Notably, a quarter of graduate student survey participants responded that they used some amount of personal funds in order to attend LFC47. The ECC recommends that the Section consider additional opportunities to streamline and reduce the financial burden of membership, particularly for early career individuals. Some recommendations discussed within the ECC include sponsoring one year of Section membership for LFC student award recipients (talk and poster) and/or offering small membership grants similar to the Section's travel grants.

LFC47 conference

The 47th Larval Fish Conference took place from May 12-16th, 2024 in Huron, Ohio. Over 95% of survey respondents reported that they were satisfied or extremely satisfied with this year's meeting, the conference logistics, and the scientific quality of the talks and posters presented at this year's meeting. Multiple respondents commended LFC47 conference organizers and appreciated how well-organized, welcoming, and enjoyable the meeting was. Conference participants also greatly valued in-person interaction and networking opportunities, with >88% of survey responders indicating that a virtual attendance option would not have precluded their desire to attend LFC47 in-person. However, based on the survey results, if conference organizers pursue hybrid delivery in the future, they should consider offering entire days or sessions for virtual participation at a reduced cost. Survey participants were also asked what theme sessions would be of interest for next year's meeting, and the top responses were: recruitment variability, otoliths, aquaculture, trophic dynamics, larval physiology, and application of DNA barcoding for larval identification and ecology.

Fig. 4: Early Career Workshop at the LFC 47 entitled 'Tips to Avoid Scientific Burnout'.

Early Career Participation

For LFC47, the ECC planned and coordinated an Early Career Workshop entitled 'Tips to Avoid Scientific Burnout' (Fig. 4), which was an interactive panel discussion with experienced mentors who provided perspectives and recommendations for tackling this prevalent issue. A big thank you to ECC member Emma Siegfried (UConn) for facilitating this important discussion and to Chris Chambers (NOAA), Katey Marancik (NOAA), Dominique Robert (UQAR), Ali Deary (USFWS), John Majoris (Texas A&M), and Hannah Murphy (DFO) for graciously serving on the panel and sharing valuable insights and tips on how to navigate scientific careers while avoiding burnout. Nearly 68% of survey responders participated in the Early Career Workshop and the feedback was very positive overall. One participant appreciated that the panel discussion provided thoughtful insight into the varied experiences of professionals in the field ("It's important to be able to talk about the 'good, bad, and the ugly'"). Another found the discussion reassuring as an early career scientist and appreciated that this difficult subject could be discussed in order to normalize it. One recommended allotting more time for Early Career panel discussions in the future (on the order of 2-2.5 hours). This year the Early Career Workshop was purposely scheduled to not overlap the Annual Business Meeting and early career members were encouraged to participate in the ELHS Section's meeting in order to increase inclusivity, transparency, and institutional knowledge. This was a great improvement from previous years and ExComm should proactively take steps to ensure these two important events do not overlap at future conferences.

The ECC is now beginning to plan for the 48th Larval Fish Conference, which will be held in Québec City, Québec (Canada) on June 15-19th, 2025. In Québec, we hope to continue our commitment to early career development by hosting another professional skills workshop. Responses to this year's survey suggest that the next Early Career Workshop will be focused on 'paper reviewing skills and strategies', 'managing conflict, or 'how to give and receive constructive criticism'. Please reach out to afs.elhs@gmail.com if you or someone you know would be interested in sharing expertise and helping the ECC host an event on one of these important topics! As always, thank you so much for your dedication to the ELHS and check out our Facebook page (@earlylifehistory) and X account (@AFS_ELHS) for updates from our colleagues around the world.

NEWS FROM THE REGIONS

EUROPEAN REGION
CATRIONA CLEMMESEN

Climate challenges for fish larvae: Interactive multi-stressor effects impair acclimation potential of Atlantic herring larvae

Andrea Franke

Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB) and Alfred-Wegener-Institute, Helmholtz-Centre for Polar and Marine Research (AWI)

Fish early life stages are particularly vulnerable and heavily affected by changing environmental factors. The interactive effects of multiple climate change-related stressors on fish larvae remain, however, largely underexplored. As rising temperatures can increase the abundance and virulence of bacteria, we investigated the combination of a spring heat wave and bacterial exposure on the development of Atlantic herring larvae (*Clupea harengus*). The primary objective of this study was to determine whether multiple climate change-related stressors elicit an additive or even synergistic stress response in Atlantic herring larvae.

Eggs and larvae of Western Baltic Spring-spawners were reared until yolk-sac depletion at a normal and high temperature ramp and exposed to *Vibrio alginolyticus* and *V. anguillarum*, respectively (see Fig. 5). Subsequently, mRNA and miRNA transcriptomes, microbiota composition, growth, and survival were assessed.

Our study demonstrates high sensitivity in herring larvae to both increased temperature and *V. alginolyticus* infection, resulting in pronounced transcriptional downregulations (Table 1) likely reducing cell proliferation. The observed cellular stress response could facilitate acclimation by minimizing macromolecule damage as reflected in the enriched GO terms, which are almost exclusively involved in cell proliferation (e.g., 'DNA replication', 'chaperone-mediated protein folding',

Pairwise comparisons	# DE mRNAs	# DE miRNAs	# predicted target mRNAs
H.C vs N.C	4,826 (840/3986)	12	541 (817)
N.Val vs N.C	1,048 (148/900)	2	0
N.Van vs N.C	12 (10/2)	0	0
H.Val vs N.C	37 (5/32)	54	540 (816)
H.Van vs N.C	2,264 (507/1757)	6	336 (593)
H.Val vs H.C	2,922 (2425/497)	14	0
H.Van vs H.C	0	0	0
H.Val vs N.Val	1 (1/0)	15	266 (268)
H.Van vs N.Van	2,402(253/2149)	9	372 (392)

Table 1: Pairwise comparisons of treatments and their respective number of DE mRNAs (in brackets number of up- and downregulated genes) and miRNAs and the number of predicted unique target mRNAs, i.e., if different DE miRNAs had the same target mRNA, the repeating targets were not counted again (in brackets the total number of predicted target mRNAs). N.C = Normal temperature, no bacteria; H.C = High temperature, no bacteria; N.Val = Normal temperature, *V. alginolyticus*; H.Val, = High temperature, *V. alginolyticus*; N.Van = Normal temperature, *V. anguillarum*; H.Van = High temperature, *V. anguillarum*

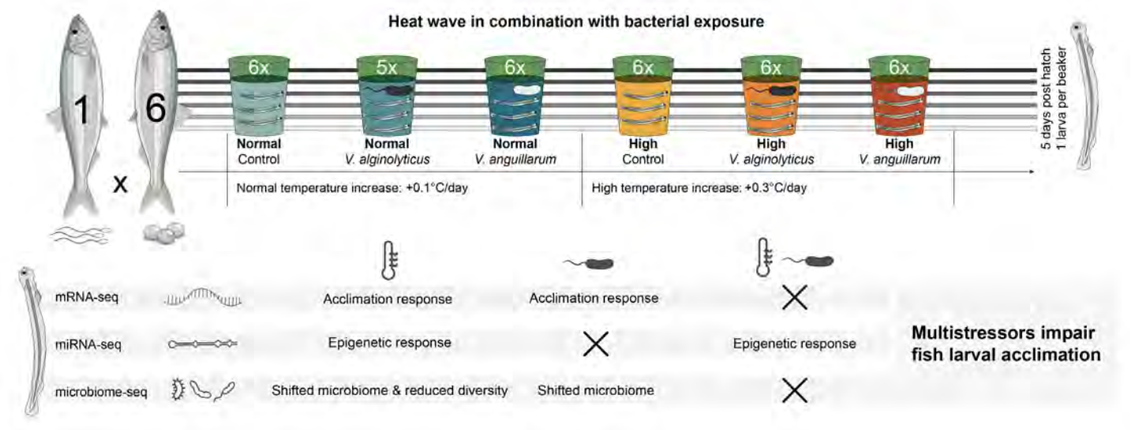


Fig. 5: Graphical overview of the experimental design and the main results. (× indicates no significant response).

'mRNA transport', 'mitotic nuclear division', and 'double-strand break repair'). Hence, the high temperature alone and the *V. alginolyticus* exposure at a normal temperature both may exert an inhibitory effect on the development of herring yolk-sac larvae.

In contrast, interactive effects of elevated temperature and *V. alginolyticus* resulted in minimal gene expression changes, indicating an impaired plastic response, which may cause cellular damage reducing survival in later larval stages. Hence, in contrast to our hypothesis, herring larvae exhibit an antagonistic stress response when exposed to bacteria during a heat wave. This indicates a lack of phenotypic plasticity with multi-stressor exposure, which could lead to irreversible cellular damage, increased vulnerability and reduced survival in later larval stages.

Moreover, the heat wave alone or in combination with *V. alginolyticus* induced a notable shift in miRNA expression leading to the down- but also upregulation of predicted target genes (Table 1). When both factors were combined, a unique class of highly repetitive miRNA dominated. Furthermore, both increased temperature and the *Vibrio* exposures significantly altered the larval microbiota composition (Fig. 6), with warming reducing microbial richness and diversity, potentially leading to dysbiosis and decreased larval health, although larval survival and growth were not significantly affected.

The outcomes of this study highlight an acclimation response on the gene expression level of herring larvae towards single climate change-related stressors, such as higher temperatures and bacterial exposure. However, interactive effects of multi-stressors may exceed the larval stress threshold impairing essential acclimation responses. This prompts further research on the

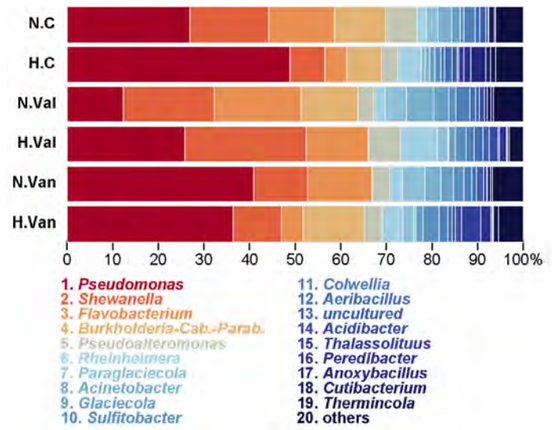


Fig 6. Larval bacterial communities per treatment on the genus level (based on the medians of the normalized counts to correct for disproportional effects of outliers).

effects of multiple environmental stressors on herring recruitment. The investigation of older, feeding larvae under realistic climate change scenarios needs specific attention. Future studies could help to unravel the factors behind the continuously decreasing recruitment of Western Baltic Spring-Spawning herring and, therefore, provide essential information for effective management strategies.

For more detailed information please see the original publication:

Franke, A., Bayer, T., Clemmesen, C., Wendt, F., Lehmann, A., Roth, O., Schneider, R. F. (2024). Climate challenges for fish larvae: Interactive multi-stressor effects impair acclimation potential of Atlantic herring larvae. Science of The Total Environment, 953. https://doi.org/10.1016/j.scitotenv.2024.175659

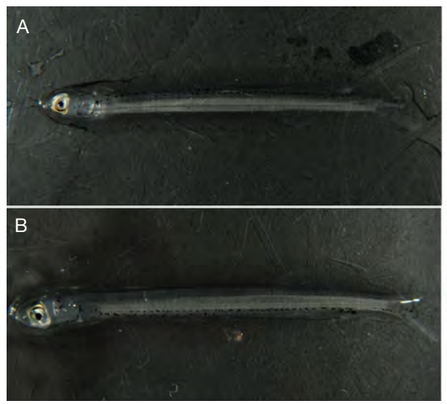
Growth of Atlantic herring larvae under experimental spring and autumn light conditions

Florian Berg, University of Bergen, Norway

Atlantic herring (*Clupea harengus*) populations differ in their spawning time, and spring- and autumn-spawning populations are genetically distinct. Offspring of these populations encounter seasonal variations in productivity. To investigate their growth trajectories to these seasonal changes, we conducted a long-term experiment over more than 3 years. The original plan was to cross genetically distinct spring- and autumn-spawning herring. Both spawning types co-exist and interbreed on a local spawning ground near Bergen in western Norway (Berg et al., 2021, Mueller et al., 2023). We have collected spawning herring during both spawning seasons and cryopreserved sperm of spawning males. The original plan was to use the cryopreserved sperm in the following spawning season to cross spring-autumn hybrids. However, experimental studies never follow the original plan. We tried for 5 subsequent spawning seasons to fertilize eggs with cryopreserved sperm and failed in all cases. After three years, in our sixth spawning season, we finally had high fertilization in the group using cryopreserved sperm. This was the starting point of our long-term experiment. Offspring were reared for three years with a seasonal varying light cycle starting either in spring or autumn, using two fixed temperature levels and food provided in excess. This experimental setup with varying light conditions and fixed low (7 °C) and high (10 °C) water temperatures should provide new insight into the growth trajectories of larvae

hatched in different seasons. Thus, we had in total four experimental groups, two replicates/tanks per group, and 1200 herring larvae within each tank. The plan was that these larvae consisted of 50% autumn-spring hybrids and 50% pure spring-spawning herring. However, when we conducted our first sampling one week after hatching, we conducted genetic analysis to identify hybrids and purebreds, but the genetic results showed that we only had purebreds in the tanks. Thus, we went back and analyzed the fertilized eggs. The results were clear, we have also failed to cross hybrids this time. For unknown reasons we had cross-contamination between the hybrids and the purebreds group. Anyway, we continued with the experiment with only genetically spring-spawning larvae that were now reared in different light and temperature regimes. We hypothesized that longer daylengths early in life would provide an overall growth advantage resulting in larger size after one year (same amount of light) compared to those experiencing prolonged daylight later in life due to higher size-dependent growth rates at smaller sizes. The results of the long-term experiment are presented in Berg et al. (2024), here we only focus on the growth trajectories of herring during the first year.

During the first three months of the experiment, larval growth was linear for all four experimental groups (Fig. 7). Both, temperature and light influenced the growth trajectories of larvae. Larvae reared at 10 °C and under natural light (spring) had the highest growth rates, whereas larvae reared at 7 °C and in the offset light (autumn) regime had the lowest growth rates.



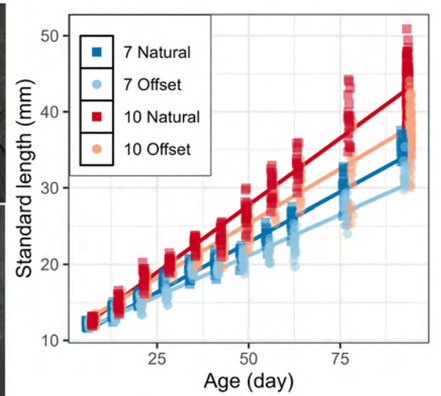


Fig. 7: Typical length of 56 days-old herring larvae reared at 7 °C and autumn light conditions (A) or 10 °C and spring light conditions (B). Right panel: Standard length at age for herring larvae for the first 93 days of the experiment (from equinox to solstice) reared under different light and temperature regimes. Modelled linear trend lines are shown.

After 1 year and the same amount of daylight, the standard length of herring reared under natural (spring) and offset (autumn) light conditions did not differ between fish in the 10 °C temperature regime. Herring reared at 7 °C and under natural light conditions were slightly

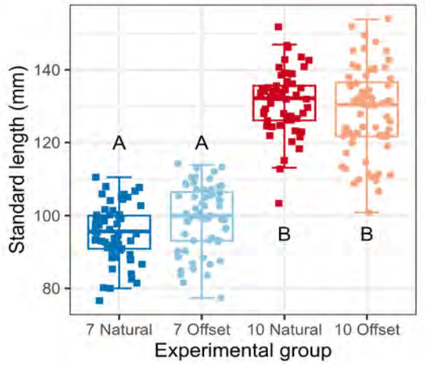


Fig 8. Standard length of individual age-1 herring reared under different light and temperature regimes. Horizontal lines represent medians, boxes represent the interquartile range, and whiskers represent the lowest and highest observations within 1.5× the interquartile range. Individual points indicate raw data. Compact letter displays of all pair-wise comparison based on the two-way ANOVA are provided to demonstrate statistical differentiation.

smaller than individuals from the offset light regime. Herring reared at 10 °C were, on average, 32.4 mm longer than individuals reared at 7 °C (Fig. 8).

To our knowledge, this is the first study where viable offspring of Atlantic herring have been reared in captivity for 3.5 years under simulated natural and offset light regimes at different temperatures. The results of our study clearly reject the initial hypothesis that longer daylengths early in life would provide an overall growth advantage compared to those experiencing this later in life. After 1 year herring reared under the offset light regime were either of equal size or even larger compared to herring under the natural light regime in colder temperatures. As expected, herring were larger at age at higher temperature, while the overall and seasonal patterns observed followed the same trends between the two temperature regimes. Our novel results indicate that herring display considerable growth plasticity, reflecting the wide range of environmental conditions and life histories sustaining herring populations.

Reference:

Berg, F., Seljestad, G., and Folkvord, A. 2024. Growth of spring- and autumn-spawned larvae of Atlantic herring *Clupea harengus*: a long-term experiment mimicking seasonal light conditions. Marine Ecology Progress Series,741:203-216. https://doi.org/10.3354/meps14521

Berg, F., Østgaard, H. D., Slotte, A., Andersson, L., and Folkvord, A. 2021. A combination of genetic and phenotypic characterization of spring- and autumn-spawning herring suggests gene flow between populations. ICES Journal of Marine Science, 78: 694–703. https://doi.org/10.1093/icesjms/fsaa046

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. https://doi.org/10.3389/fmars.2023.978694

Larval Fish Course 2024 at the Marine Station in Concarneau, France

Nalani Schnell, Catriona Clemmesen, Cindy Van Damme, Tony Miskiewicz

For the third time we held our European based Larval Fish Course at the marine station of the Muséum national d'Histoire naturelle in Concarneau, France (Fig. 9). The Marine station was founded in 1859 and is the oldest marine station in the world with still ongoing research activity. It was originally designed for breeding marine animals, and soon became an active research facility. Since 2018 it is a European hotspot for larval fish identification during our international larval fish course.

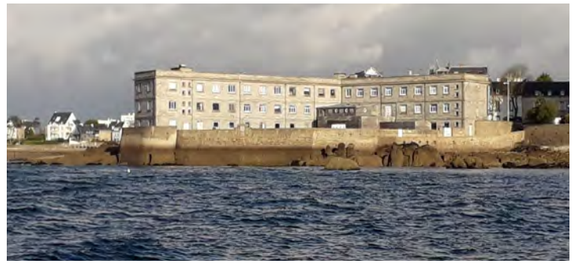


Fig. 9: Marine station of the Muséum national d'Histoire naturelle in Concarneau, France.

October 4th 2024, marked the conclusion of this intensive two-weeks course that brought together a diverse group of participants and experts from research and academic institutions from around the globe, including France, Spain, Portugal, the United Kingdom, the Netherlands, Germany, Taiwan, Australia, and the United States (Fig. 10). Together we were engaged in a comprehensive program featuring lectures and laboratory sessions focused on larval fish identification, ecology, as well as sampling and preservation techniques (Fig. 11). The course included lectures on the following topics " What is a fish larva? How and what do fish larvae feed on? Match-mismatch theory", "Physical processes and environmental factors influencing recruitment, larval age and growth", "Biochemical indicators for the determination of nutritional condition and growth", "Mortality and recruitment", "Fish larvae and climate change", "Sampling and preservation methods", "Fish egg identification, key identification features, relevant literature and available resources", and, of course, lectures and labs on larval fish identification of about 60 fish families. Fifteen participants took part in the first week where we provided pre-identified larval samples from the Eastern North Atlantic in order to train the identification on a species level. Nine participants stayed for

Fig. 10: Larval fish course 2024.

the second week where we sorted and identified parts of the huge museum's larval fish collection from the Pacific. We aimed for a family level identification for this collection, but in many cases the participants were even able to identify to a genus or species level. Once identified, the specimen/s received a MNHN collection number. In total the larval fish collection received about 600 new collection entries - amazing! At the same time, we are still left with thousands of unsorted and unidentified samples that can be used in many, many future courses. So, watch out, when we will announce it again! For more pictures and info visit our website: https://sites.google.com/view/larval-fish-course/home

The course was taught by Catriona Clemmesen (GEOMAR, Germany), Cindy van Damme (Wageningen Marine Research, Netherlands), Tony Miskiewicz (Australian Museum & UNSW Sydney, Australia), and Nalani Schnell (MNHN).

Fig. 11: Larva of this year's course cover: *Liopropoma olneyi* Baldwin & Johnson, 2014. Impressions from the lecture room and lab.

NORTHEAST REGION
KATEY MARANCIK

Evidence for adaptive strategies in larval capelin on the northeastern coast of Newfoundland, Canada

Ashley Tripp[1], Hannah M. Murphy[2], and Gail K. Davoren[1]

[1]University of Manitoba, Biological Sciences Department, Winnipeg, MB, Canada
[2]Northwest Atlantic Fisheries Centre, Fisheries and Oceans Canada, St. John's, NL, Canada

Early this year the Davoren Lab at the University of Manitoba, published current post-doc Dr. Ashley Tripp's last Ph.D. thesis chapter on the early life history of larval capelin in coastal Newfoundland, Canada. This study examined support for adaptive strategies including match/mismatch, coastal water mass replacement, and bet-hedging in larval capelin, a small forage fish species that plays a pivotal role in the marine food web as one of few species funnelling energy up to many top predators (e.g., whales, seabirds, piscivorous fishes). Capelin migrating into coastal Newfoundland in the summer months demonstrate two reproductive modes where they spawn at both intertidal and subtidal sites based on a combination of suitable temperature and sediment sizes for adherent eggs, creating potential for different egg incubation conditions within a spawning season (Fig. 12). Combining environmental data with larval capelin densities, predator biomass, and prey biomass we examined whether greatest larval emergence was timed to match with optimal prey (match/mismatch) and decreased predator abundance (coastal water mass replacement) or whether larval emergence would be diffuse throughout the summer to increase the likelihood that some larvae experience good conditions (bet-hedging). We also compared larval morphometrics (i.e., larval length, yolk-sac diameter, gape width, body depth) to determine body condition of larvae emerging

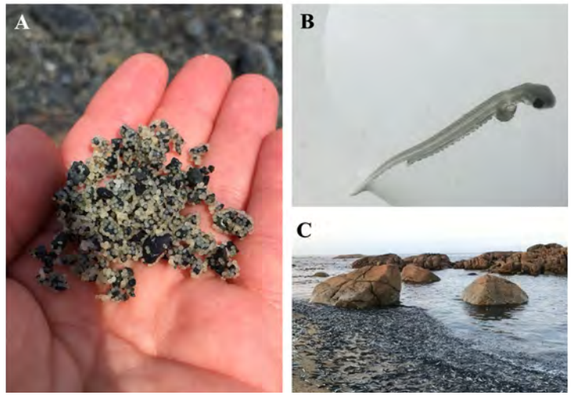
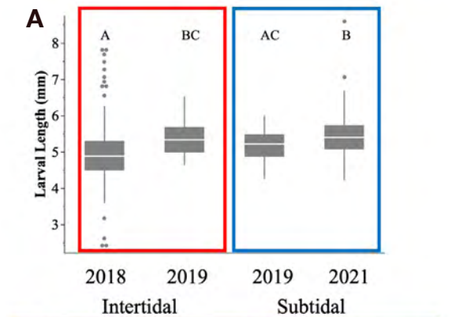
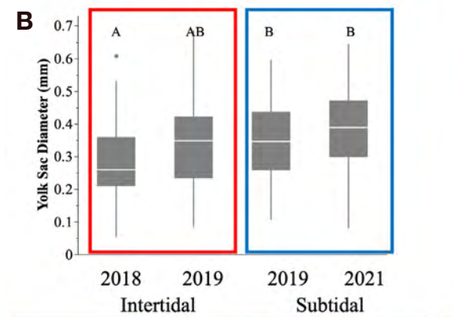


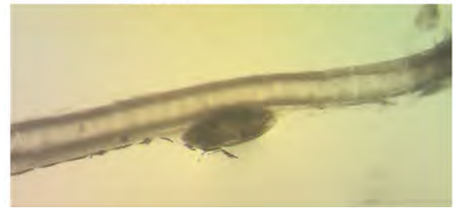
Fig. 12: Photographs of (A) capelin eggs adhered to sediment at an intertidal spawning site in Newfoundland (B) a recently hatched capelin larvae with visible yolk-sac and (C) an intertidal capelin spawning site with adult capelin 'rolling' to spawn.

from intertidal and subtidal spawning habitats (Fig. 13).





Figs. 13: Comparisons of larval capelin morphometrics between intertidal and subtidal spawning sites in coastal Newfoundland comparing (A) larval length measured from snout to tail and (B) yolk-sac diameter. For both metrics condition was similar or slightly improved at the subtidal spawning site relative to the intertidal site.



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NORTH CENTRAL REGION
STACEY IRELAND

Egg thiamine concentrations in Lake Trout and hatched fry from the northern refuge of Lake Michigan

Sara Ang[1], Kevin Keeler[1], Chuck Madenjian[1]

[1]U.S. Geological Survey – Great Lakes Science Center

Lake Trout *Salvelinus namaycush* is a highly valuable commercial and recreational fishery in the Laurentian Great Lakes. As a native predator, they have played a critical ecological role in the food web and are considered indicator species of overall ecosystem health. However, the species was extirpated from Lake Michigan by 1960 (Wells and McLain 1973; Hansen 1999) due to overfishing and predation from invasive Sea Lamprey. In an effort to bring back the Lake Trout population, a reserve area within Lake Michigan was established in 1985 to stock and create a self-sustaining population. This area, known as the Northern Refuge, has been stocked with millions of Lake Trout (Fig. 14).

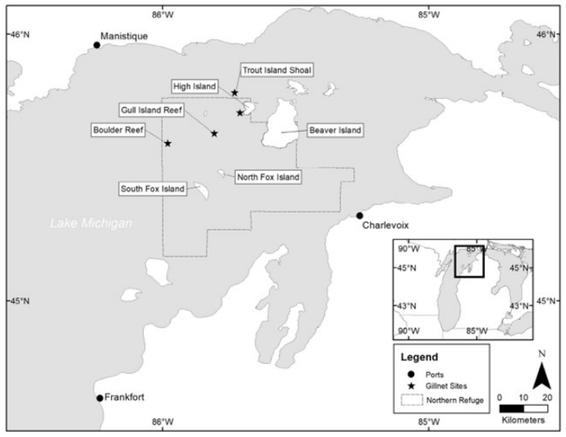
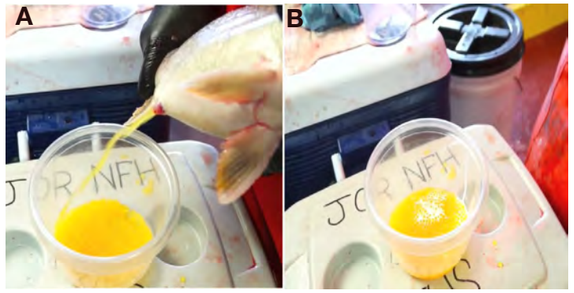


Fig. 14: Map of gill-net sites at which Lake Trout were caught during October 23-November 8, 2019-2023, in the Northern Refuge of Lake Michigan.

The Northern Refuge contains Boulder and Gull Island reefs. Through 2020, evidence of successful recruitment from the stocked Lake Trout in the Northern Refuge had been very limited (Madenjian and Desorcie 1999, 2010; USGS GLSC 2019). The Alewife *Alosa pseudoharengus*, an invasive species that took over the Great Lakes and one of the reasons why salmon were introduced to manage their overpopulation, may have represented an impediment to successful natural reproduction by Lake Trout. Alewives may feed upon Lake Trout fry (Krueger et al. 1995; Madenjian et al. 2008). Additionally, investigation into what may be driving this recruitment limitation have led to inquiries of whether thiamine deficiency complex (TDC) could be a factor. TDC results from the inability to acquire or retain thiamine, an essential



Figs. 15: A) Lake trout egg spawning from adult female and **B**) egg fertilization using dry fertilization method with milt from adult male in October of 2019l

B vitamin for metabolism and nervous system function. This can be connected to the significance of Alewife to the Lake Trout diet. The enzyme thiaminase has been found in Alewives and could be responsible for degrading the total thiamine (TTH) content within the body of Lake Trout. However, it's important to first understand the effect of TDC and if it exists in Lake Trout from The Northern Refuge. Gillnet surveys on the R/V Sturgeon for adult Lake Trout occurred during spawning when aggregations were most dense (October-November). Gametes were gathered and fertilized (Fig. 15) and then taken to the USGS Great Lakes Science Center in Ann Arbor, MI to be hatched. From 2019-2020, eggs were fertilized, reared, and hatched (Fig. 16). The gillnet survey occurs every year and egg collection for thiamine analysis occurs almost every year. Unfertilized eggs from ovulating Lake Trout were collected during spawn in 2020-2022 and measured for TTH concentrations. In 2023, eggs were collected but given additional thiamine supplements at fertilization to establish the significance of supplementation of thiamine as a management tool, TDC in fertilization, hatching success and mortality.

Mean thiamine concentrations in unfertilized eggs in Lake Trout caught in 2020, 2021, 2022 and the fertilized eggs and larvae from Lake Trout caught in 2019 and 2023 were all above the lethal threshold concentration of 2.3 nmol/g which, by Futia and Rinchard (2019), would suggest that the likelihood of TDC-induced mortality in the fry is low. Overall, the future of Lake Trout reestablishment in the Northern Refuge of Lake Michigan is promising given that 4% of caught fish in gillnets were wild in 2021 (Madenjian et al. 2023) and the relatively high hatchability and high thiamine concen-

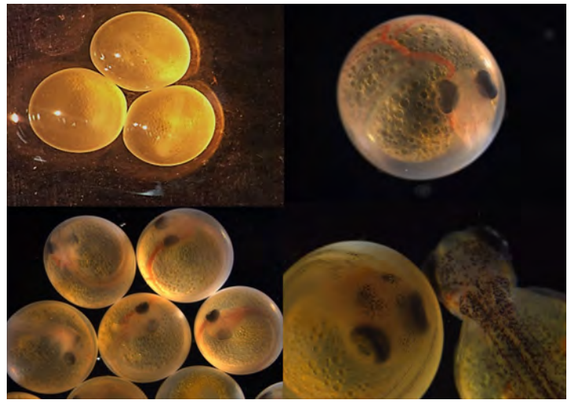


Fig. 16: (Top Left) Near complete epiboly of developing embryos on 19 Nov 2019 (21 days post-fertilization). (Top Right) Development of the embryo 54 days post-fertilization from adults collected near Gull Island in Lake Michigan. (Bottom Left) Development of multiple embryos at 55 days post-fertilization using collected adults from Boulder Reef (Bottom Right) Embryo near hatch with a recently hatched larvae at 94 days post-fertilization using collected adults from Boulder Reef.

trations of the eggs and larvae. Our plan is to continue to collect eggs from adults in the Northern Refuge in the fall of 2024 and fertilize, rear, and hatch them out in the following spring. We plan to continue similar procedures of thiamine supplementation on eggs and larvae to further investigate the role of thiamine in Lake Trout recruitment.

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Seining to Determine Abundance of Various Fish Species in the Detroit and St. Clair Rivers

Jenna Bemis

USGS Great Lakes Science Center

A seine survey was conducted to assess the juvenile fish community in the Detroit and St. Clair Rivers. The survey was done at 10 sites, four of which were in the Detroit River, and six from the St. Clair River. These sites are part of long-term juvenile fish monitoring that had been sampled in previous years. At each site, 4 tows were done parallel to the shoreline and pulled upstream for 15.25 m (Fig. 17). After each tow, the fish were identified to species and the length of each fish was measured (Fig. 18). As soon as the fish had been measured, they were released back into the river downstream of the previous tow. This was done to ensure the fish were not recaptured. The next tow began where the previous ended, continuing upstream. This survey was conducted over a two week period at the end of August. Common

Fig. 17: Technicians seining at Pointe Mouillee State Game Area on the Detroit River. Photo credit: USGS.(NHMD).

Fig. 18: Rock Bass (*Ambloplites rupestris*) collected at the Blue Water River Walk in Port Huron, Michigan, on the St. Clair River. Photo credit: USGS.

species found were Brook Silversides (*Labidesthes sicculus*), Round Goby (*Neogobius melanostomus*), and Emerald Shiners (*Notropis atherinoides*). The survey frequency will now be at least every five years to coincide with the intensive monitoring year for Lake Erie.

SOUTHERN REGION
TRIKA GERARD

Maternal effects and trophodynamics drive interannual larval growth variability of Atlantic bluefin tuna (*Thunnus thynnus*) from the Gulf of Mexico.

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[2]NMFS, Southeast Fisheries Science Center Miami, Florida

Environmental factors, maternal inheritance, and feeding success are influential factors in fish growth, especially during the larval stage, encompassing their early days of life. Growth rates play a crucial role in larval survival, particularly in species with high energy requirements such as the Atlantic bluefin tuna (ABFT). Analyses of two patches of ABFT larvae collected in the Gulf of Mexico spawning region during different years reveal variable larval growth, depending on prey availability. Larval growth also shows a direct relationship to maternal feeding. Estimates of larval trophic positions are primarily influenced by food web length and energy transmission efficiency, leading to differences in larval growth and underscoring the importance of considering trophic dynamics in results interpretation. These findings offer novel insights into how these factors affect ABFT larval growth, potentially informing conservation efforts and fisheries management strategies by governmental institutions.

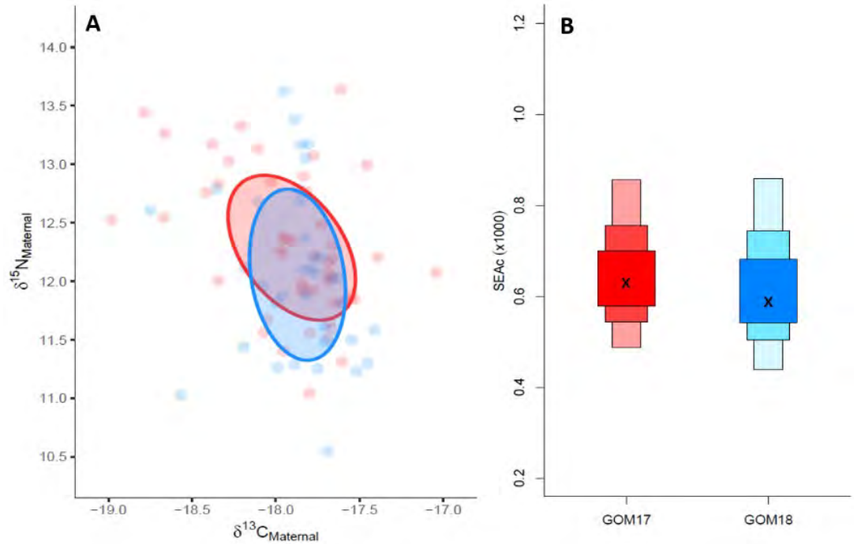

Fig. 19: (A) $\delta^{15}N$ vs $\delta^{13}C$ maternal values for GOM17 and GOM18. Maternal trophic niches are represented by the ellipse areas. (B) Estimated ellipse areas applying the correction for small sample sizes (SEAc). 2017 samples are in red and 2018 samples are in blue.

Two cohorts of Atlantic bluefin tuna (*Thunnus thynnus*) larvae were collected in 2017 and 2018 during the peak of spawning in the Gulf of Mexico (GOM). We examined environmental variables, daily growth, otolith biometry and stable isotopes and found that GOM18 larval cohorts grew at faster rates, with larger and wider otoliths. Inter and intra-population analyses (deficient vs. optimal growth groups) for pre- and post-flexion developmental stages were done to determine maternal and trophodynamic influences on larval growth variability based on larval isotopic signatures, trophic niche sizes and their overlaps. For pre-flexion stages in both years, optimal growth groups had significantly lower δ 15 N implying a direct relationship between growth potential and maternal inheritance (Figs. 19, 20). Optimal growth groups and stages for both years showed lower C:N ratios reflecting a greater energy investment in growth. The result of this study reflect the interannual transgenerational trophic plasticity of a spawning stock and its linkages to the growth potential of their offspring within GOM.

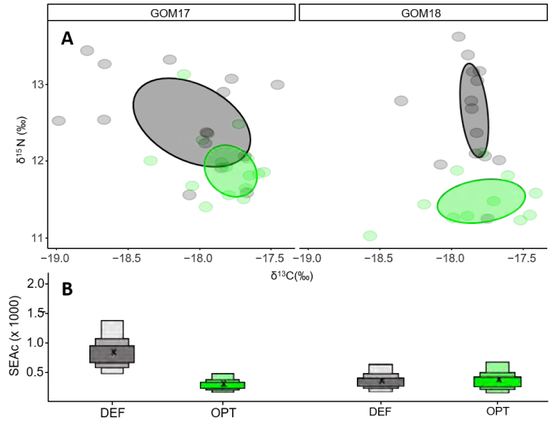

Fig. 20: (A) $\delta^{15}N$ vs $\delta^{13}C$ maternal values for GOM17 and GOM18. Mate2nal trophic niches are represented by the ellipse areas. (B) Estimated ellipse areas applying the correction for small sample sizes (SEAc). Green denotes optimal growth groups and black denotes deficient growth groups.

For more detailed information please see the original publication: Quintanilla JM, Borrego-Santos R, Malca E, et al. Maternal Effects and Trophodynamics Drive Interannual Larval Growth Variability of Atlantic Bluefin Tuna (*Thunnus thynnus*) from the Gulf of Mexico. Animals (Basel). 2024;14(9):1319. https://doi.org/10.3390/ani14091319

WESTERN REGION
DAN MARGULIES

US Fish and Wildlife Service visits Jordan River National Fish Hatchery (NFH) in northern Michigan

Alison Deary

Abernathy Fish Technology Center U.S. Fish & Wildlife Service

Early October is a busy time for those of us who work for the United States federal government. We close down one fiscal year and open a second year, typically on a continuing resolution, leading to a ton of administrative tasks. In the midst of the fiscal year transition, some colleagues and I (Fig. 21) in the US Fish and Wildlife Service had an exciting opportunity to visit Jordan River National Fish Hatchery (NFH) in northern Michigan to learn about their partial recirculating aquaculture system (pRAS) for rearing a native forage fish species known commonly as Cisco (*Coregonus artedi*). This species, along with other coregonines are sensitive to environmental perturbations and crowding, making them challenging to rear in an aquaculture setting. Our interest in visiting Jordan River NFH stems from the application of pRAS to mitigate for the impacts of climate change on water resources where precipitation patterns have shifted, leading to less snowpack in the western part of the US, which historically would have sourced cold water to facilities during the dry months. Seeing Jordan River NFH and meeting the people who make this incredible system work was remarkable! The conversations identified areas that we need to investigate more in current and future pRAS systems in the West. I had also never seen a Cisco before and we timed our visit to meet the cohort as they were being prepared for release into the Great Lakes!

Fig. 21: The US Fish and Wildlife Service crew posing in front of the Jordan River National Fish Hatchery sign after a great visit. From left to right: Nate Wiese, Bill Gale, Ali Deary, Ron Twibell.

Since we were generally in the neighborhood, we reached out to Stacey Ireland at the USGS Great Lakes Science Center in Ann Arbor, Michigan to visit the ichthyoplankton lab and hear about the team's cool projects! I met Ed Roseman, now retired, at my first Larval Fish Conference in Wilmington, North Carolina in 2010 and I was in awe of the monitoring of Lake Sturgeon spawning before, during, and after habitat restoration. I was thrilled to be able to meet the current team and see the facility that made such an exciting project (as well as many others) possible. Stacey is also the Northcentral Regional Representative for the Early Life History Section so it was wonderful to meet another member of the Section's governance. After visiting the plankton lab, Stacey introduced us to Kevin Keeler, Charles Madenjian, and Sara Ang. When unknown eggs are collected

in the field, Stacey works closely with Kevin to rear the eggs on station (Fig. 22) to a stage where she and the team are able to identify the individuals. Kevin is also collaborating with the team at Jordan River NFH so we were able to visit some of the older cohorts of coregonines that are being reared at USGS. Another interest for us stemmed from a poster that Kevin, Charles, and Sara presented at the Larval Fish Conference in May on their recent work examining the impact of thiamine deficiency on Lake Trout. Sara also has a piece talking about the work in this issue of the newsletter! Thiamine deficiency is cited as a culprit for the recent poor returns and lower than normal early life history stage survival of salmon in California and we are very keen to learn about the research of others as we focus on the research questions that we need to ask of our salmonid species in the Pacific Northwest.

Fig. 22: During the visit at USGS, we learned about the aquatic animals they maintain on station and how the space is used to accomplish the various experiments across life stages. From left to right: Bill Gale (US FWS), Kevin Keeler (USGS), Charles Madenjian (USGS), and Stacey Ireland (USGS).

PACIFIC RIM REGION
AKINORI TAKASUKA

Akinori Takasuka

Recently, I had opportunities of hosting two special guests in my laboratory at the University of Tokyo, Japan. Dr. Kostas I. Stergiou (Aristotle University of Thessaloniki, Greece) visited us for two weeks as a part of his short sabbatical. This was the first time I met Kostas in person, even though I knew him from a number of publications. The first 30-min chat was enough to recognize his friendly and thoughtful personality. Despite the short stay, we learned a lot from him, and my students had precious moments in communicating with such a great scientist. The other guest, Etienne Germain, was from the laboratory of Dr. Dominique Robert, the ELHS president. Etienne stayed here for approximately two months based on the program funded by the JSPS (Japan) and Mitacs (Canada). He and my students immediately warmed up to each other. This collaboration has a history. I am very happy that he has established a collaborative relationship for his generation. Here are the reports from Kostas and Etienne about their experiences at our campus.

Two weeks at the University of Tokyo

Konstantinos (Kostas) I. Stergiou

Laboratory of Ichthyology, Department of Zoology, School of Biology, Aristotle University of Thessaloniki, Greece. E-mail: kstergio@bio.auth.gr

I visited for two weeks, from 17 May to 2 June 2024, Akinori Takasuka at the Fisheries Biology Laboratory, which belongs to the Department of Aquatic Bioscience, Graduate School of Agricultural and Life Sciences, the University of Tokyo. I stayed at the excellent and affordable facilities of Mukougaoka Faculty House in the university campus, which is a two-minute walk from Akinori's laboratory. During this short period, I had the chance to extensively discuss with Akinori several issues related to small pelagics, notably their role in the ecosystem in light of climate change. In addition, I discussed extensively with Akinori's PhD and MSc students, working on various aspects of the life history of small pelagic fishes, especially with Shota Tanaka (PhD), Taro Taniguchi (MSc) and Junichi Iijima (PhD). During my stay, I delivered two lectures to PhD and MSc students of the department. The first one was entitled "Fish fecundity – a review". This talk is based on a recent review, undertaken by me and my collaborators (Tsoukali et al. 2024, and in preparation), for which we collected all published data on the fecundity of marine fish species (using Scopus, Web of Science and Google Scholar). The collected data are derived from all areas of the world ocean (Fig. 23) and refer to 74 families and 237 unique species for batch spawners and to 60 families and 199 unique species for total spawners. Some of the findings are that for batch spawners batch fecundity is higher in species with pelagic eggs and lower in "bearing" species. Batch fecundity is also higher in species exhibiting no parental care and lower in species

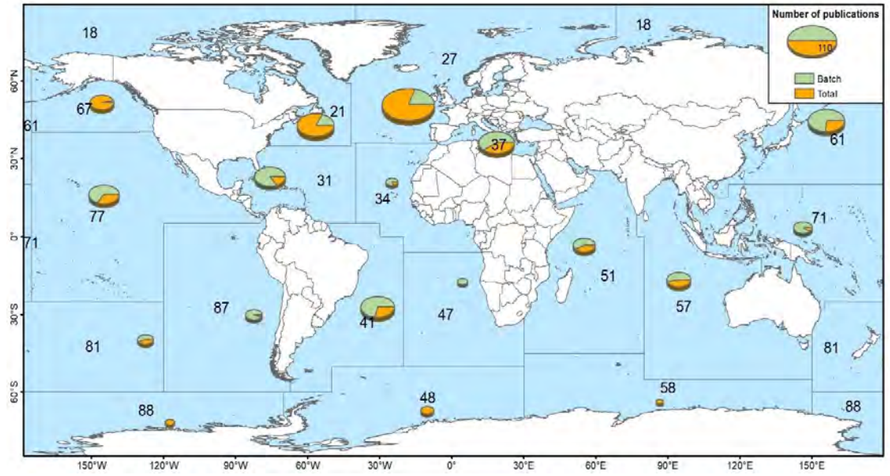

Fig. 23: The number of publications for batch (green) and total (orange) spawners by FAO area used for the review of marine fish fecundity (Tsoukali et al., 2024). The size of each pie is representative of the number of publications per area.

from the cold climate zone. For total spawners, total fecundity is lower for species living in cold and tropical zones and higher for species with pelagic eggs. Total fecundity is also lower for species bearing eggs and higher for species exhibiting no parental care.

Fig. 24: Kostas Stergiou delivering a talk on "The Mediterranean Large Marine Ecosystem". This slide presents the Mediterranean landings reported to FAO (lower line) when compared to the reconstructed landings during 1970–2017. Reconstructed landings are about 2 times the reported ones. Reconstructed landings (estimated based on Pauly and Zeller, 2015), include all types of fisheries removals: reported, unreported catches (from both industrial and artisanal fisheries), recreational catches, subsistence catches and discards.

The second talk was entitled "The Mediterranean Large Marine Ecosystem". In this talk (Fig. 24) I presented an overview of the geography, oceanography, biology and fisheries of the Mediterranean Large Marine Ecosystem, paying particular attention to (a) the distribution of trophic levels (see Fig. 25 as an example from Greek waters); (b) the effect of climate change on the Mediterranean, including simulations; (c) the expansion of invasive species; and (d) the state of the Mediterranean fisheries resources. SST, the changes of which are largely similar in the W, Central and E Mediterranean, increased by 1.5°C in the last 40 years with important effects on the expansion of invasive species as well as on fisheries resources. Pelagic landings are dominated by sardine (23%), anchovy (10%), *Trachurus* spp. (9%), and sardinella (7%) in the W Mediterranean, by anchovy (18%), sardine (15%), and sardinella (7%) in the Central Mediterranean and by sardine (14%), anchovy (9%), bogue (5%), and sardinella (4%) in the E Mediterranean (Stergiou et al., 2016). Demersal landings are mainly composed of hake and bogue in the W Mediterranean, hake, common pandora, deep-water rose shrimp and *Mullus* spp.in the Central Mediterranean, and natantia decapods, and bogue in the E Mediterranean (Stergiou et al., 2016). Total landings declined in all Mediterranean areas after about the late 1980s/1990 and modelled biomass (t/km2) declines for all main functional groups except invertebrates, during 1950-

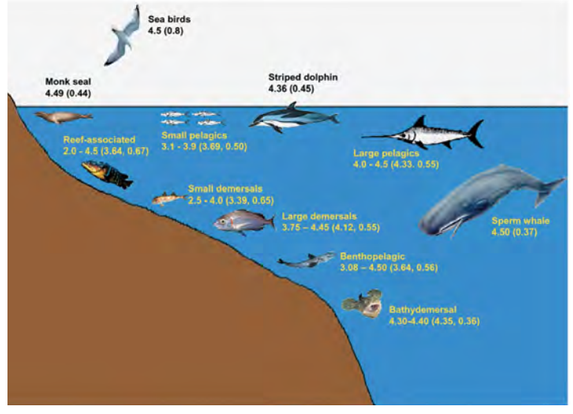

Fig. 25: Trophic levels (range and in parentheses, mean and standard error) of fishes by major habitat (as defined in FishBase, www.fishbase.org), together with the trophic levels of other top predators (i.e., marine mammals and seabirds) in the Greek Seas. The main ecosystem components missing from this schematic outline are: phytoplankton and benthic flora (which by definition are at trophic level 1), zooplankton, cephalopods (their trophic level ranges from 3 to 4.5), large crustaceans and other benthic or pelagic invertebrates (from Stergiou and Karpouzi, 2005).

2011 (Piroddi et al., 2020). Moreover, studies from as early as 2000 (Stergiou and Koulouris, 2000; Stergiou and Polunin, 2000) indicate that the Mediterranean food webs were (see Fig. 26 as an example from Greek waters) and still are fished down (Piroddi et al., 2020).

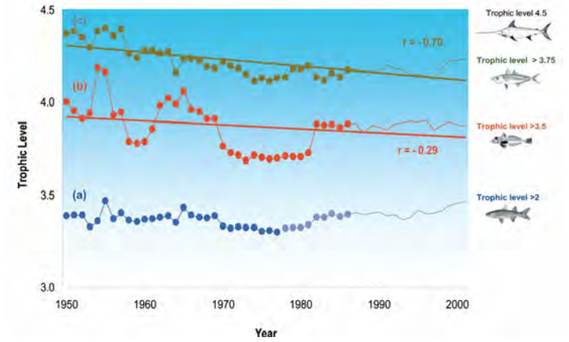

Fig. 26: Long term trends in the mean trophic level of the landings in Greek waters during 1950-2001, for all fish species (trophic levels >2) and for fish species having trophic levels >3.5 and >3.75 (from Stergiou, 2005).

During my visit I also met most of the staff and graduate students from the Fisheries Biology Laboratory (Fig. 27) and we had the opportunity to set the foundation for closer cooperation between the Laboratory of Ichthyology of the Aristotle University and the University of Tokyo.

Fig. 27: Kostas Stergiou with the members of the Fisheries Biology Laboratory. Bottom row: Daichi Murayama, Akihiko Goto, Yusuke Kumai, Kostas Stergiou, Akinori Takasuka, Shota Tanaka, Junichi Iijima (from left to right); top row: Hikaru Shimada, Takashi Yamakawa, Mari Kuroki, Kazuha Takai, Mingkun Li, Kimito Morimoto, Taro Taniguchi, Ryunosuke Gishi, and Kanon Tokura (from left to right).

Naturally, I did not miss the opportunity to taste several local specialties (Fig. 28) such as sushi, ramen, yakitori, omelet over rice, known as omurice, wagyu, yakitori, Japanese dumplings, teppanyaki and mochi. I also, in my spare time, visited many districts such as Shinjuku, Shibuya, Asakusa, Akihabara, and Ginza.

Overall, this was a very fruitful short sabbatical that started a new collaboration and friendship! Akinori was an excellent and gracious host and I await him and Shota to visit me in Thessaloniki.

Fig. 28: Upper photo: Akinori Takasuka, Junichi Iijima and Shota Tanaka (from left to right); lower photo: Shota Tanaka, Kostas Stergiou and Junichi Iijima (from left to right) in Tsukishima (the area famous for unique and traditional “Monjya-yaki”).

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Building on collaborative foundations: My internship experience at the University of Tokyo through the JSPS Summer Program – a second generation of laboratory partnership between Canada and Japan

Etienne Germain

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In 2006, Dominique Robert, our President but a PhD student back then, conducted a research internship through the Summer Program of the Japanese Society for the Promotion of Science (JSPS), which offers fellowships for a three-month internship in Japan to graduate students from Canada, France, Germany, Sweden, the UK and the US. He realized his internship with Dr. Akinori Takasuka, then researcher at the National Research Institute of Fisheries Science, Japan Fisheries Research and Education Agency, in Yokohama. This internship, which eventually resulted in a publication (Robert et al., 2010), was the beginning of a long-term collaboration between the two scientists (e.g., Robert et al., 2023; Tanaka et al., 2023).

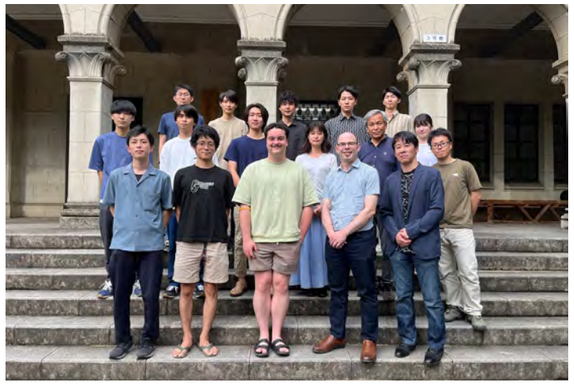

Fig. 29: Etienne Germain and members of the Fisheries Biology Laboratory. On the front row, from left to right: Akihiko Goto, Shota Tanaka, Etienne Germain, Dominique Robert, Akinori Takasuka.

When working with larval fish growth and survival, it is natural to come across the work of Dr. Akinori Takasuka and his renowned expertise in fish population dynamics, early life stages of fishes, and the impacts of environmental factors on fisheries resources. In particular, a key concept that he proposed 2 decades ago is the growth-selective predation mechanisms, which predicts how faster growth rates increase larval survival probabilities under predation pressure, and subsequent recruitment (Takasuka et al., 2003).

Working on juvenile Atlantic herring (*Clupea harengus*) growth through otolith analysis, I have been very interested in Akinori’s work since the beginning of my research career. But it would have been difficult to predict that almost two decades later, it would be my turn to travel to Japan through the same JSPS Summer Program to obtain an experience in his laboratory! Thus, during the summer of 2024, I conducted a research internship at the Graduate School of Agricultural and Life Sciences of The University of Tokyo (Fig. 29), where Dr. Takasuka is now professor.

During my stay, I teamed up with PhD student Shota Tanaka (Fig. 30), who is working on larval Japanese anchovy (*Engraulis japonicus*) growth. Some of Shota’s recent work has focused on understanding the effects of temperature on the relationship between otolith size and somatic size in Japanese anchovy larvae, exploring how these factors contribute to seasonal variability in fish re-

Fig. 30: Etienne Germain and Shota Tanaka: a second generation of collaborators.

cruitment mechanisms (Tanaka et al., 2024). Now, he is working on understanding the growth-feeding linkage and how variable this relationship is throughout the year.

Within this context, I have joined Shota's project and analyzed daily increments in larval anchovy otoliths (Fig. 31) during the summer. It has been a truly fantastic experience, allowing me to learn many techniques that I will directly soon apply to my MSc project on Atlantic herring. I also discovered the shirasu, a fishing industry that targets larval fishes, mainly Japanese anchovy and sardine. Shirasu is a very popular food resource in Japan, where it is consumed either fresh, boiled (Fig. 32) or dehydrated. Other than being quite tasty, I found shirasu really interesting because it offers a unique access to larvae for biologists that are interested in studying early-life stages of fishes.

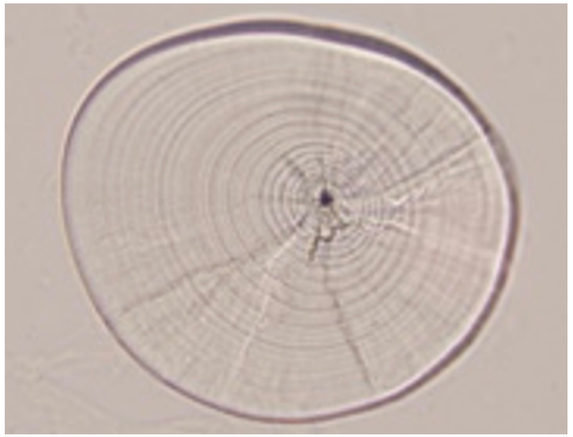

Fig. 31: Otolith of a Japanese anchovy (*Engraulis japonicus*) larva, showing its daily increments.

In conclusion, my internship experience in Japan has been profoundly enriching, teaching me the invaluable role that collaboration plays in advancing research. The connections I established and the knowledge I gained will be precious as I move forward through my academic journey. I am deeply grateful for this opportunity and look forward to nurturing these collaborations, as I believe they hold the potential for remarkable achievements in the future.

Fig. 32: Boiled shirasu as commonly found in Japanese supermarkets.

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LARVAL FISH COLLECTION OF THE ISSUE

Larval fish collection at the Nelson Mandela University, Port Elizabeth, South Africa

Nadine A. Strydom

Prof Nadine A. Strydom (Fig. 33) is the leading Africa-based researcher working on larval fishes. Nadine has been working on early life history stages since 1997 with postgraduate degrees all focused on larval stages of fishes. She holds a PhD in Ichthyology from Rhodes University (2002) and has specialised in early life history stages all of her career spanning ocean, estuarine and riverine habitats that is published in nearly 100 peer-reviewed journal articles to date. Her work covers ecology, feeding, swimming abilities and threats to nursery areas with a strong conservation focus. Nadine has been generating a reference collection of larval fishes since her M.Sc studies that lives on to this day under her own curation. Currently, the collection comprises approximately 150 species from temperate South African waters. The collection is actively used by her postgraduate students for comparison during the identification process. Nadine is in the process of generating an identification guide to larval fishes occurring in temperate waters of South Africa and is currently in the process of illustrating specimens from her collection.

Fig. 33: Nadine A. Strydom identifying larval fishes

LARVA(E)/EGGS OF THE ISSUE

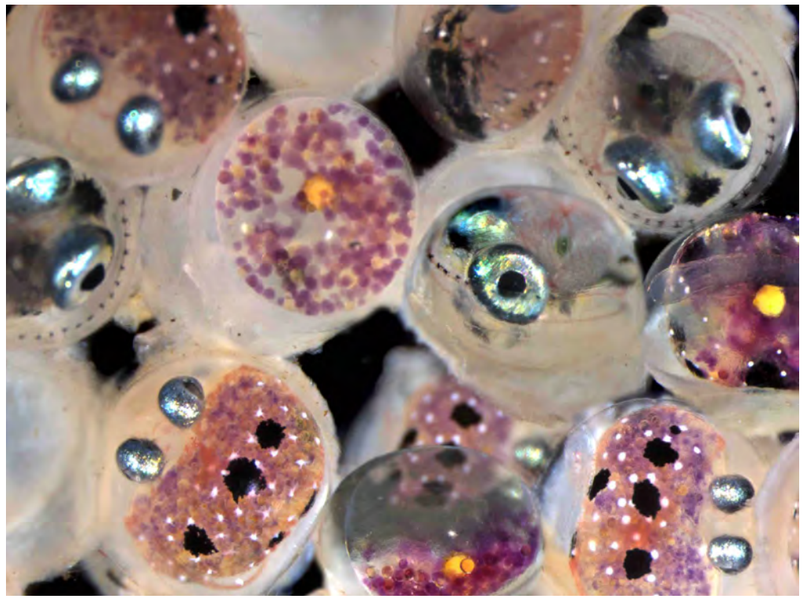


Fig. 34: The adherent eggs of the Peacock blenny (*Salaria pavo*).

The adherent eggs of the Peacock blenny

Nalani Schnell

The peacock blenny, *Salaria pavo*, lives in the shallow waters of the eastern Atlantic, Mediterranean and Black Sea. The female deposits her eggs preferably in the empty shells of molluscs, such as oysters. The male guards the nest and aerates the eggs.

IN MEMORIAM

G. David Johnson 1945-2024

by Jeff Leis

Dave Johnson, Curator of Fishes at the Smithsonian's National Museum of Natural History (NMNH), passed away on 22 November 2024 after a bad fall caused by cardiac arrest. Dave was known to many ELHS members for his interest in, and contributions to, larval fish biology and systematics. He received his undergraduate degree from the University of Texas, Austin and in 1975 his PhD from Scripps Institution of Oceanography, just down the hill from the National Marine Fisheries Service La Jolla facilities. During his PhD studies, Dave was introduced to fish larvae and their use in elucidating relationships by the legendary team of "Ahlie" Ahlstrom and Geoff Moser and made major contributions in this area throughout his career.

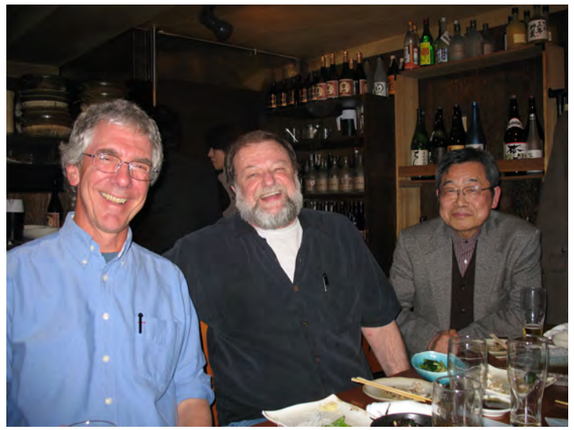


Fig. 35: Dave Johnson in 2008 (center) with fellow larval-fish enthusiasts Jeff Leis (left) and Muneo Okiyama (right). enjoying the "Red Fish" pub, Tokyo, following a symposium. Photo by Ai Nonaka

While at the Chesapeake Biological Laboratory, University of Maryland, Dave authored volume 4 (Carangidae through Ephippidae) of the landmark multi-volume Development of Fishes of the Mid-Atlantic Bight (1978). He then moved to the South Carolina Marine Resources Research Institute where he worked on a larval-fish research program and co-authored publications on grouper larvae identification and ecology, phylogenetic implications of grouper larvae morphology and developmental osteology of Morone species. In 1983, Dave became Curator of Fishes at NMNH, and his most cited work, a major chapter on development and relationships of the Percoidei, was published in the famous Ahlstrom Symposium "Red Book" (1984). Throughout his career he published widely on the relationships of a huge range of fish taxa based on both larval and adult characters. His constant message emphasized the power of ontogeny for testing character homology, and hence hypotheses of relationships, echoing Ahlstrom and Moser. Dave co-authored five family chapters in Bill Richards' Early Stages of Atlantic Fishes: an Identification Guide for the Western Central North Atlantic (2005), and a chapter in each in the Indo-Pacific larval-fish identification books by Leis and Trnski (1989) and Leis and Carson-Ewart (2000).

More recently, Dave and his collaborators, particularly his wife, Ai Nonaka (NMNH), recognized the potential provided by "Blackwater" diving photographers, who are able to capture striking in situ images as well as specimens of fish larvae in their pelagic habitat (Nonaka et al., 2021). This has led to a series of publications that utilize the intact specimens, which are far superior to those captured by towed nets, for morphological research and genetic sampling, for confirming identifications and evaluating relationships. A bonus is the natural history information provided, particularly on larval morphological specializations, behaviour and symbiotic relationships.

Dave published 173 journal papers, book chapters, and books from 1974 through 2024, and there are certain to be more as co-authors complete their collaborations with him. His work, with many collaborators, has been cited over 8000 times (about 300 citations per year in the past 15 years) with an impressive h-index of 43. This high citation rate – uncommon for systematic research – reflects the quality and influence of his research. In 2003, he received the premier award for Excellence in Systematic Ichthyology, the Robert H Gibbs, Jr. Memorial Award from the American Society of Ichthyologists and Herpetologists. His full publication list is at: https://naturalhistory.si.edu/staff/g-david-johnson

Dave was noted for his work ethic, his meticulous morphological work and commitment to excellence, and broad knowledge of fishes both inside and outside, not to mention the first-class images in his publications and oral presentations. He was a natural collaborator with a wide range of people. Dave was an enthusiastic sampler of many cuisines, with an enviable 'life list' of fish species eaten. He knew how to have a good time, both in his work and after hours. Dave Johnson didn't suffer fools –he had too much to do. He has left an impressive legacy based in large part on studying fish larvae.

Reference cited: A Nonaka, JW Milisen, BC Mundy, GD Johnson 2021 Blackwater diving: an exciting window into the planktonic arena and its potential to enhance the quality of larval fish collections. Ichthyology and Herpetology 109(1):138-156.

Fig. 36: *Acanthurus* sp., cleared and double stained by Dave Johnson.

ANNOUNCEMENT

Early Life History and Biology of Marine Fishes: Research inspired by the work of H Geoffrey Moser published on line

Jeff Leis

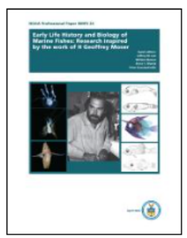
Institute of Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania, Australia

The 14th paper in the "Moser Volume" (Early life-history and biology of marine fishes: research inspired by the work of H. Geoffrey Moser) was published on line (on 28 November 2024). The proofs of the 15th paper are with the authors for checking, and this paper should be published soon. The Managing Editor is trying to get the remaining four papers published before she retires at the end of December.

The published papers can be found here:

https://spo.nmfs.noaa.gov/content/early-life-history-and-biology-marine-fishes-research-inspired-work-h-geoffrey-moser

Early Life History and Biology of Marine Fishes: Research inspired by the work of H Geoffrey Moser



Author(s): Jeffrey M. Leis, William Watson, Bruce C. Mundy, and Peter Konstantinidis (guest editors)
Year published: 2024
Report: https://spo.nmfs.noaa.gov/taxonomy/term/1957
Articles for this volume are published online after being typeset. The full volume will be published in print after all articles are published online. To see those that have been published and abstracts for papers in process, click on Report link above.

RAMBLE ON

Don't miss out! Renew your membership for 2025

Time to renew your membership and ensure you continue receiving future issues of STAGES! We know that you're all excited to attend the 48th Larval Fish Conference in Québec, it's shaping up to be amazing thanks to Dominique Robert and the organizing team. Attend as a member and **renew your membership for 2025 today**! If you have already paid your 2025 dues, thank you for your support. If not, you have several options to join ELHS:

1) **Joining ELHS as a voting member** (you must be or become an active member of AFS)

If you are an active member of AFS wishing to add (or renew) ELHS membership, simply check the box for the Early Life History Section on your annual fall AFS dues/subscription statement for the upcoming year and add the $15 annual ELHS dues to your annual AFS dues and other payments.

2) **Joining ELHS as an Affiliate Member** (non-voting member of organization, AFS affiliates and persons not belonging to AFS). $15 annual ELHS dues. You can join online at the website: https://earlylifehistory.fisheries.org/how-to-join/

Affiliate members of the Section are encouraged to participate in Section meetings, committee work, and other activities, but they cannot vote on official Section matters, run for or hold an elected office, or chair standing committees. All members receive STAGES, the official ELHS Newsletter.

A big thank you to the entire community for all your contributions this year! We hope you enjoy reading this issue as much as we enjoyed putting it together.

We wish you all Happy Holidays !

Ali & Nalani

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