



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

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Audrey J. Geffen & Cindy J.G. van Damme, Editors

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Please join us at the

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42nd Annual Larval Fish Conference

The 42nd annual Larval Fish Conference (LFC) will be held from 24-28 June 2018 in Victoria, British Columbia, Canada. The meeting is being organized by John Dower (dower@uvic.ca), Francis Juanes (juanes@uvic.ca) and Pierre Pepin (pierre.pepin@dfm-mpo.gc.ca). Victoria is located on Vancouver Island and can be reached via connections through Vancouver and Seattle airports as well as via car ferries and high-speed catamarans.

Registration and Abstract submission now open! <http://lfc-2018.com/>

...More info on p. 8

ELHS Back Then

5 years ago: ICES launches online eggs and larvae database for ICES coordinated ichthyoplankton surveys (eggsandlarvae.ices.dk)

15 years ago: Bibliographic committee updates Bob Hoyt's bibliography to include 15,596 entries through July 2002

25 years ago: Bob Hoyt appointed as first Historian/Archivist for Section

35 years ago: Section membership was 360 members, with "several dozen" 'newsletter members'

President's Message



Dear friends and colleagues,

Warm greetings from the frosty US Gulf coast! It seems like I always start these messages with some acknowledgment of my current weather conditions, but honestly it's hard to ignore the meteorological craziness we've experienced. It's been some year in the southern US, with a sweltering summer (okay, that's the norm), bouts of torrential rain, a series of tropical storms and hurricanes, and now record low temperatures for many of us. I'm writing this message from home in south Alabama because today is a "snow day" for many of us; roads and bridges are iced over, and schools, offices, and universities are closed all along the Gulf coast. Admittedly, it's a laughable amount of snow compared to what our higher latitude members experience, just barely enough for us to make (pathetically small) snowmen. But believe me, as mild as it seems to many of you (and I've heard the snickering already), you really don't want to be out on the roads with a bunch of southerners trying to drive in these conditions. That's just asking for trouble!

...continued on p. 6

Deadline for material to be included in the next issue of Stages:

June 15, 2018

News from the Regions



Pacific Rim Region

Akinori Takasuka

Launching a collaborative framework between Universidade de São Paulo and the Japan Fisheries Research and Education Agency

A workshop on “Comparative study on biological processes of population dynamics of small pelagic fish in the Southeastern Brazilian Bight and Kuroshio Current system: Launching a collaborative framework” was held in Yokohama, Japan, during October 23–27, 2017. This workshop was intended to launch a collaborative framework for a comparative study on small pelagic fish biology in the Southeastern Brazilian Bight (SBB) and Kuroshio Current system (KCS)” between Instituto Oceanográfico, Universidade de São Paulo (IO-USP) and National Research Institute of Fisheries Science, Japan Fisheries Research and Education Agency (NRIFS-FRA). The collaborators from Brazil and

Japan had a practical workshop to discuss collaboration plans after exchanging the information on recent progresses in studies on small pelagic fish on each side. During the workshop, the participants reviewed the data availability, developed a collaborative framework, selected relevant topics, and then proceeded with some preliminary analyses. The workshop was conducted in a closed style (invited participants only), but an open-style seminar was held to provide a networking environment between the institutes.

In a past issue of STAGES (Vol. 37 (1) March 2016), I reported my visit to São Paulo, Brazil, to introduce the recent activities of the Laboratory of Ichthyoplankton at the IO-USP. Since then, I have planned this workshop to establish a collaboration framework between IO-USP and NRIFS-FRA. For this purpose, I invited Drs. Mario



Group photo of the collaborators with some audience after the seminar at NRIFS-FRA on October 23, 2017.

Katsuragawa, June Ferraz Dias, and Jana M. del Favero (IO-USP) to NRIFS-FRA in October, 2017. Dr. Yoshioki Oozeki, Hiroshi Kuroda, and Takeshi Okunishi, and me participated in the workshop from the FRA side. Before the workshop, an unexpectedly huge typhoon (No. 21), whose central atmospheric pressure stood at 945 hectopascals, was traveling north at a speed of 40 km/h around Japan. The timing was quite marginal. The typhoon reached to Yokohama on Sunday night (immediately after the flight arrival of the three scientists from São Paulo)

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Section Officers

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research activities.*



Western region

Dan Margulies

Larval fish assemblages in the eastern and western Gulf of Alaska provide insight into ecosystem connectivity, regional responses to climate variability, and spatial management delineations in a large marine ecosystem

One substantial challenge in the management of Large Marine Ecosystems (LMEs) lies in defining ecologically relevant spatial delineations for management over expansive geographic domains. As management goals expand in scope from a population to an ecosystem perspective, ecosystem components including oceanography, single species dynamics, and communities must be understood in isolation and in concert in order to address interactions and responses to environmental variability. The Gulf of Alaska (GOA) is currently managed as a single LME and is connected by prevailing westward

flowing currents (see Figure); however, recent oceanographic (Ladd and Cheng 2016; Ladd *et al.* 2016) and demersal fish community studies (Mueter and Norcross 2002) suggest that the eastern GOA and western GOA may be regionally distinct environments. We utilized a multispecies approach using 6 years (2010-2015) of larval fish community data to enhance our understanding of ecosystem connectivity across the GOA as a part of a larger Gulf of Alaska Integrated Ecosystem Program (GOAIERP). We hypothesized that patterns in pelagic larval fish communities would reflect ecosystem continuity across the GOA as a result of the prevailing currents. Further, we paired larval fish assemblage data with co-collected water temperature and salinity, seasonal and inter-annual temperature variability, adult fish distributions, satellite-tracked drifters, and a particle tracking Individual-Based Biophysical Model (IBM) to determine the potential drivers of assemblage patterns.

The results of our study reveal seasonal patterns in assemblages and suggest that westward flowing currents create a gradient in larval fish assemblages that ultimately results in distinct communities in the eastern and western GOA (see Figure). While

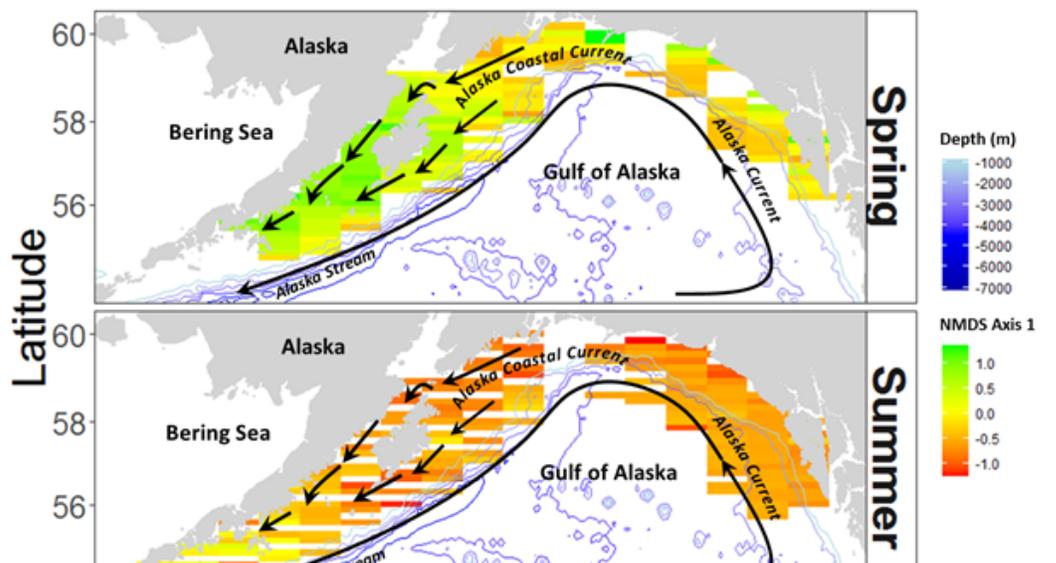
our results suggest that the local physical environment plays a minor role in structuring assemblages, larval fish communities in the eastern and western GOA responded differentially during years of anomalously warm water conditions associated with the “the blob” that began in the spring of 2013 and continued through 2015 (Kintisch 2015). Such patterns indicate regionally distinct responses to climatic variability in the GOA. Ultimately, our results suggest that despite some connectivity and continuity in larval fish assemblages across the GOA, the eastern and western GOA represent unique ecosystems with differential responses to anomalous climatic conditions. Shifts in assemblage patterns associated with anomalously warm water also highlight the influence of climate variability on community dynamics and the implications of such patterns toward ecosystem management and delineations. This study underscores the potential role of larval fish assemblages as indicators of ecosystems dynamics that can reflect oceanographic conditions and rapid responses to environmental and climate variability.

Kintisch E (2015) ‘The Blob’ invades Pacific, flummoxing climate experts. *Science* 348:17–18
Ladd C, Cheng W (2016) Gap winds and their effects on regional oceanography Part I: Cross Sound, Alaska. *Deep Sea Res Part II Top Stud Oceanogr* 132:41–53

Ladd C, Cheng W, Salo S (2016) Gap winds and their effects on regional oceanography Part II: Kodiak Island, Alaska. *Deep Sea Res Part II Top Stud Oceanogr* 132:54–67

Mueter FJ, Norcross BL (2002) Spatial and temporal patterns in the demersal fish community on the shelf and upper slope regions of the Gulf of Alaska. *Fish Bull* 100:559–581

- Esther Goldstein, Janet Duffy-Anderson and Ann Matarese (NOAA/NMFS Alaska Fisheries Science Center, Seattle, Washington)



Spatial depiction of multivariate analyses of fish assemblages from 2010-2015 in spring and summer seasons. Non-metric Multidimensional Scaling Analysis (NMDS) using Bray-Curtis dissimilarity index axis 1 scores were averaged across all study years within each grid cell and designated by color. Arrows represent general oceanographic currents within the Gulf of Alaska, and contours show the bottom depth.

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North East Region

Katey Marancik

Are northern sand lance (*Ammodytes dubius*) embryos particularly sensitive to high CO₂?

Wednesday, 22 Nov 2017: On this dimly lit November afternoon, rain mercilessly drenched scientists and crew on board the RV "Auk" as it slowly navigated the waters of Stellwagen Bank. A world like a wet sponge. Sky and ocean, indistinguishable.

Thanksgiving, the next day: Despite the circumstances, the team's mood was nothing short of elated. Our small beam trawl had just spilled hundreds of silvery fish on deck, wriggling like eels. They were Northern sand lance (*Ammodytes dubius*).

Running ripe adults.

Spawning.

Apparently, they like Thanksgiving, too.

As the ship docks back in Scituate harbor that day, the rain thinned to hazy darkness.

"Let's get a coffee and then on the road," mumbled Chris, who led the team, "the real work of the experiments has just begun."

Stellwagen Bank, the National Marine Sanctuary just north of Cape Cod is a true hotspot for some of the Atlantic ocean's most iconic creatures: whales, seals, tunas, seabirds, who all share a particular appetite for this one fish – sand lance. The Sanctuary calls this species its 'backbone', to others it's a classic forage fish responsible for transferring massive amounts of energy from lower to upper trophic levels. Sand lance have a few interesting and rare characteristics; they alternate between pelagic schooling (foraging) in the water column and extended periods of being almost completely buried in sand. For that, they rely on sand of a particular grain size and with very little organic content. It's the kind of sand that happens to define large areas of the Stellwagen Bank.

Surprisingly little is known about the ecology and ecosystem importance of this sand lance species, although research on its European relatives (*A. tobianus*, *A. marinus*) is more advanced. In particular, experiments on early life stages of *A. dubius* have been lacking, although pioneering work by the late Alfons Smigielski in the 1980s detailed rearing methods on the more coastal species *A. americanus* (Smigielski et al. 1984).

coastal wasters, where smaller seasonal and diel CO₂ fluctuations more closely resemble oceanic conditions. Could therefore sand lance offspring be particularly sensitive to predicted oceanic CO₂ levels during the next 100-300 years?

Over the past two years (2016-17), we successfully found and sampled spawning ripe sand lance on Stellwagen Bank during a narrow window in late November. The adults were strip-spawned on board or after being transported live to our laboratory (Rankin Lab, University of Connecticut, Avery Point). We reared newly fertilized embryos to hatch and feeding larval stages under factorial combinations of



The RV Auk in early morning, getting ready for another sand lance sampling trip to Stellwagen Bank (photo: Hannes Baumann)



Chris Murray checks the content of a sediment grab for sand lance. RV Auk (Photo: Jacob Snyder, RedSkiesPhotography)

One question that was of particular interest to our lab involved the potential CO₂ sensitivity of this fish species. That's due to two other interesting and rare characteristics of sand lance. They spawn in late fall and winter in cold (and still cooling) waters, which is why their eggs and larvae develop extremely slow compared to other, more typical spring and summer spawning species. In addition, the species is found not in

temperature × CO₂, measuring survival and growth traits along the way.

Our experiments are still ongoing, and rearing protocols are being improved.

The preliminary findings, however, are stunning. Survival to hatch was dramatically reduced under elevated (~1,000 μatm) and high (~2,300 μatm) compared to ambient CO₂ conditions (~400 μatm) and severely lowered at higher (10°C) compared to lower temperatures (5°C, Murray et al. 2017). Our second experiment this year appears to repeat this pattern. If true, this would make sand lance one of the

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Southern Region

Trika Gerard

The Spanish Institute of Oceanography (IEO) hosts an international meeting on the study of atlantic bluefin tuna larval ecology at Málaga Oceanographic Center

This past November, the Málaga Oceanographic Center of the Spanish Institute of Oceanography (IEO) hosted the second coordination meeting of the project ECOLATUN (CTM2015-68473-R MINECO/FEDER). The project's main objective is advancing the ecology of larval Atlantic bluefin tuna (*Thunnus thynnus*), in its two main spawning areas: the western Mediterranean Sea and the Gulf of Mexico.



Scientists from USA, Spain, Japan, Mexico attend ECOLATUN's 2nd meeting in November 2017, at IEO, Malaga, Spain.

Scientists from USA (NOAA SEFSC, NOAA FORCES Lab, City University of New York, Woods Hole Oceanographic Institution, University of Miami's CIMAS), Japan (National Research Institute of Fisheries Science), Mexico (El Colegio de la Frontera Sur, Chetumal), and Spain (SOCIB and IEO) attended the meeting for this project led by IEO scientists.

the goal of assessing the trophic webs and their relation to the environment comparing Mediterranean and the Gulf of Mexico ecosystems.

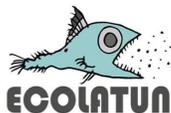
In addition, ECOLATUN will evaluate the oceanographic features of the spawning areas, as well as assess the composition and structure of the larval fish community concurrent with bluefin tuna larvae. Using the larval isotope signature, valuable information regarding early life trophism will be ascertained and assimilated with the maternal influence on their development.

This project will improve the characterization of the populations and more accurately define suitable habitats that promote the survival of bluefin tuna larvae. Finally, ECOLATUN's comparative synthesis will improve the predictive power of larval habitat and larval survival models which have consequence for the management of this valuable fishery.

Project website:

<http://raullaiz.wixsite.com/ecolatun>

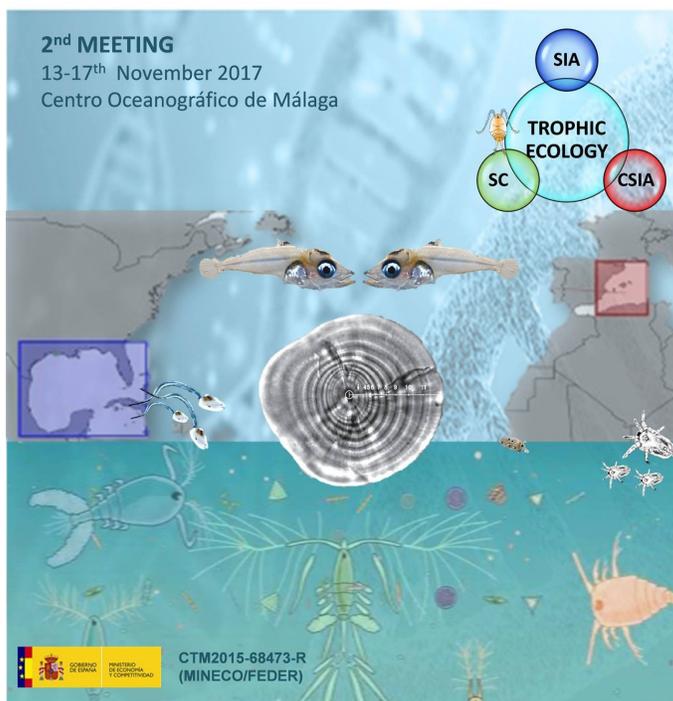
-- Trika Gerard §



Comparative trophic ECOlogy of LARvae of Atlantic bluefin TUNa (*Thunnus thynnus*) from NW Mediterranean and Gulf of Mexico spawning areas

2nd MEETING

13-17th November 2017
Centro Oceanográfico de Málaga



The ECOLATUN project uses a comparative ecosystem approach in which the different larval feeding strategies may explain the large variability observed in growth of Atlantic bluefin tuna larvae. This variability has important repercussions for larval survival, and consequently, in their recruitment. To this end, novel scientific methodologies are being developed and tested, such as stable isotope analysis, together with the study of daily growth of larvae and the analysis of stomach contents, with





Europe

Hubert Keckeis

Dispersal during early life history of fish

A new Special Issue “Dispersal during early life history of fish” from the 39th Annual Larval Fish Conference in Vienna, Austria was published in Canadian Journal of Fisheries and Aquatic Sciences.

The special issue presents the latest research and understanding of dispersal patterns and processes of early life stages of fishes. Overall, 15 contributions from 13 countries present information about changing morphometric relationships during early ontogeny and the consequences for dispersal, field observations of spatio-temporal dispersal patterns in rivers, estuaries, and oceans, extent of and connectivity with spawning grounds, patterns of settlement (recruitment) to reefs, as well as behavior patterns of fish larvae in flow, and dispersal modelling (Table 1). An important component of this compendium is to outline the

consequences of these findings for recruitment, population dynamics, conservation, and management in different aquatic environments around the world. The special issue has been edited by Hubert Keckeis (University of Vienna), Catriona Clemmesen (GEOMAR Helmholtz Centre for Ocean Research Kiel), Paul Humphries (Charles Sturt University) and Su Sponaugle (Oregon State University).

-- Hubert Keckeis §

Title	Corresponding author	Environment	Approach	Country/Area	Investigation Site(s)
The combination of bivariate and multivariate methods to analyze character synchronization and early allometric growth patterns in the stellate sturgeon (<i>Acipenser stellatus</i> Pallas, 1771) as tools for better understanding larval behaviour.	Gisbert, Enric	freshwater	in vitro study	Iran	open flow tanks
Modelling the dispersal of riverine fish larvae: from a raster-based analysis of movement patterns within a racetrack flume to a reaction-based correlated random walk (RCRW) model approach.	Glas, Martin	freshwater	in vitro experimental study	Austria	racetrack flume
Linking spawning ground extent to environmental factors - patterns and dispersal during the egg phase of four North Sea fishes.	Hoeffle, Hannes	marine/North Sea	field study	North Sea	North Sea
Temporal variability of larval drift of tropical amphidromous gobies along a watershed in La Réunion Island.	Lagarde, Raphael	freshwater/river	field study	La Réunion	Mât River
Otolith microchemistry to identify sources of larval Yellow Perch production in a fluvial lake.	Lazartique, Angélique	freshwater/fluvial lake	field study	Canada	Lake Saing-Pierre
The influence of discharge, current speed and development on the downstream dispersal of larval nase (<i>Chondrostoma nasus</i>) in the River Danube.	Lechner, Aaron	freshwater/river	field experimental study	Austria	River Danube
Downstream migration and mechanisms of dispersal of young fish	Mikheev, Victor	freshwater/river	Review	Russia	Upper and lower Volga, Kol' River
The Ecology of Oceanic Dispersal and Survival of Anguillid Leptocephali.	Miller, Michael	marine/open ocean	Review	North Atlantik Ocean, Indo-Pacific	Sargasso Sea, West-Sumatra, South China Sea, Java Sea, Banda Sea
High temporal resolution sampling reveals reef fish recruitment is highly clustered.	Piercy, Julius	marine	field study	Indonesia	Hoga Island
Larval fish dispersal along an estuarine-ocean gradient.	Ramos, Sandra	estuarine	field study	Portugal	Lima estuary
How environmental conditions influence dispersal and distribution of larval fish in the Mahury River estuary (French Guiana).	Rousseau, Yann	estuarine	field study	French Guiana	Mahury River Estuary
Patterns in larval reef fish distributions and assemblages with implications for local retention in mesoscale eddies.	Shulitzki, Kathryn	marine/coastal area	field study	USA	Strait of Florida
Modeling the drift of European (<i>Anguilla anguilla</i>) and American (<i>Anguilla rostrata</i>) eel larvae during the year of spawning.	Westerberg, Hakan	marine/open ocean	field study	North Atlantik Ocean	Sargasso Sea
Influences of the Three Gorges Dam on drifting larvae of the four major Chinese carps according to distance from the dam, with suggestions for reprioritizing conservation measures.	Xie, Songquang	freshwater/river	field study	China	Middle Yangtze River
Movement patterns and rheoreaction of larvae of a fluvial specialist (nase, <i>Chondrostoma nasus</i> , Linnaeus 1758): the role of active versus passive components of behaviour in dispersal.	Zens, Bernhard	freshwater/river	in vitro experimental study	Austria	racetrack flume

Table 1: Title, corresponding author, type and location of studies from the special issue “Dispersal during early life history of fish” from the 39th Annual Larval Fish Conference in Vienna.

President's message...cont'd from p. 1

But on to warmer thoughts. I trust each and everyone of you had a safe and enjoyable holiday season, and that you're off to a productive and exciting new year!

Part of that exciting new year, of course, is the Larval Fish Conference! If you're like me, then you are brimming with anticipation for the 42nd Annual Larval Fish Conference to be held June 24-28, 2018 in Victoria, British

Columbia, Canada. Our hosts (John Dower, Francis Juanes and Pierre Pepin) have put together a fantastic program, and the venue with its beautiful natural setting will be truly amazing. I encourage you to look over the conference announcement in this issue of STAGES, and to follow along with the conference website (<http://lfc-2018.com/>) for future updates. In addition to a great line up of theme sessions, there will be another mentoring session this year for early career scientists and a

one-day larval identification workshop. I want to thank the organizers of these special events, as they really make our meeting a one-of-a-kind experience for our young (and old!) scientists. And I'm very much looking forward to hearing from this year's plenary speaker, Dr. Janet Duffy-Anderson! Thanks Janet for agreeing to kick-start our science sessions and set the tone for a great conference.

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2nd North American Ichthyoplankton Workshop- Woods Hole, September 26-27th, 2017

Representatives from all six National Marine Fisheries Service (NMFS) Science Centers, NMFS Headquarters, Canada Department of Fisheries and Oceans (Atlantic and Pacific), the CICIMAR lab in Mexico, and academic scientists from several universities on both coasts met for a 1.5-day workshop to discuss current ichthyoplankton sampling methodology and time series trends for many different ecosystems, spanning from the tropics (Hawaii, Caribbean Sea, Baja California) to boreal (Bering Sea, Labrador Sea, Barents Sea) ecosystems. The unifying theme of the workshop was the use of ichthyoplankton data to inform single-species and/or ecosystem management. The workshop concluded with a roundtable discussion covering multiple aspects of fish early life history and its benefits, as well as pitfalls, in Ecosystem-Based Fishery Management.

Much progress has been made since the first workshop in La Jolla, California in November, 2016. That workshop followed a 1-day Topic Session at the North Pacific Marine Science Organization (PICES) Annual Meeting entitled "Early life history stages as Indicators and Predictors of Climate Variability and Ecosystem Change" where representatives from throughout the northern hemisphere presented examples of the utility of using larval time series as predictors of climate change. One recommendation of that workshop was to develop an exploratory database tool to house all the available North American ichthyoplankton time series. The tool called FLEX, developed by Todd O'Brien at NMFS Headquarters, is now in operation (see bit.ly/flex_2_4)

and examples of its capabilities for searching, displaying, overlaying, and statistically and graphically analyzing multiple data sets were presented. From there, regional and cross-regional presentations were made and many examples were shown of abrupt and sometimes transformative changes in ichthyoplankton communities related to climatic trends, and especially related to major perturbations such as the North Pacific "warm blob," which resulted in substantial phenological and distributional shifts in fish spawning along the West Coast. Larval fish can be used as "early warning indicators" for ecosystems undergoing change related to climatic or anthropogenic drivers. Many direct applications of larval fish data to fisheries management were provided, including the use of fish larvae as proxies for the availability of juvenile fish prey for salmon. This indicator is one of the earliest and most robust predictors of subsequent salmon returns to the Pacific Northwest. Other talks focused on using larval fish as an early indicator of stock collapse (e.g., northern cod) and rebuilding (sablefish and mackerel). Larval data can provide useful information on stock structure (red hake, tuna) and estimation of spawning stock biomass that are directly applicable to fisheries management. Examples were given of larval fish indicators of degrade environmental conditions and for the spread of invasive species. Larval fish can also be used to assess the efficacy of Marine Protected Areas and to examine patterns of larval drift to nursery areas.

Specific recommendations to come from the discussion session on the second day included: 1) continuing to examine for synchrony or asynchrony in larval time series both within basins and between the Atlantic, Gulf of Mexico and Pacific and elucidate physical mechanisms driving these patterns, 2) incorporating larval fish community patterns into more regional status reports (e.g. stoplight charts, status report cards) and interpret for managers the utility of such indicators,

3) comparing larval time series to those from juvenile and adult surveys with appropriate lags to look at bottlenecks in recruitment and also for evidence of early warning signals to community changes, and 4) moving away from simply using large-scale climatic indices (PDO, MEI, NAO) as these do not provide any mechanistic underpinnings and use more local scale indices including modeled output (e.g. ROMS).

To provide another venue to continue these fruitful discussions and bring together insights from academic and government researchers from around the globe, we developed a theme session for the Larval Fish Conference in Victoria, British Columbia, Canada in June 2018 entitled "Application of Ichthyoplankton Data to Fisheries Management." Chaired by Drs. Alison Deary and Pierre Pepin, the workshop will focus on the use of early life history data as a tool in fisheries management. We are particularly interested in how ichthyoplankton data 1) may be useful fishery-independent indicators of spawning stock size, 2) improve the forecasting power of models, and 3) be used to identify the mechanisms that contribute to potential recruitment bottlenecks since it is often the early stages that are more susceptible to environmental conditions, climatic variability, and habitat loss than adults. So remember to register for this year's conference and do not hesitate to contact Ali Deary (alison.deary@noaa.gov) with questions about the theme session!

- Ali Deary, Tony Koslow, and Ric Brodeur §

*Call for Stages new
feature series:
Send us your stories
of your larval fish
collections.*

Larval Fish Conferences



Early Life History Section - American Fisheries Society



The 42nd annual Larval Fish Conference (LFC) will be held from 24-28 June 2018 in Victoria, British Columbia, Canada. The meeting is being organized by John Dower (dower@uvic.ca), Francis Juanes (juanes@uvic.ca) and Pierre Pepin (pierre.pepin@dfo-mpo.gc.ca).

Victoria is located on Vancouver Island and can be reached via connections through Vancouver and Seattle airports as well as via car ferries and high-speed catamarans. The Delta Victoria Ocean Point Resort, located on Victoria's inner harbour and just a five minute walk to downtown Victoria, will serve as the venue for the conference. A block of 75 rooms has been set aside for conference participants. Book the group rate room for the Larval Fish Conference at <https://tinyurl.com/ybto2qvc>. Students looking to share hotel accommodations can submit a request through the organizers who, with the help of Alison Deary and Marta Moyano, will coordinate requests.

There will be four full days of presentations (Monday through Thursday), with a poster session on Monday evening and a social event at the University Club on Wednesday evening. The LFC 2018 website is located at <http://lfc-2018.com/>. Registration and abstract submission via the website is now open and will close on the 16th March 2018. Registration will be \$600 CDN (~\$480

USD; ~€400) for non-students and \$300 CDN for students.

Janet Duffy-Anderson (NOAA, Alaska Fisheries Science Center, Seattle, WA USA) will present the conference keynote address.

There will be five theme sessions: [1] There is life (and death) after metamorphosis: Recent advances in the ecology of juvenile fish; [2] Fisheries oceanography in a changing ocean; [3] Predator-prey interactions and consequences to growth-survival; [4] Emerging threats to ELH stages and potential consequences to physiological processes; and [5] Application of ichthyoplankton data to fisheries management. There will also be a contributed paper session.

A special mentoring session aimed at Early Career Scientists will be hosted by Alison Deary (alison.deary@noaa.gov) and Marta Moyano (marta.moyano@uni-hamburg.de) on the afternoon of Sunday June 24, 2018. Stuart Ludsin (Co-director of the Aquatic Ecology Laboratory, The Ohio State University) will be providing a 3 hour tutorial on proposal writing (see p. 9 & 15)

A one-day Larval Fish Identification Workshop will be held on the campus of the University of Victoria by Peter Konstantinidis (peter.konstantinidis@oregonstate.edu - Oregon State University, Dept. of Fisheries and

Wildlife), Alison Deary (NOAA, Alaska Fisheries Science Center) and Moira Galbraith (Fisheries and Oceans Canada, Institute of Oceans Sciences) on Saturday June 23, 2018. Participation will be limited to 15 people, with students having priority. Details can be found on the website; in the meantime, see pages 9 & 10.

Website: <http://lfc-2018.com/>

E-mail: lfc2018@gmail.com

Looking forward to seeing you next June in Victoria!

- Francis and Pierre §



LFC Workshops!

(info on p. 9)



LARVAL FISH IDENTIFICATION WORKSHOP – JUNE 23rd, 2018

Research on the early life stages of fishes has increased extensively and progress has been made in many areas, such as understanding larval survival, recruitment, dispersal, comparative anatomy, and ecology. At the base of these diverse and exciting research disciplines is the need to understand the species composition, and with that the associated skills required to identify larval fishes. Although molecular identification techniques have advanced our knowledge of larval fish taxonomy rapidly, it is a complementary method and is not able to provide morphological and descriptive information needed. However, the expertise needed to identify larval fishes based on morphological characters



NOAA FISHERIES
National Oceanic and Atmospheric Administration



Fisheries and Oceans Canada

Pêches et Océans Canada

Ecosystems and Oceans Science

Sciences des écosystèmes et des océans

is fading, with the retirement of many ichthyoplankton experts and the lack of training in younger generations.

If you are interested, and we believe you are, because you registered for the Larval Fish Conference, we invite you to our one-day workshop on June 23rd, which is a day before the conference. In this workshop, we will train you in the basics of ichthyoplankton identification. During this crash course, we will sort through unsorted ichthyoplankton samples to give you hands-on experience in 1) understanding the characters needed to identify early stage fishes, 2) using larval fish identification keys, and 3) curation of ichthyoplankton samples.

This hands-on workshop will begin with a lecture on the evolution of important early life history characters and an introduction of useful sources for larval fish identification. The rest of the day will be dedicated to sorting

and identifying a wide array of larval fishes from different areas around the world. Participants will sort and identify ichthyoplankton samples to the family level under the guidance of three expert taxonomists: Drs. Alison Deary (NOAA, Alaska Fisheries Science Center, Seattle), Peter Konstantinidis (Oregon State University, Dept. of Fisheries and Wildlife, Corvallis) and Moira Galbraith (Institute of Ocean Sciences, Sidney, Canada).

Participation will be limited to 15 people and students will have priority. Signup information: <http://lfc-2018.com>

Where: Lab space TBD

When: June 23rd; 8.00 – 17.00

For: Anybody with the sincere need how to identify ichthyoplankton

Max. Participants: 15 §

Early Career Event- Demystifying Proposal Writing

Led by Dr. Stuart Ludsin, The Ohio State University (<http://www.ludsinlab.com/>)

Has your research come to a halt because you cannot secure funding? Are you unsure of where to look or who to contact for help? Well, look no further than this year's Larval Fish Conference in Victoria, British Columbia (Canada)! The Early Career Committee is happy to announce that we are organizing a three-hour workshop on grant proposal writing led by Dr. Stuart Ludsin from The Ohio State University. With almost 70% of our survey participants requesting a writing-themed workshop, we decided to focus on proposal writing for the 2018 conference because the strategies for quality writing transcend proposals, even if English is your first language!

The workshop will explore key components of successful proposals and will leave time for participants of any career status to ask questions. For this LFC workshop, Dr. Ludsin will adapt material from several courses that he developed at his university, which focused on scientific writing and proposal preparation. He will also share with us his insights from his own research experiences, which includes successfully competing for more than two dozen grants (valued at over \$21 million US dollars!) and serving as a reviewer on numerous proposal review panels.

For the workshop entitled "Demystifying Proposal Writing," he will discuss:

- 1) How to identify novel research ideas;
- 2) How to "sell" your science to reviewers; and

3) How to navigate the proposal process.

If you would like to improve your writing and ability to assemble successfully-funded proposals, consider registering for this workshop! Updates about the workshop will be posted on the conference website (<http://lfc-2018.com>) and our social media pages on Facebook (@earlylifehistory) and Twitter (@AFS_ELHS). In the meantime, do not hesitate to contact Ali Deary (alison.deary@noaa.gov) with questions.

We look forward to seeing you in Victoria!

- Your Early Career Committee Chairs, Ali Deary and Marta Moyano, and Stu Ludsin



Larval Fish Conferences

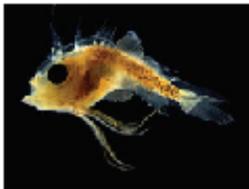
Early Life History Section - American Fisheries Society



Register Now!



Larval Fish Identification



Workshop



June 23rd, 2018,

At 42nd Annual Larval Fish

Conference

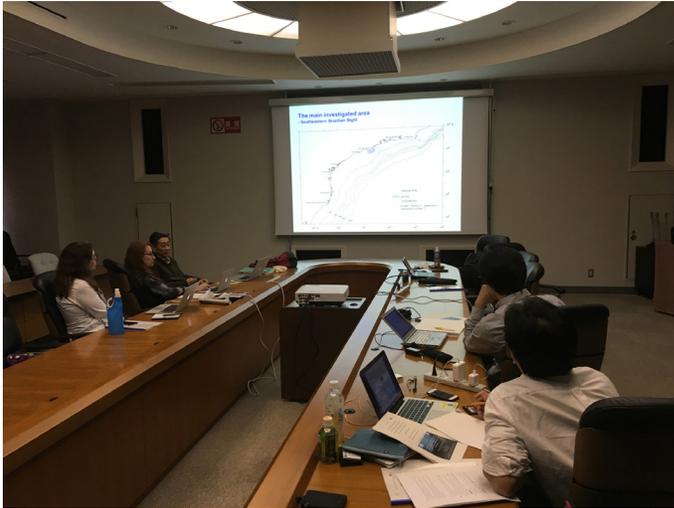


Questions? Contact Peter Konstantinidis
(peter.konstantinidis@oregonstate.edu) or
Ali Deary (alison.deary@noaa.gov)



LFC Workshops!

(more info on p. 9)



Workshop at NRIFS-FRA.

and passed through Yokohama on Monday morning (just before the start of the workshop).

In the open-style seminar, the three invited speakers (Drs. Mario Katsuragawa, June Ferraz Dias, and Jana M. del Favero) introduced the history and current activity in the respective study topics. First, Mario reviewed the studies on ichthyoplankton in the SBB. This review included a summary of history and current activities of his laboratory and his perspectives for future studies of early life biology. Then, June summarized her studies on reproductive biology of small pelagic fish in the SBB, including traditions, knowledge gaps, and future perspectives. Jana presented a summary of her PhD thesis on anchovy *Engraulis anchoita* eggs and larvae in the SBB and perspectives

from a historical ichthyoplankton survey data set. Subsequently, I talked about biological mechanisms of species alternations, focusing on interspecific and intersystem comparisons. Lastly, Yoshi introduced our recent study on population dynamics of small pelagic fish in the Kuroshio and Humboldt Current systems. Unfortunately, the two Japanese oceanographers, Hiroshi and Takeshi were not able to attend

the seminar because their transportations were stuck under strong wind and heavy rain in the northern areas of Japan. Yet, Hiroshi overviewed oceanographic variability in the Kuroshio and Oyashio Current system, and Takeshi reviewed growth and migration model for small pelagic fish in the Kuroshio Current system on the first day of the workshop.

In the workshop, we developed a collaboration framework which includes multiple topics: population dynamics, spawning habitat, reproductive biology, early life biology, and physical and biological oceanography. We also reviewed the availability of data relevant to the

topics for main target species selected as anchovy and sardine (*Engraulis japonicus* and *Sardinops melanostictus* in the KCS; *Engraulis anchoita* and *Sardinella brasiliensis* in the SBB). Then, we picked up some key questions and set several hypotheses on the population dynamics and oceanographic systems in the KCS and SBB, based on the information exchanged during the seminar. Further, we discussed a baseline of memorandum of understanding (MOU) to be exchanged between the institutions in the near future. We finished a fruitful workshop during the full week, immediately before a typhoon hit Japan again in the weekend.

- Akinori Takasuka §



Friends from São Paulo enjoying a night view from the Landmark Tower in Yokohama (from the left: Mario and Tomoko Katsuragawa, Jana M. del Favero, and June Ferraz Dias)

President's message...cont'd from p.6

Indeed, we are in good hands as John, Francis and Pierre work to make the next LFC an unforgettable experience. But as members of the ELHS, we are not entirely off the hook, so as President I am issuing a call to action, and that is for everyone to do their part in promoting and advertising our next LFC in order to maximize conference attendance. Having full sessions with a complete line up of speakers and an engaged audience in attendance is critical to the success

of any scientific meeting. I would particularly encourage everyone to recruit students to this year's meeting. The students who attended last year's LFC did a tremendous job (as usual), but the overall student participation was noticeably lacking, so much so that we did not have enough student submissions during the poster session to hold our annual competition for the Blaxter Award. Many of us (myself included) first attended a LFC meeting as a graduate student, and then got hooked! Please remind students that

travel support is available through the ELHS, among other sources. The success of the LFC and our ELHS depends on our continued engagement with our early career scientists, so I ask our membership to please encourage student attendance as much as you can.

In addition, promoting the LFC, particularly while at other conferences you may attend this year, enables us to recruit new researchers and

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Sablefish research in Alaska

Sablefish (*Anoplopoma fimbria*) is a high market value fish that has experienced declining recruitment in Alaska for decades. Recruitment is episodic, interest in understanding sources of recruitment variability in the species is high, and year-class strength is likely set sometime in the first year of life. Sablefish undergo an extreme ontogenetic vertical migration where they hatch at depths greater than 300m in cold water (less than 6°C) lacking eyes, a gut, or a mouth but possess a huge yolk sac in the early spring. Larvae migrate towards the surface and become neustonic as fully competent larvae a few weeks later and remain in the neuston for the remainder of the first year of life. For sablefish to survive this migration, they grow extremely rapidly in the earliest stages, at about 2 mm/day! To support these rapid growth rates, it is likely that sablefish are extremely sensitive to variations in the prey field and require an ample supply of quality prey to survive after yolk-absorption.



Hatch, 3.00 mm NL

Sablefish larvae at hatch.
Photo credit- S.M. Porter

Despite the intense interest in this species, there are few studies that quantify the fundamental parameters needed to describe and model the larval period of sablefish. An examination of these parameters will enable us to understand the mechanisms that influence recruitment for Sablefish and identify the environmental conditions that lead to strong year-classes.

Since sablefish are not often collected in our ecosystem surveys, we are primarily conducting our work in the laboratory to ensure we have plenty of experimental animals. However, we are complementing our laboratory studies with field-collected specimens from our annual cruises. In 2017, we conducted a pilot study to determine if it was feasible to rear the larvae at our facility in a small-scale operation. We are happy to report that not only was it possible, we also obtained plenty of specimens to look at condition, age, growth, and skeletal development. We achieved several goals during the 2017 pilot study determining that: (1) a small-scale rearing operation is feasible at the NOAA facility in Seattle and external developmental patterns agree with past research, suggesting minimal biases associated with our laboratory setting, (2) a hatch mark is observed on the otoliths in the laboratory-reared individuals, establishing a known landmark that can be used to improve field estimates of age in early stage sablefish, although the frequency of ring formation needs to be verified with additional lab work, (3) 30 dph is a likely recruitment bottleneck for early stage sablefish because it possibly represents the transition to the prolonged neustonic stage, and (4) based on the lack of ossification of the skeleton, particularly in the jaws, early stage sablefish are dependent on abundant, small-sized, and low-mobility zooplankton prey.

This year, now that we know we can rear the larvae and we know more about their development externally and



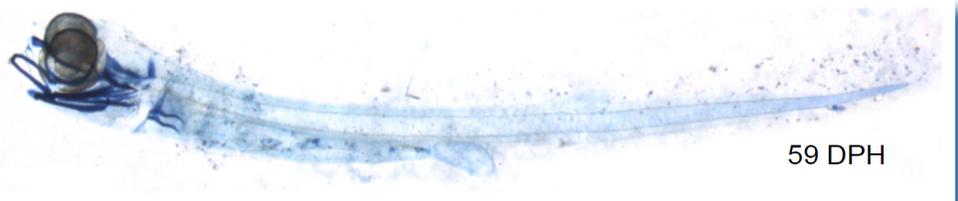
Sablefish larvae 58 days post hatch (DPH).
Photo credit- S.M. Porter

internally, we are going to investigate the impact of prey quantity and quality on condition, growth, bioenergetics, and survival under a controlled temperature. The experiments this year will provide the baseline data we need to interpret the condition and bioenergetics of field-collected specimens from the 2017 field season to understand the mechanisms that result in strong year classes.

Additionally, sablefish undergo drastic thermal shifts as they move from their hatching depth to the surface. However, we do not know how temperature affects growth rates, stage duration, and metabolic requirements in the early stages so it is difficult to forecast how events like the recent "warm blob," which is associated with climate change, affect sablefish recruitment. Therefore, in future laboratory studies, we also want to examine the cumulative impact of temperature, prey quantity, and prey quality on condition, bioenergetics, growth, survival, and development to gain a more complete understanding of the mechanisms that influence year-class strength in sablefish.

- Ali Deary, Steve Porter, Annette Dougherty, and Janet Duffy-Anderson

§



Cleared and stained Sablefish larvae 58 days post hatch (DPH). Notice that no elements are fully ossified yet. Photo credit- A.L. Deary

most CO₂ sensitive species studied to date.

General interest in sand lance goes beyond its CO₂ sensitivity. Given the species importance for the ecosystem and coastal economy, there are now increasing efforts to better understand sand lance feeding ecology, distribution, and connectivity. In this regard, funding by the Regional Sea Grant Office of our project proved prescient and a seed for subsequent grants from MIT SeaGrant and the Bureau of Energy Management (BOEM) to continue the work in the future. Surely, the groundswell of interest in sand lance is commensurate with the species importance and will enable insights into better management strategies for sensitive ecosystems like those along the US Atlantic coast.

Funding: This work is funded by Regional Sea Grant project #RNE16-CTHCE-I. It supports shiptime and funds a PhD student (C. Murray).

Collaborators: D. Wiley (NOAA-SBNMS), P. Valentine (USGS), S. Gallagher (WHOI), J. Llopiz (WHOI)

Smigielski AS, Halavik TA, Buckley LJ, Drew SM, Laurence GC (1984) Spawning, embryo development and growth of the American sand lance *Ammodytes americanus* in the laboratory *Mar Ecol Prog Ser* 14: 287-292

Murray, C. S., Wiley, D., and Baumann H. 2017. A preliminary study testing the effects of high CO₂ on the early life stages of the northern sand lance *Ammodytes dubius*. (1) ICES Annual Science conference, Fort Lauderdale 18-22 September 2017, (2) Regional Association for Research on the Gulf of Maine (RARGOM), Annual Science Meeting, 12 October 2017, Poster.

- Hannes Baumann



Turning fish purple to observe the impacts of ocean acidification

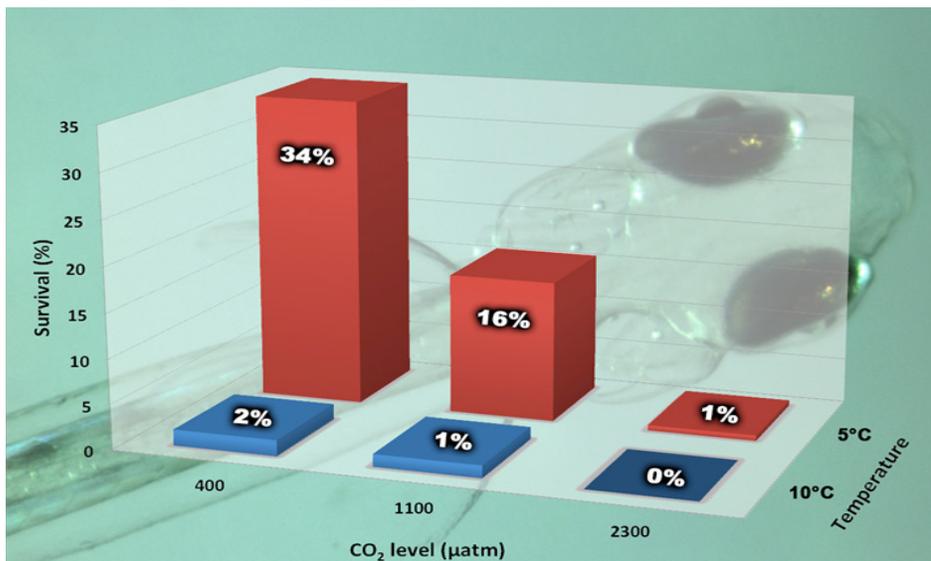
Despite what their name suggests, chloride cells aren't just used to transport chloride ions and maintain osmoregulation in fishes; they also play an important role in acid-base regulation. In the early life history stages during which gill formation is not yet complete, skin surface chloride cells could be the primary structure helping fishes cope with stressful external pH levels.

As part of a collaborative project led by Drs. Hannes Baumann (University of Connecticut) and Janet Nye (Stony Brook University), graduate student Teresa Schwemmer (Stony Brook University) is testing whether ocean acidification influences chloride cell abundance on the skin surface of larval Atlantic silversides (*Menidia menidia*).

In this experiment, silversides were spawned from wild-caught adults and raised in a factorial combination of temperature and carbon dioxide treatments. Larvae were sampled from each treatment tank at early (1 day post hatch) and late (10-25 days post hatch) stages in development to be stained for Na⁺/K⁺-ATPase, an enzyme abundant in chloride cells. The immunoenzymological stain produces a deep purple hue in the chloride cells (as shown in the photo), which allows them, and thus the regulatory capability of the fish, to be quantified.

The results will be presented at the Ocean Sciences Meeting in Portland, OR, on Thursday, February 15th, from 4:00PM-6:00PM at the poster session "Multiple Stressors and Multiple Disciplines: Understanding the Consequences of Global Ocean Change for Marine Species".

- Teresa Schwemmer



Survival to hatch of Northern sand lance (*Ammodytes dubius*) embryos reared at three CO₂ levels and two temperatures

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UQAR MSc student Safouane Khamassi is using Northern gannet as a sampling tool to sample YOY mackerel.

Predicting recruitment of Gulf of St. Lawrence Atlantic mackerel from the characteristics of prey ingested by Northern gannet

Dominique Robert's laboratory at Université du Québec à Rimouski has received funding from WWF-Canada and the Department of Fisheries and Oceans to shed new light on the early life dynamics of Atlantic mackerel in the Gulf of St. Lawrence, Canada. The last strong recruitment event for that stock occurred in 1999, and recruitment has been low since then with notable effects on the fisheries and ecosystem. Declining mackerel biomass has impacted commercial landings, which have decreased from \$30M in 2005 to less than \$9M in 2015. During the same period, the

Bonaventure Island Northern gannet colony, the largest in North America, has experienced a continuous decline. This gannet colony is considered one of the main predators of the Gulf of St. Lawrence mackerel with more than 100,000 individuals preying over an area of 200 km radius centered at the heart of mackerel fishing grounds.

Recruitment of Atlantic mackerel has been positively related to growth rate achieved during early life stages (Robert et al. 2007). Individual

summer at Bonaventure Island from early June to late September. Gannet readily regurgitate when captured on their nests for monitoring purposes, making it possible to sample YOY mackerel when they grow into the prey size range of the gannet. YOY mackerel appeared in the regurgitations as early as the second week of August, and were regularly sampled until gannet left the colony to return to their overwintering area in late September. A total of 265 YOY mackerel were sampled with ages potentially ranging



Collecting gannet regurgitation: Upon capture, gannet readily regurgitate, allowing Safouane to collect YOY mackerel recently fed by the birds.



Capture of gannet: Northern gannet are captured and released as part of an annual monitoring program at Bonaventure Island, the largest colony in North America.

larval growth history can be documented from the otolith microstructure, and the comparison of growth characteristics between the original larval population and juvenile survivors constitutes a promising way to predict recruitment. A limitation to this method so far is that young-of-the-year (YOY) juvenile mackerel (i.e. survivors of the larval period) are difficult to capture as they avoid plankton sampling gear targeting larvae and are not yet recruited to commercial gear targeting adults. A promising way to sample this 'missing' life stage is through gut contents of their predators.

between 1-3 months.

Safouane is currently determining growth trajectories in YOY mackerel with the goal of detecting potential periods during the early juvenile stage (prior to first winter) of high growth-selective mortality, which could be interpreted as survival bottlenecks. Safouane will be travelling to the 42nd LFC in Victoria next summer to present his results, so stay tuned!

Robert, D., M. Castonguay, and L. Fortier. 2007. Early growth and recruitment in Atlantic mackerel: discriminating the effects of fast growth and selection for fast growth. *Marine Ecology Progress Series* 337:209-219.

MSc student Safouane Khamassi joined the Northern gannet monitoring team last

- Dominique Robert §

President's message...cont'd from p.11

new ideas into our ELHS community. This year's LFC theme sessions are diverse in their scope and provide us with an opportunity to invite scientists from a wide range of fisheries-related disciplines (beyond just fish 'larvae'). I am confident new attendees to the LFC will be very impressed by the quality and breadth of research presented. This, in turn, will assist in recruiting new members to our ELHS (which is always a good thing!).

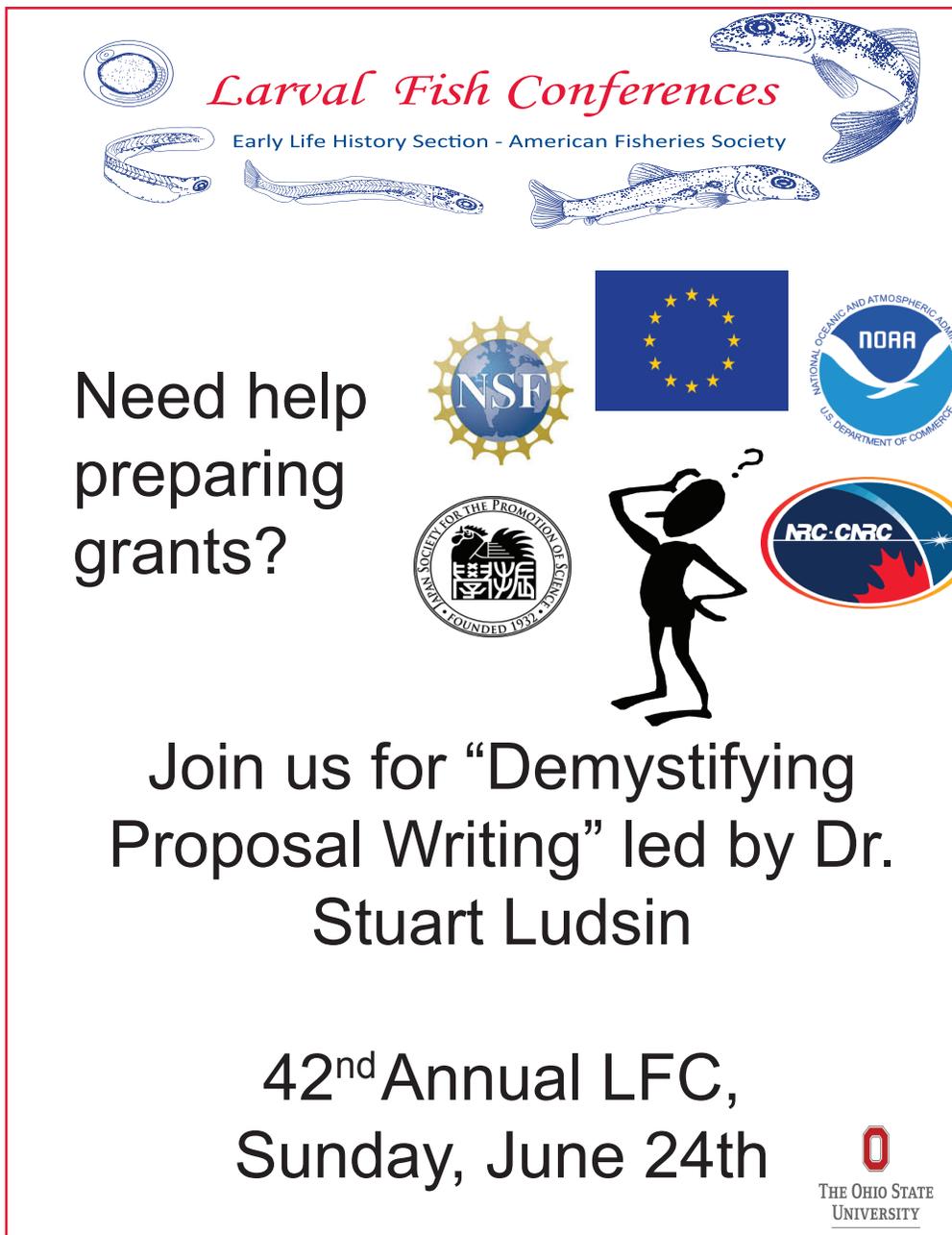
Fortunately, advertising next year's LFC is easy. Many ELHS members are active on social media platforms, and can spread the news via links to our website, Facebook page, and Twitter account. For those attending conferences, we have printed some 'save-the-date' conference postcards that can be distributed at meetings. Please feel free to contact me (frank.hernandez@usm.edu) to request some of these for your next conference or scientific gathering. Lastly, we are preparing a one-page conference flyer

that can be printed and posted on message and bulletin boards wherever you go. A link to this flyer will be posted on our website shortly.

With that, I will wrap up this message by again wishing everyone a happy new year. See you in Victoria!

Best regards,
- Frank Hernandez, President (and shivering southerner) §

LFC Workshops! (more info on p. 9)

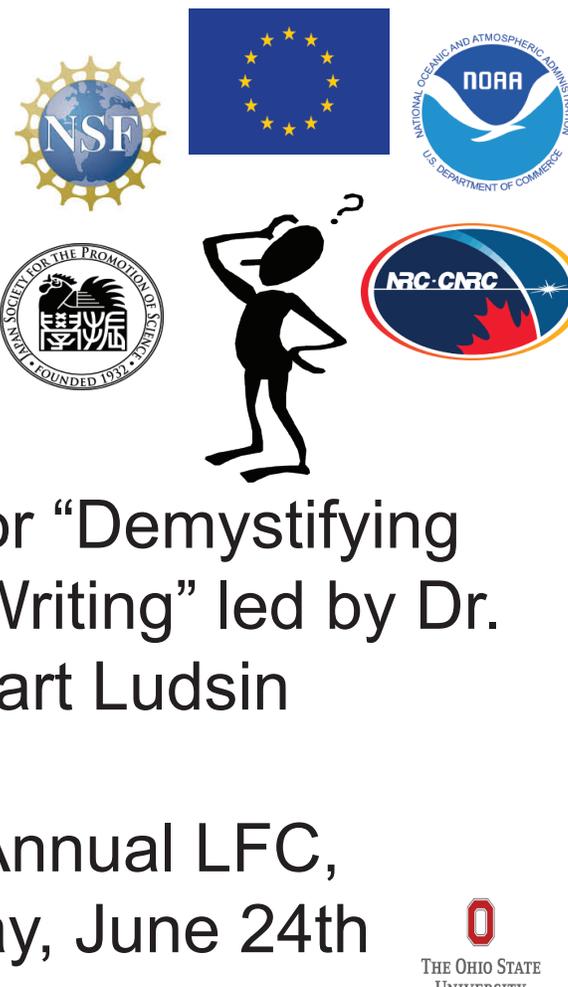


Larval Fish Conferences
Early Life History Section - American Fisheries Society

Need help preparing grants?

Join us for "Demystifying Proposal Writing" led by Dr. Stuart Ludsin

42nd Annual LFC,
Sunday, June 24th



The flyer features several logos: NSF (National Science Foundation), the European Union flag, NOAA (National Oceanic and Atmospheric Administration), NRC-CMRC (National Research Council - Coastal and Marine Resources Center), and The Ohio State University logo.

Newsletter Production Team

Stages is published in February, June, and October each year. It is assembled by the Newsletter Editors with contributions from Regional Representatives and other individuals. Please send any articles, announcements, or information of interest to Early Life History Section members or affiliates to your local Regional Representative or to the Editors.

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Affiliate membership is open to persons or organizations who are not members of AFS. Affiliate members 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.

ELHS has a PayPal account to receive affiliate membership dues. To join ELHS as an affiliate or to renew affiliate status online, go to:

earlylifehistory.fisheries.org/how-to-join/

Editor's Ramblings



Top level policy initiatives in many countries are seeking to strengthen mentoring and career development support, and many of you will have noticed that concrete plans for career development are now a required part of funding proposals. We are lucky to have an active group making this a priority in ELHS. On a wider scale, our parent organization has an Equal Opportunities Section and an Education Section with relevant contacts. The student subsection of the Education Section is organising a symposium at the main AFS meeting this year: “Engaging the Next Generation of Fisheries Scientists: Strategies for Student Subunits of AFS” (<https://students.fisheries.org/2018/02/subsection-symposium/>).

But what about that tenuous post-postdoc stage? Here it is the responsibility of the different organizations to support and nurture career development – and for younger academics and researchers to actively seek out opportunities. One of the biggest challenges is learning to recognize the wider relevance of the skills learned through the years as a student and PhD researcher. Experience in data management and analysis, project management, communication, time management, expedition/experiment planning and leadership are all part of becoming an independent research scientist. Learning to document and communicate these skills is important at all stages to support and develop one's career. Being a fish biologist is great fun, and wonderfully rewarding, but it is also excellent preparation for joining a wide range of organizations.

- Audrey & Cindy §