STAGES

Newsletter of the
Early Life History Section
of the American Fisheries Society

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INSIDE THE ISSUE

ELHS Back in the Days

10 years ago: Sometime in 2010 Jeff Buckel takes over as ELHS Treasurer

15 years ago: The sudden passing of president elect Ed Brown shakes the society

25 years ago: Tom Miller takes over the newsletter and termed it STAGES

HEADLINE NEWS

Early Life History Section Election

The deadline for submitting nominations for the positions President-Elect and Secretary-Elect has passed and we received expressions of interest for both positions. Please take time to vote at the following link ELECTION. We only have one candidate for each position. The election will canvas full members of the Section. This year, we will hold our annual business meeting virtually to provide updates to our members from the Executive Committee and other ELHS teams. To accommodate our international membership, we propose hosting two options for the business meeting. One to accommodate those members in western North America and the Pacific (November 5th at 16:00 Seattle time; 17:00 Mountain; November 6th at 09:00 Tokyo time) and a second to accommodate those members in eastern North America and Europe (November 6th at 16:00 Berlin; 11:30 NL; 10:00 Eastern; 09:00 Central). Details for the virtual meetings will be sent by email prior to the meeting.

PRESIDENT'S MESSAGE

Although this may sound like a cliché but the impact of the pandemic has forced all of us to change how we approach our lives, education, research and interactions with colleagues. An impressive adaptive response to conditions surrounding COVID 19 was demonstrated by Hannes Baumann and the organizers of LFC 44 (Eric Shultz, Jacqueline Webb, Paul Anderson, Jon Hare) and the coordinators of the Early Career networking and hangout with larval fish experts (Hannah Murphy, Kelsey Swieca, Lysel Garavelli, Carolin Mueller, Michael Sswat, and Jessica Randall). Forced to postpone the in-person event until 2021, the team pivoted to produce an online virtual town hall that gathered roughly 170 people to listen to 16 well delivered and interesting presentations that covered an impressive range of topics dealing with the study of early life stages. An innovative response to difficult circumstances and the strong participation by our community is a demonstration of the strength of its membership and the dedication to the exchange of ideas.

The Early Life History Section is made up of individuals with a diverse range of interests. Although the historical link between ecological processes and the dynamics of exploited populations remains important, research linked to conservation, husbandry, and phylogeny provide the diversity to the section that make up its strength. Outside the LFC, where we have a change to appreciate contributions on a broad range of topics because of the plenary format we adopted recently, the newsletter provides members with a good opportunity to share the outcome of their research by contributing to the regional updates. A few paragraphs allow readers to gain insight into areas of research and education that they might not see in their normal review of the literature and thereby give an opening to incorporating a broader perspective in their understanding of early life history stages of fishes.

Fall of 2020 will see me step down from the presidency of our section to pass the mantle to Claire Paris. To be honest, I have not achieved what I had hoped to accomplish by increasing participation in the Early Life History Section of the American Fisheries Society as a result of changing work responsibilities that affected my ability to engage the broader community. Volunteerism is the foundation for the success of our Section and I have to thank all members of the executive committee (Hannes Baumann, Claire Paris, Alison Deary, Jeffrey Buckel), editors of the newsletter (Cindy van Damme, Audrey Geffen, and now taken over by Peter Konstantinidis), regional representatives, social media coordinator (Dominique Robert), and place and time coordinator (Chris Chambers). Individuals who agree to organize the annual Larval Fish Conference and the Early Career Events, a particular breed because all the planning and effort that goes into the execution of a successful event, also deserve special recognition as well as individuals who make special contributions to the meeting. However, this is a period of transition and there is a need for renewal as we seek applications for the position of President and Secretary Elect. While I realize that everyone has demands on their time, the continued health of the Section and the LFC depends on the willingness of people to step forward.

TOWNHALL MEETING

Fellow Larval Fish Enthusiasts!

"When life gives you lemons, make lemonade" Many of us have heard and uttered this saying before, but before the global COVID pandemic hit, few would have ever applied it to our section's most sacred and beloved institution, the Annual Larval Fish Conference. For more than 40 years, the conference has served as a unique forum for our tight-knit scientific community to exchange ideas, foster invaluable contacts for future careers and collaborations, and make friends. The organization of this year's 44th LFC was already in full in Mystic, Connecticut, one of those charming New England towns, where summer heat and ocean breeze combine to lift anyone's spirits. Alas, like so many events and gatherings this year, Olympics, Wimbledon, conferences large and small – we, too, had to abandon the idea of a physical meeting to keep us all safe.

But we weren't willing to simply hit 'Pause' for a year, which is where the lemonade comes in. We invited you to join a one-day virtual conference, and on 23 June 2020, more than 250 of you from all over the world came together to remotely attend 16 diverse science talks and a round table discussion – making history as the 1st Virtual Larval Fish Science Town Hall (Fig.1). Not only did we learn about new upcoming research and participated in a Round Table discussion organized by the Early Career Committee, we actually discovered that the virtual format also has a few surprising upsides. Most importantly, we had more attendees than during the last Larval Fish Conferences, many of which would not have been able to attend for financial reasons even in normal times. I personally enjoyed the unobstructed front row seat I had for every talk – and I could actually read everything that was on each speakers slide! Switching between speakers - often continents apart - was very straightforward and time-efficient, and the level of discussion after each presentation was engaging.

And because the event was stretched out over 12 hours, most time zones found a viable way to participate.

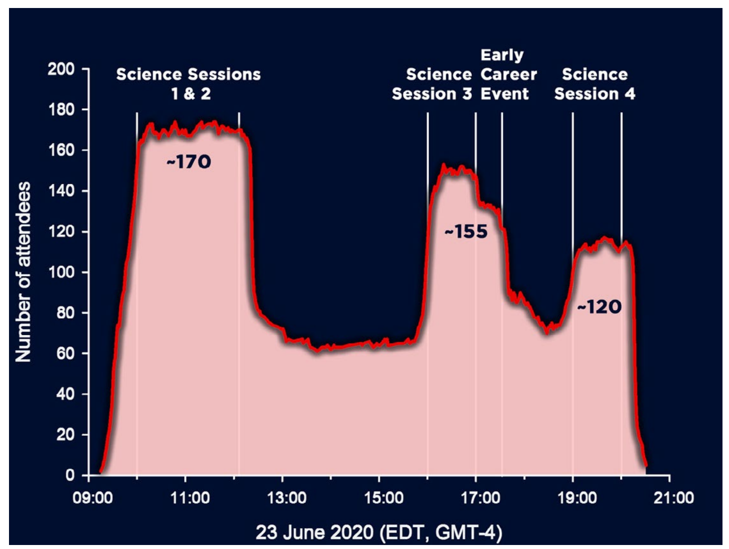


Figure 1: See how 252 attendees of the Virtual Larval Fish Science Town Hall spent their day. Science sessions were followed by 120-170 attendees worldwide

The First Virtual Larval Fish Science Town Hall ended with a participant poll for best presentation (congratulations, Ai Nonaka) and another online competition for best larval fish image (congratulations Kerryn Parkinson, Fig.2). The full line-up of talks, recordings, speaker information and all picture submissions are still available at lfc44.uconn.edu. We, the organizing committee, are profoundly grateful to all speakers and panelists for rising to the challenge and for their wonderful contributions.

But most importantly, let us all cross fingers for the dire circumstances to abate, so that we finally have a chance to welcome y'all to the real 44th Larval Fish Conference in Mystic, CT (20-25 June 2021). Save the date!

— Hannes Baumann, Eric Schultz, Jacqueline Webb,

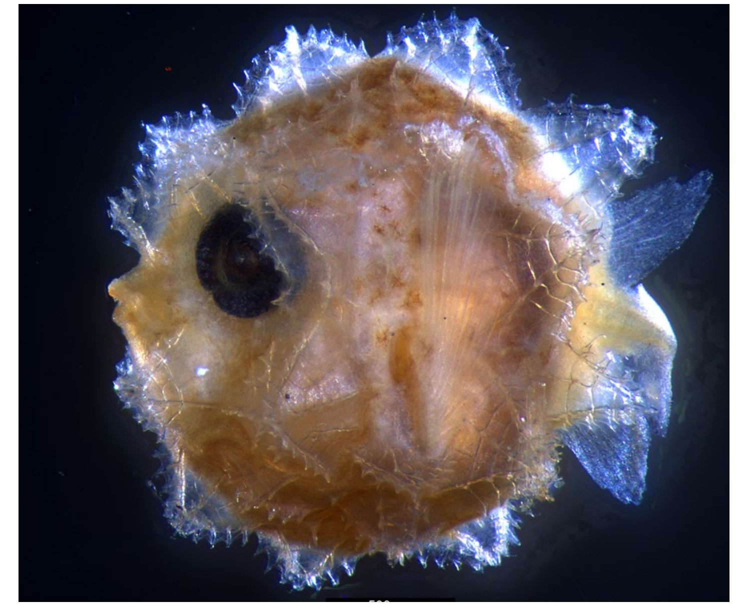


Figure 2: Photo competition winner - Kerryn Parkinson! *Mola* sp. - a larval Ocean sunfish collected off New South Wales, Australia

NEWS FROM THE REGIONS

North Central Region
By Ed Roseman

Due to the pandemic, most field programs were suspended or delayed in the region and across the Great Lakes. Our USGS crew working on the St. Clair and Detroit Rivers set egg mats in mid-March prior to suspension of field activities and were not able to lift them until June when approvals were granted for single day small boat field work. We expected to find no eggs but were pleasantly surprised to see viable lake sturgeon eggs on mats collected from man-made spawning reefs in the St Clair River, confirming use by lake sturgeon for another consecutive year since the reefs were built in 2014. Many of our staff are working from home, continuing to identify samples, performing data analyses, and preparing reports and manuscripts. We have also participated in numerous webinars, training sessions, and conferences, including the AFS Symposium "Contributions of Research on Early Life Stages of Fish to Informing Fisheries Management". Field work to assess fall spawning activities in the St. Clair and Detroit Rivers is expected to occur, following COVID-19 safety protocols.

Beginning in mid-June, USGS crews were cleared to conduct overnight multi-traveler field work, following strict COVID-19 safety protocols. This allowed our St. Marys River crew to conduct 6 weeks of larval sampling to assess larval drift and production near the Sault Locks, St. Marys River Rapids, and Little Rapids (https://www.glc.org/work/aocs/stmarys).

Figure 1: U.S. Geological Survey Great Lakes Science Center field crew processing a larval fish sample on the St. Marys River, August 2020. High densities of the cladoceran *Holopedium gibberum* made onboard sample processing challenging. Photo by E. Roseman.

These surveys measure changes in larval drift and production in relation to variable discharge rates through the St. Marys River Rapids, assess habitat changes in response to lock renovations, and monitor habitat restoration at Little Rapids.

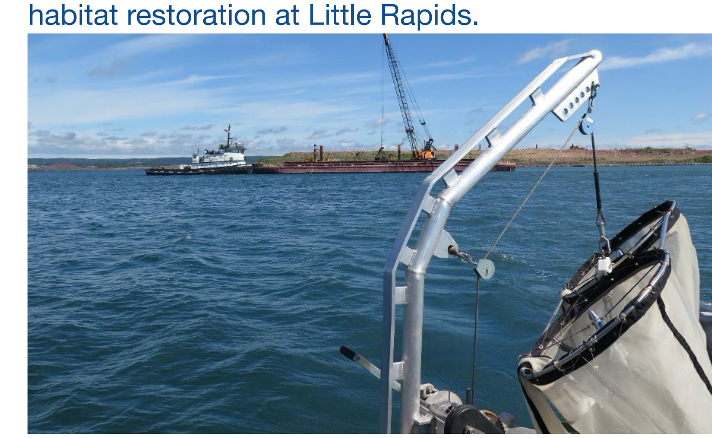


Figure 2: U.S. Army Corps of Engineers dredge barge in background deepening the upstream approach to the Sault Locks of the St. Marys River. Photo by E. Roseman.

Please see Roseman et al. (2020) listed below that describes discovery of lake sturgeon spawning in the St. Marys River Rapids.

Recent ELH Publications from the U.S. Geological Survey Great Lakes Science Center:

Baetz, A., T. Tucker, R.L. DeBruyne, A. Gatch, T. Höök, J.L. Fischer, and E.F. Roseman. 2020. Review of Methods to Repair and Maintain Lithophilic Fish Spawning Habitat. Water https://www.mdpi.com/2073-4441/12/9/2501/pdf.

Fischer, J.L., G.P. Filip, L.K. Alford, E.F. Roseman, and L. Vaccaro. 2020. Supporting Aquatic Habitat Remediation in the Detroit River through Numerical Simulation. Geomorphology. https://doi.org/10.1016/j.geomorph.2019.107001.

Fischer, J.L., E.F. Roseman, C. Mayer, T. Wills. 2020. If You Build it and They Come, Will They Stay? Maturation of Constructed Fish Spawning Reefs in the St. Clair-Detroit River System. Ecological Engineering.

Hunter, R., E.F. Roseman, N.M. Sard, R.L. DeBruyne, and K.T. Scribner. 2020. Genetic Family Reconstruction Characterizes Lake Sturgeon Use of Newly Constructed Spawning Habitat and Larval Dispersal. Transactions of the American Fisheries Society. https://doi.org/10.1002/tafs.10225.

Hunter, R., E.F. Roseman, N.M. Sard, R.L. DeBruyne, and K.T. Scribner. 2020. Egg and Larval Collection Methods Affect Spawning Adult Numbers Inferred by Pedigree Analysis. North American Journal of Fisheries Management DOI: 10.1002/nafm.10333.

Gatch, A.J., S.K. Koenigbauer, E.F. Roseman, T.O. Höök. 2020. The effect of sediment cover and female characteristics on the hatching success of walleye. North American Journal of Fisheries Management. 40(1): 293-302.

Roseman, E.F., Adams, R. L. DeBruyne, J. Gostiaux, H. Harrington, K. Kapuscinski, A. Moerke, and C. Olds. 2020. Lake sturgeon (*Acipenser fulvescens*) spawn in the St. Marys River Rapids, Michigan, Journal of Great Lakes Research https://doi.org/10.1016/j.jglr.2020.07.005

Roseman, E.F., S. Riley, T. Tucker, S. Farha, S. Jackson, and D. Bowser. In press - 2020. Diet and bathymetric distribution of wild juvenile lake trout *Salvelinus namaycush* in Lake Huron. Journal of Aquatic Ecosystem Health and Management Society.

Schmidt, B., E.F. Roseman, T. Tucker, C.M. Mayer. In press - 2020. Determining habitat limitations of Maumee River walleye production to western Lake Erie fish stocks: documenting a spawning ground barrier. Journal of Great Lakes Research.

A changing stock dynamic of Lake Whitefish in Green Bay, Lake Michigan.

Andrew Ransom and Lydia Doerr, M.S. Candidates University of Wisconsin-Green Bay, Aquatic Ecology and Fisheries Laboratory (PI Dr. Patrick S. Forsythe and Dr. Chris Houghton)

Lake Whitefish *(Coregonus clupeaformis)* are an economically and socially important fish native to the Laurentian Great Lakes. Widespread shifts in the Great Lakes food web is thought to be generating

Figure 1: Larval Lake Whitefish with red circle indicating the otoliths

corresponding changes in Lake Whitefish population levels and growth patterns, creating considerable concern among managers. Recently, a historic resurgence of spawning populations have been observed in major tributaries to Green Bay, a large embayment in the northwestern region of Lake Michigan. While Lake Whitefish within Lake Michigan proper have been declining, populations in Green Bay have shown the opposite trend. It is currently unknown how much these re-established ecotypes are contributing to the overall metapopulation.

To investigate this, we sampled for Lake Whitefish during the pelagic drifting larval stage in four major tributaries (Fox, Oconto, Peshtigo, and Menominee Rivers) suspected of producing fish. 1372 Lake Whitefish larvae were captured during the two year sample period (spring of 2017 and 2018) immediately downstream of spawning locations, and successful recruitment to the larval stage was confirmed in each tributary. The collection of these larvae represent the first ever documentation of Lake Whitefish reproduction in tributaries to Green Bay, and only the second occurrence in a tributary throughout the species' range. Larvae were also captured in downstream reaches of the Fox and Menominee Rivers, suggesting fish outmigrate and contribute to the population residing in Green Bay. Total production by each tributary was variable by year, but 479,753 to 1,987,497 larvae are estimated to have been produced during the two sample years.

Traditional stock delineation using genetic microsatellites has proven ineffective within the small geographical area of Green Bay, and otolith microchemistry is a potential tool to assess contribution by tributaries to the metapopulation.

Lake Whitefish are an ideal candidate for this technique at the larval stage due to a unique 4-5 month long incubation period and relatively large otolith size at hatch. Preliminary Linear Discriminant Function (LDF) results suggest this technique is able to successfully differentiate between riverine and open water (collected from both Green Bay and Lake Michigan) larvae, and had an overall reclassification rate of 76.8%. Specifically, this model had a successful open water reclassification rate of 71.4%, whereas the pooled Fox, Menominee, and Peshtigo River larvae

Figure 2: Neuston net used to sample larval Lake Whitefish in the four major Green Bay tributaries

were correctly reclassified 80.9% of the time. This LDF model can be modified to address different stock delineation objectives, and it is our hope that further development of this tool will aid managers in improving our understanding of the overall Lake Whitefish metapopulation structure within Green Bay and Lake Michigan proper.

Figure 3: Larval Lake Whitefish just after capture

Northeast Region
By Katey Marancik

Long-Term Ichthyoplankton Data a Valuable Addition to Stock Structure Determination

Early life history data from 3 decades of plankton sampling were used in a recent project to understand stock structure for Red Hake, a managed species in northeast US shelf waters. Red Hake have historically been managed as two stocks between the Gulf of Maine and North Carolina, with the dividing line through Georges Bank. This dividing line had never been thoroughly examined. In recent years, the northern stock has grown while the southern stock numbers have dwindled, leading to increased interest into the validity of the historic stock structure.

The Northeast Fisheries Science Center has sampled the early-life stages of fish on the northeast United States continental shelf since the 1970s, with the two most consistent programs being the Marine Resources Monitoring, Assessment, and Prediction

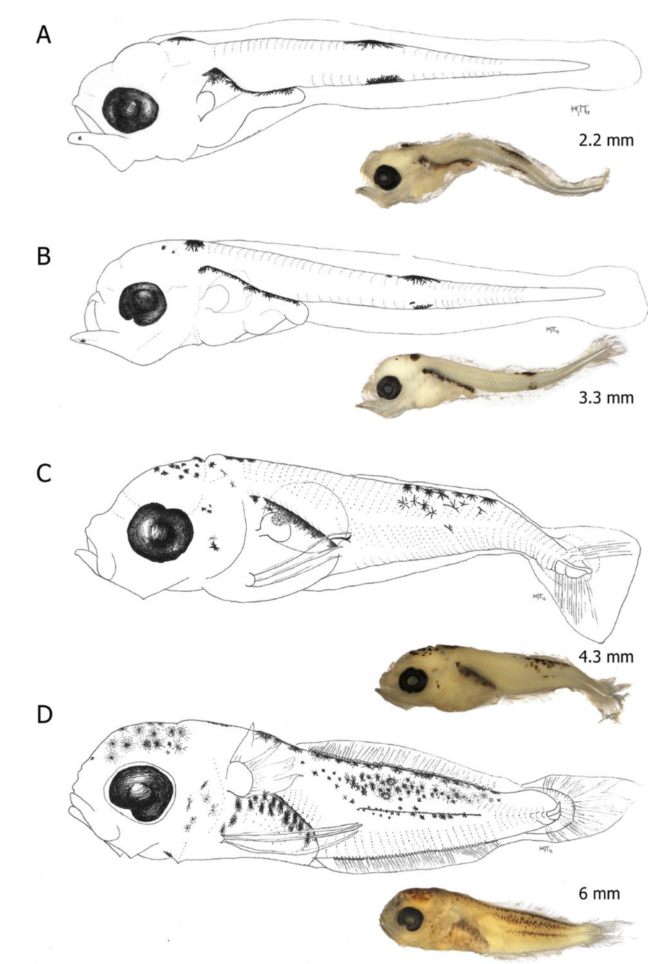


Figure 1: Red Hake series from Marancik et al., 2020

(MARMAP; 1977-1988) program and the Ecosystem Monitoring (EcoMon; 1999-present) program (Richardson et al., 2010, Walsh et al., 2015). Both programs sampled about 6 times per year from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia using 61-cm bongo nets.

Re-examination of thousands of larvae, including genetic barcoding, led to an updated description of morphological traits to separate species of the *Urophycis* genus (Marancik et al., 2020). In addition to the morphological analysis, a total of 92 otoliths were analyzed from red hake larvae collected from 2006 to 2009 and 2013. The size range spanned recently-hatched larvae to 8 mm, post-flexion larvae with an estimated age range of 1 to 25 days.

Larval distributions – observed data

Urophycis chuss larvae were collected throughout the Northeast U.S. continental shelf. Unique areas of spawning were identified using hot spot analysis (Gi* statistic; Getis and Ord, 1992) of *U. chuss* larvae under 5 mm BL. The presence of hot spots in time and space was used to identify unique clusters of strata that support high larval abundances. The southern New England and Georges Bank regions had significantly high abundances. The highest abundance of larvae observed in the western Gulf of Maine occurred

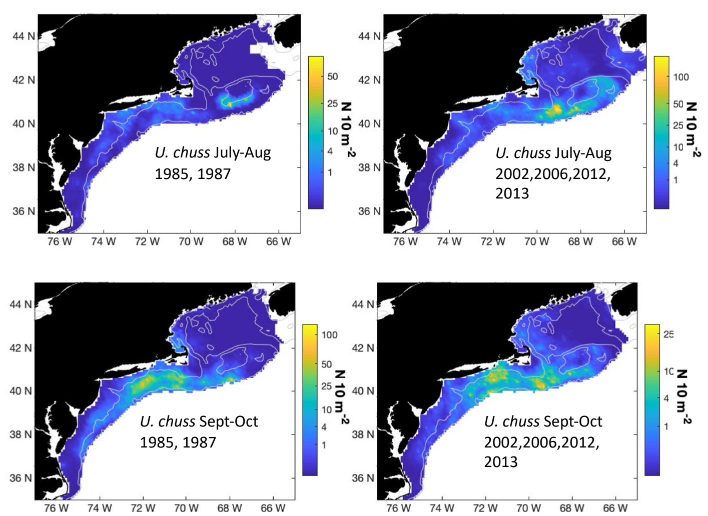


Figure 2: Red Hake larvae are consistently collected from the shelf offshore of approximately Chesapeake Bay to Portland, ME.

in 2012 and drove the identification of this area as a hot spot. Larval distribution throughout southern New England and Georges Bank has remained relatively stable through the 3 decades of sampling. An increase in larval abundances in the western Gulf of Maine was observed, but this is a fraction of the number of larvae occurring in southern areas (mean of 3.9%; range of 0-20.9%).

Larval transport evaluation methods – modeled data

A number of factors influence the scale of larval dispersal including: patterns in ocean currents, spawning location and timing, larval duration, larval vertical movements, and directed horizontal swimming capabilities. We used two approaches to evaluate larval transport, a larval transport model and a drifter trajectory analysis. Larval transport models couple ocean circulation models with models of larval behavior that can range from simple to complex. A general description of the particle-tracking model we used can be found in Churchill et al. (2011). Drifter trajectory models examine actual movement in the ocean as monitored by drifters, which have a buoy floating at the surface and an underwater sail, called a drogue, set at a predetermined depth (usually averaging 15 m). The drifter trajectory model was developed using the methodology described by Hare and Walsh (2007). From each model, the number of particles from a given release zone found in surrounding zones after a specified time were used to calculate estimates of retention and transport rates.

Spawning locations

We used the particle tracking and drifter model results to evaluate the likely source location of particles of a certain duration. Comparing the drifter tracks and particle-model tracks to larval distributions, suggests that spawning most likely occurs in the subregions of and adjacent to the highest concentrations of larvae. In our larval collections, 50% of larval red hake are <3 mm (~ 10 days post-spawning) and 90%of larvae are <5 mm (~16 days post-spawning) and thus transport times are short. Larvae collected in the western Gulf of Maine are likely the result of spawning in the western Gulf of Maine.

Spawning seasonality

Length and hatch date distributions were analyzed for red hake larvae collected during cruises recently re-identified for Marancik et al. (2020). The smallest larvae (1–6 mm) were collected during all seasons from May-June to November-December. However, July-August (54 %) and September-October (45%) had the highest proportion of larvae, with a peak of 2-mm larvae in July-August and 3-mm larvae in September-October.

Red hake larvae had estimated hatch dates ranging from week 22 to 46, the last week of May to the second week of November. Hatch date distributions estimated from larval ages indicated red hake spawn primarily during the summer (July to September). Importantly, these results differ from some of those presented in the review of red hake spawning phenology, possibly due to the availability of accurate species level larval identifications for this analysis.

The data and trends from these larval studies were combined with data from juvenile and adult stages, fisheries dependent and independent surveys, and otolith chemistry and physiology work. Together the data did not make a compelling argument against the historic stock structure and boundaries. A full discussion of the data and conclusions can be found in the recently released Final Report of the Red Hake Stock Structure Working Group (https://apps-nefsc.fisheries.noaa.gov/rcb/publications/crd2007.pdf)

Recent ELH Publications of the Region

Churchill, JH, J Runge, C Chen. 2011. Processes controlling retention of spring-spawned Atlantic cod (*Gadus morhua*) in the western Gulf of Maine and their relationship to an index of recruitment success. Fish. Oceanogr. 20: 32-46.

Hare, JA and HJ Walsh. 2007. Planktonic linkages among marine protected areas on the south Florida and southeast United States continental shelves. Can. J. Fish. Aquat. Sci. 64: 1234-1247.

Marancik, KE, DE Richardson, M Konieczna. 2020. Updated morphological descriptions of the larval stage of *Urophycis* (Family: Phycidae) from the northeast United States continental shelf. Copeia 108(1): 83-90. https://doi.org/10.1643/CG-19-219

Richardson, DE, JA Hare, WJ Overholtz, DL Johnson. 2010. Development of long-term larval indices for Atlantic herring (*Clupea harengus*) on the northeast U.S. continental shelf. ICES J. Mar. Sci. 67: 617-627.

Walsh, HJ, DE Richardson, KE Marancik, JA Hare. 2015. Long-term changes in the distributions of larval and adult fish in the Northeast U.S. shelf ecosystem. PLOS ONE 10:e0137382.

Trophodynamics of larval Redfish, *Sebastes* spp.

Figure 1: Newly-extruded redfish larva with commonly consumed prey taxa: copepod eggs and naupliar stages of copepods.

The lab of Dominique Robert at the Université du Québec à Rimouski is happy to announce a recent publication in the Journal of Plankton Research that reveals the trophodynamics of larval redfish, *Sebastes* spp., in the Gulf of St. Lawrence. This paper is the first to be published from Corinne Burns' Ph.D. thesis, which aims to identify drivers of the unprecedentedly strong recruitment of deepwater redfish in this region during the past decade.

After dissecting guts of newly-extruded larvae sampled from 1997-2000, larval redfish were classified as relatively generalist feeders. Whereas other species with similar morphology, such as Atlantic cod and Atlantic mackerel, feed on increasingly larger prey items throughout development, larval redfish continued to feed on small prey taxa, such as copepod eggs. Eggs from the calanoid copepod *Calanus finmarchicus* represented the bulk of carbon ingested by redfish larvae of all size classes in all four collection years. Chesson's-alpha selectivity indices, which compare proportions of taxa in the diet to proportions of the taxa in the environment, indicated neutral selectivity for all 7 commonly consumed prey taxa in the larval diet, with the exception of positive selection for *C. finmarchicus* eggs by redfish larvae from 1999 and 2000. These results support a previous hypothesis proposed by Runge and de Lafontaine (1996) that early-life redfish survival in the Gulf of St. Lawrence directly depends on the spatiotemporal overlap between larvae and a high abundance of *C. finmarchicus* eggs.

After 30 years of poor recruitment, deepwater redfish has boomed to >5 million tons within the Gulf and is poised to become one of the most important fisheries in Eastern Canada over the coming years. The present study constitutes the first step for gaining in-depth understanding of bottom-up drivers regulating the fluctuations of this population.

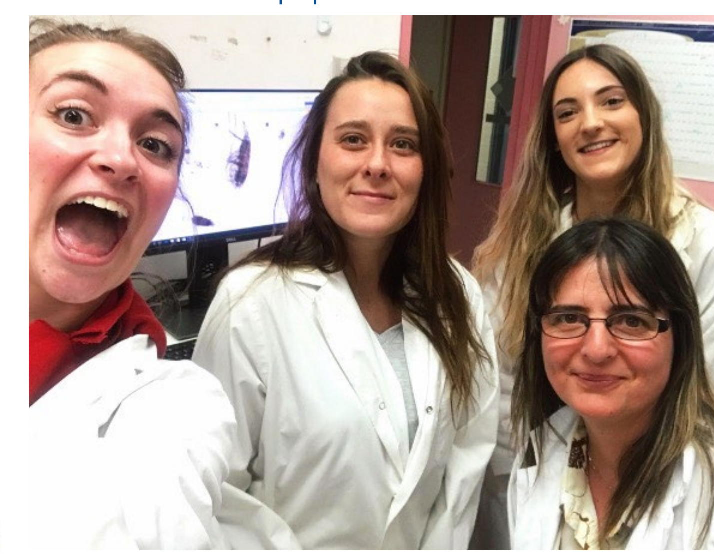


Figure 2: The Robert lab's "Team Sébaste" (sébaste is the common name of redfish in Québec) enjoyed learning copepod identification in order to assess diet composition of larval and juvenile redfish from lab technician, Lucienne Chénard. Pictured from left to right: Corinne Burns, Sarah Brown-Vuillemin, Lucienne Chénard (bottom), Lola Cous

The overall goal of Corinne's Ph.D. thesis is to provide tools that will facilitate the sustainable management of the redfish fishery.

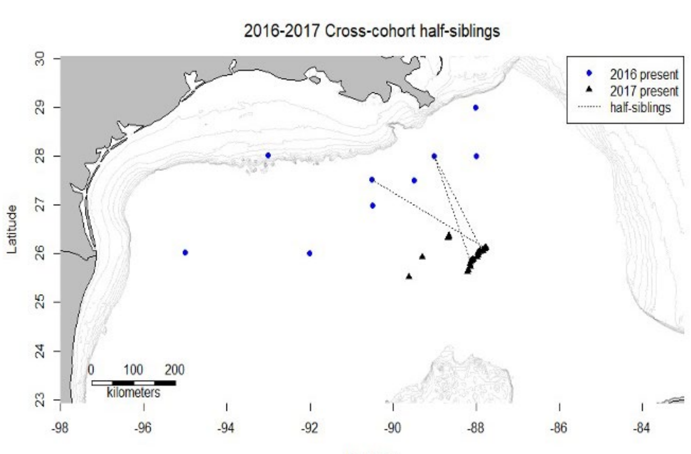
Corinne and co-authors would like to thank everyone in the ELHS community who offered feedback on this project after presenting these results at the 43th Annual Larval Fish Conference in Mallorca, Spain prior to the writing of this paper.

Burns, C.M., Lauzon, F., Plourde, S., Sirois, P., Robert, D. (2020) Interannual variability of diet composition and prey preference of larval redfish (*Sebastes* spp.) in the Gulf of St. Lawrence. *Journal of Plankton Research*, 42(5):581-594. doi: 10.1093/plankt/fbaa040

Southern Region
By Trika Gerard

Globally, tunas are among the most valuable fish stocks, but are also inherently difficult to monitor and assess. Standardized larval surveys aim to measure relative spawning biomass of West Atlantic Bluefin tuna, *Thunnus thynnus* annually in the northern Gulf of Mexico (GoM). In a collaborative effort, The Early Life History Unit and the Sustainable Fisheries Division at NOAA's Southeast Fisheries Science Center (SEFSC) used Close-kin mark recapture to determine levels of sibship within and among larval aggregations of Bluefin tuna in the GoM. Close-kin mark recapture is a genetics-based technique capable of identifying individuals in the population based on the DNA profiles of their closely related family members, including parent-offspring and sibling genetic matches. Application of close-kin mark recapture to Atlantic bluefin tuna is expected to solve two major uncertainties: 1) identify the origin of fish caught by U.S. fisheries and 2) estimate the absolute abundance of Gulf of Mexico spawning stock annually. These two pieces of genetics-based information will allow SEFSC to monitor the trends in domestic stock production, as well as the contribution to catches of other stocks that migrate to U.S. fishing areas.

The research leveraged biological sampling for bluefin tuna in the West Atlantic to build a genetic database of DNA profiles. Sampling from known spawning grounds in the Mediterranean Sea and Gulf of Mexico provided genetic baselines for the stocks, from which we identified stock-identification markers. The larval collections also provided a method of marking actively spawning fish each year without ever handling the large, mature tuna. Simply put, each larval fish contains the genotypes of its mother and father, and therefore contains the genetic tag of two spawning fish in the Gulf of Mexico. Sampling adult fish from the fishery provided the recapture event, after the spawning fish migrated and mixed with the unmarked population. In our first pilot study evaluation, we identified two parent-offspring matches of fish that spawned in the Gulf of Mexico in May 2017 and were captured and sampled in Canada later in fall of 2017. Results also identified two half-sibling captures across years (2016 and 2017), translating to the recapture of two unique parents between 2016 and 2017. This pilot study provided the proof of concept that quantifying the unique number of spawners in the population based on larval catches is a possibility. The goal for the next phase of the project is to estimate the total abundance of the Gulf of Mexico spawning stock based on the ratios of genetically marked and unmarked fish in the 2016 to 2018 biological collections. The work is collaboratively conducted with partners from the Commonwealth Scientific and Industrial Research Organization, Virginia Institute of Marine Sciences, University of Maine, Canada Department of Fisheries and Oceans, and NOAA Fisheries.



Western Region
By Dan Margulis

Light trap captures of larvae of endangered Razorback Sucker *Xyrauchen texanus* are used to guide flow release timing from reservoirs and measure their annual reproductive success in the Green River, Utah, upper Colorado River basin, USA. However, little is known regarding efficacy of light traps to capture or retain larvae under variable and field-relevant environmental conditions. We conducted laboratory and field experiments, which are described in two articles presently *In Press* in the North American Journal of Fisheries Management (early online versions available at

https://afspubs.onlinelibrary.wiley.com/doi/10.1002/nafm.10491 [Featured article] and https://afspubs.onlinelibrary.wiley.com/doi/10.1002/nafm.10508). In the first article, we describe laboratory experiments that investigated effects of light trap set time, fish release distance from trap, light presence, turbidity, fish density, and cover on capture and retention probabilities of five early life stages of Razorback Sucker (range = 7-37 mm TL). Mean capture probability of protolarvae 7–9 mm TL was relatively low at 0.40 (range = 0.28–0.55) prior to swim bladder development, but increased to 0.86 for mesolarvae (0.82–0.90; 11–17 mm TL), the most common life stage captured in field sampling, and then declined for metalarvae and juveniles (e.g., juvenile mean = 0.24, range = 0.20–0.28). Larvae retention probabilities were generally high (> 0.75) and increased to 0.97 for juveniles. Longer set times positively influenced capture probabilities, though capture probabilities were similar with 1-, 3-, and 5-m release distances. Light presence in traps greatly increased capture and retention of larvae compared with unlit traps.

To test our laboratory findings in a field-relevant setting, we released unmarked and marked (oxytetracycline hydrochloride immersion) mesolarval Razorback Sucker in a 53-ha wetland of the middle Green River, Utah and report those results in the second article. Batches of 10, 50, 250, or 1,000 larvae were released 3- or 10-m from light traps, which were equipped with either a light-emitting diode (LED) or chemical light stick (CL). Light traps recaptured larvae each night at all release abundances in this large and open habitat. Recapture proportions (no. recaptured/ no. released) for individual traps ranged from 0 to 0.68 (mean = 0.11) over the two release nights. Recapture proportions were similar over all release abundances, indicating light trap captures may be an index of larvae abundance. In addition, recapture proportions of larvae in traps (light sources combined) were not influenced by release distance, and LED-lit traps had consistently higher recapture proportions than CL-lit traps, in support of laboratory findings.

Our results confirm that light traps may be useful to detect first presence of Razorback Sucker larvae in Green River backwaters each spring, which triggers Flaming Gorge Reservoir releases to inundate floodplain wetlands, and will aid management and conservation of endangered Razorback Sucker in the Colorado River basin. We also provide recommendations for gear set up, deployment, and techniques to increase capture and retention probabilities of Razorback Sucker larvae. Please contact us if you would like more information about our research.

Catherine M. de Vlaming and Kevin R. Bestgen

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IN MEMORIAM

In Memoriam

Robert G. Werner

1936 – 2020

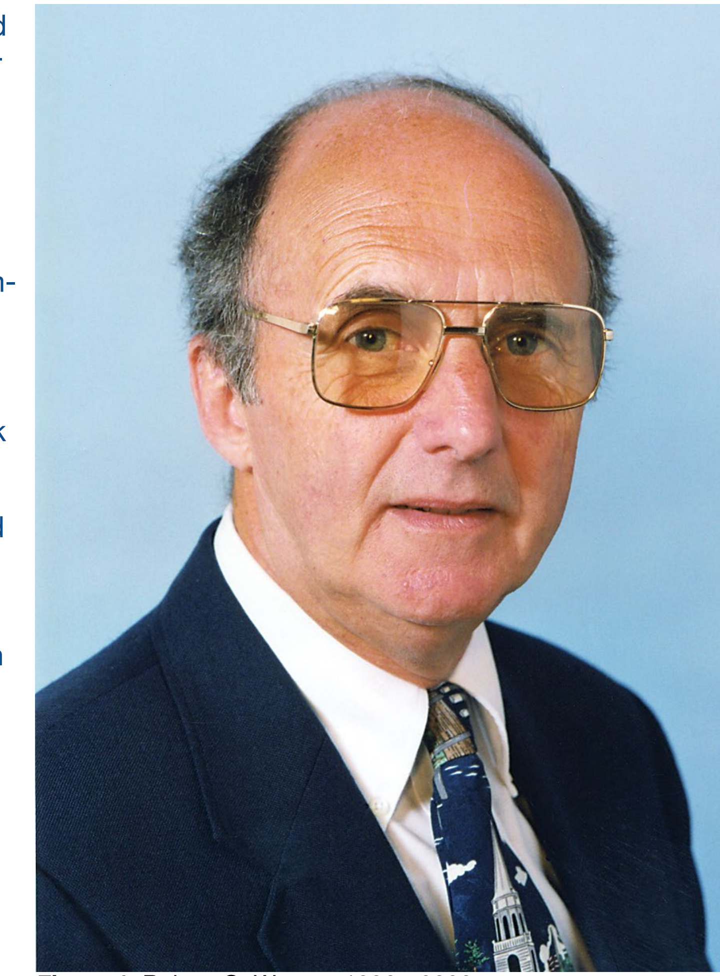

Figure 1: Robert G. Werner; 1936 - 2020

The Early Life History Section lost one of its most long-standing members on September 13, 2020. Bob Werner passed away after 6-month battle with cancer. Bob enjoyed more than 20 years of retirement, so many members of today's ELHS community may not have had the great pleasure of knowing this warm, charming, happy, humble, and gracious fellow. An article in the October 2004 issue of STAGES, which commemorated Bob's retirement several years earlier, summarized his professional career to that point. Here, I repeat and update that article.

Bob Werner was a dedicated member of the Section since its inception. He was appointed to the Provisional Executive Committee that led the Section through its organizational year (1979-1980). The Section largely grew out of the Larval Fish Conferences, and in the early years of the ELHS its editorial board oversaw publication of the Larval Fish Conference proceedings. Bob served as an Associate Editor (1985-1988). His service to the Section's governance continued when he served as President-Elect (1986-1988) and the Section's seventh President (1988-1990). Up until that time, only one of the 12 Larval Fish Conferences had taken place outside the U.S. (Vancouver, 1984). In his "President's Reports" published in STAGES, Bob described new initiatives to expand involvement of scientists from other nations and to increase interactions with other AFS sections. Since then, the conferences gained more and more international participation.

Born in South Bend, Indiana, Bob received a B.S. in Zoology from Purdue University. After serving a tour of duty in the U.S. Marine Corps, stationed in California, he attended UCLA and received a master's degree in Zoology. From there, he returned to his home state to enter a doctoral program at Indiana University under the supervision of Shelby Gerking. Bob's doctoral dissertation research resulted in publications on the ecology and movements of bluegill larvae, which appeared in *Transactions of the American Fisheries Society* (1967) and *American Midland Naturalist* (1969), as well as a chapter on methods for sampling fish larvae in Bill Ricker's *Methods for Assessment of Fish Production in Fresh Waters* (1968). These were the very early days of larval fish research in North American freshwaters systems, and Bob's work was truly pioneering. The National Power Plant Team organized a freshwater larval fish workshop in 1976 in Ann Arbor, Michigan, which preceded even the first of what we now refer to as the annual Larval Fish Conferences. Already a recognized expert, Bob was invited to attend, and the proceedings of that workshop included a "state-of-the-art" paper and an annotated bibliography, both on larval fish taxonomy and authored by Bob Werner.

The State University of New York – College of Environmental Science and Forestry (ESF) in Syracuse hired Bob as an Assistant Professor in 1966. He moved to nearby Cornell University for two years, then returned to ESF, where remained until he retired. He taught limnology, ichthyology, and fishery biology. He also developed a tropical ecology course that took him and his classes to Dominica in the West Indies, possibly to escape the long, snowy winters of Syracuse (although Bob enjoyed cross-country skiing!). His research interests were broad, including studies of fish reproductive movements and habitat use, nursery habitat ecology, feeding and growth of fish larvae, fish bioenergetics, and invasive zebra mussels. A 1999 tribute published in the Great Lakes Research Consortium Report stated: "his research has varied from sunfish, to suckers, to sturgeon, and rainbow trout to zebra mussels, plankton and aquatic insects." Within New York State, he conducted research in the Great Lakes, Adirondack Mountains, Oneida Lake, Finger Lakes, and the St. Lawrence River, where he is well known for his studies on northern pike and muskellunge. But his research extended well beyond the borders of New York. His sabbatical leaves took him to the Scottish Marine Biological Association (Oban, Scotland) to work with John Blaxter (1978), Buenos Aires, Argentina as a Fulbright Scholar (1988-1989), and the NMFS Beaufort Laboratory (1996).

Figure 2: From left to right: Bob Hoyt, Bob Werner, Lee Fuiman, and Bob Batty.

Featured among Bob's professional honors are a Fulbright Scholarship, being elected Fellow of the American Institute of Fishery Research Biologists, and the AFS Professional Achievement Award. He was elected President of the New York Chapter of the American Fisheries Society, President of the Early Life History Section of AFS, and elected to the council on Great Lakes Resource Managers. He also served as a founding Co-Director of the Great Lakes Research Consortium. He was Associate Editor of the *Journal of Freshwater Ecology* and *Transactions of the American Fisheries Society*, and he served on many more professional panels and committees.

During the summer of 1976, Bob and his family lived on an ESF property on Governors Island, where he studied fishes on the St. Lawrence River. With his students, he continued to develop a long-term fish ecology research program on the river, which eventually grew to become the Lorraine E. Lewis Thousand Islands Biological Station. Upon his retirement, he was named Professor Emeritus at SUNY-ESF.

I wrote in 2004 that this record reflects a personality that could not possibly close the door at retirement. How true that was. Around the time of his retirement, I invited Bob to help edit a textbook (*Fishery Science: The Unique Contributions of Early Life Stages*) aimed at improving the training of young fishery scientists by emphasizing the importance of early life stages. He eagerly accepted the offer, and during the course of our two-year collaboration, I found his contributions to the book to be far greater than I could have imagined. But, Bob's list of post-retirement projects was endless. After completing our book, he took on a revision of his own book *Freshwater Fishes of New York State: A Field Guide*, originally published in 1980. From what I can surmise, that revision turned into a very popular expansion, as *Freshwater Fishes of the Northeastern United States: A Field Guide,* which appeared in 2004.

He also authored several waterproof, laminated folding guides to the freshwater fishes of different parts of the United States (New England and the Adirondacks; Florida; Texas; Southeast) published between 2009 and 2011 (check them out on Amazon.com).

An interview published in the *SUNY-ESF Alumni News* (Winter 2011) described some of his contributions to organizations in Upstate New York that deal with natural resource issues. He was Chairman of the Board of the Upstate Freshwater Institute, which addresses issues of aquatic ecology on Onondaga Lake and on the water supply reservoirs in New York City. He was Secretary of the Finger Lakes Land Trust, which works with landowners and farmers to preserve the beautiful landscape of the region. As a homeowner on Skaneateles Lake, he had a professional and personal interest in the health of that system. He brought scientific expertise to the Skaneateles Lake Association, when working with the New York Department of Environmental Conservation and other organizations as they addressed the environmental challenges of invasive Eurasian watermilfoil, hydrilla, and Asian clams, and the massive influx of salt and nutrients into the lake caused by heavy rains. Because of his "passion, dedication, and commitment" to the health of the lake, the community of Skaneateles named Bob "2013 Citizen of the Year" and the *Skaneateles Press* named him "Hero of the Lake" in 2014.

Those who attended Larval Fish Conferences during Bob's active years remember him as a wonderfully charming, thoughtful, and creative fellow. They will have met his lovely and gregarious wife, Jo, who often accompanied him to conferences. They were a terrific, fun couple...if you were able to keep up with them. It's no surprise that they enjoyed the company of many friends and a loving family, including two children and five grandchildren.

The State University of New York – College of Environmental Science and Forestry is accepting donations to the Robert G. Werner Scholarship to support a student at the Thousand Islands Biological Station (https://www.esf.edu/wernerfund). Donations to honor Bob Werner can also be made to the Skaneateles Lake Association (skaneateleslake.org/memory-honor-donation) or Finger Lakes Land Trust (www.fllt.org/donate).

— Lee A. Fuiman

LARVA OF THE ISSUE

Figure: Larval Ragfish, *Icosteus aenigmaticus*, standard length 13.3 mm. Photo by Peter Konstantinidis

The Ragfish, *Icosteus aenigmaticus*, became known to science in 1880, when Lockington obtained two juvenile specimens from a fish market in San Francisco. The two specimens were unfortunately lost in a fire caused by an earthquake that devastated California in 1906.

Lockington described the ragfish as being nearly scaleless (only spinous scales on the lateral line) with bony prickles on the fin rays of each fin. Purple spots and blotches are distributed over a yellowish-brown ground colour, a round caudal fin, and small pelvic fins.

Seven years later Tartelton H. Bean received a large fish (approximately 182cm) that Mr. Charles Willoughby found in Damon, Washington. Bean recognised the close resemblance to the ragfish but based on some morphological differences described it as a different species, *Acrotus willoughbyi*, in honour of its collector, in 1888.

73 years later Clemens and Wilby realized that *Icosteus aenigmaticus* and *Acrotus willoughbyi* are the juveniles and adults of the same species.

The relationship of the ragfish to other fishes remains enigmatic, and many systematists have placed the Ragfish close to the butterfishes and their relatives (Stromateoidei), with which it shares a superficial resemblance.

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RAMBLE ON

Audrey Geffen and Cindy van Damme handed the editorial task of Stages over to me after five years of wonderful work. I am excited and look forward of communcating with you all in the years to come. As you might have noticed, I changed a few things, for example the color scheme. I introduced a new column, *Larva of the Issue*, which will be at the end of each Stages, just before I *Ramble On* (a reference to one of my favorite Led Zeppelin songs which is with 4:22 minutes length a short ramble compared to some other songs they have). For *Larva of the Issue* I invite you all to submit a photo of your favorite larva and a short description that can be featured in the issues to come. The description can be something historical (as I did it), something that you experienced working with your favorite baby, life history, what have you. In the March 2021 issue of Stages I am going to introduce another new rubric, *Ichthyoplankton Collections*. In each issue I would like to introduce a collection or museum that is of interest to larval fish enthusiasts. The reason I have in mind is to provide information of collections for loans but more importantly for potential deposits of the larvae that are collecting dust and take up a lot of space in your labs, or simply to find a collaborator for your future project, who might be able to provide guidance about sampling techniques, data management, or most importantly a timely accessioning of your samples in a suitable collection. No worries, I will provide a template by starting with the Oregon State University Ichthyology collection which has large holdings of larval fishes. I hope you enjoy the issue!

Enough Rambling On! I wish you all the best for the remaining time of 2020 and hope you will have a successful start of 2021!

Peter

Don't forget to submit your contributions for the March 2021 issue of Stages no later than February 28th, 2021.