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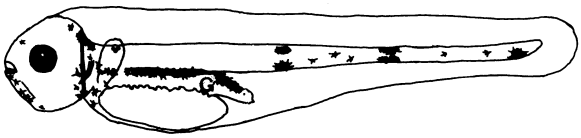

Newsletter of the AFS Early Life History Section

Volume 20, Number 1 April. 1999

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AFS: Aug 29 - Sept 2 in Charlotte, North Carolina

Flatfish Ecology Symposium: Oct 18-23, Morehead City, NC

1st Biennial Meeting on the Biology of Tautog and Cunner: Nov 30 - Dec 1, Mystic, CT

PRESIDENT'S MESSAGE

The 23rd Annual Larval Fish Conference, held 6 through 11 April 1999 on Pivers Island in Beaufort, North Carolina, and hosted by the National Ocean Service and National Marine Fisheries Service's Center for Coastal Fisheries and Habitat Research at Beaufort, came down with resounding success (*for a full meeting report - see p. 17-19*). This Annual Conference, in part a celebration of the 100th Anniversary of the Beaufort Laboratory and a Festshcrift for J.H.S. Blaxter, registered 143 with, 84 professionals and 59 students, and with representatives from 13 countries. Followed by our neighbor and colleagues from Canada, with 11 participants, was: Japan (11); Australia, South Africa, Norway, and England (2); and Mexico, Ireland, Spain, Chile, Austria, Switzerland, and New Zealand (1). The Blaxter Festschrift included invited participants from our membership at home and abroad and contributed presentations on themes of common interest to John. The participation of the international scientific community is ever rising at our Annual Larval Fish Conferences.

The growing success of our Annual Larval Fish Conferences owes to the enthusiasm and the fine contributions of comprehensive science that are presented at these conferences by our students. Thirty-three presentations were in competition for the Sally Leonard Richardson Award for best student presentation at the 23rd Annual Conference; all of them excellent. This excellence resulted in four honorably mentioned presentations by: Sharon Herzka (with Scott and Joan Holt) for her presentation on the "Evaluation of stable isotope ratios as indicators of recent settlement of individual red drum larvae (*Sciaenops ocellatus*) to seagrass nursery habitat"; Thomas Hurst (with David Conover) for "Evaluating mechanisms of winter mortality in young of the year Hudson River striped bass"; Woo Seok Gwak (with Masaru Tanaka) for "Assessment of nutritional condition of Japanese flounder (*Paralichthys olivaceus*) larvae and juveniles with special emphasis on metamorphosis and settlement"; and Edwin Nikl-

Masthead

itschek (with David Secor) for "Bioenergetic assessment of potential nursery areas for Atlantic sturgeon in the Chesapeake Bay."

The 1999 Sally Leonard Richardson Award for best student presentation went to Jean Billerbeck (with David Conover) for her presentation entitled "Big problems for little Fishes: energetic conflicts in Atlantic Silversides". In this presentation, Jean discussed comprehensively the energetics of growth rates, the apparently adaptive advantage of the latitudinal cline in growth rates, and the trade-offs of rapid growth. Congratulations, again, Jean.

Beyond the growing international participation and the ever more enlightening contributions of our students, I find an increase, year by year, in attention to the metamorphic process and the biology of juvenile fishes; clearly evident with some 29 oral and 7 poster presentations on this theme, this year. Incidentally, a new, but *ad hoc*, award for the best poster, the Crystal Fish Award, was issued to Maria Alvarez (with a host of co-authors including Tanaka-san) for her poster entitled "Social hierarchy effect on the physiology of newly metamorphosed juveniles of Japanese flounder."

Evident as well at the 23rd Annual Larval Fish Conference was an apparent resurgence of the study of the development of organ systems and the functional role that these systems play in the ecology of young fishes. This coupling of form and function, and its application to the understanding of how and why larval and juvenile fishes do as they do, is encouraging. "Ecomorphology", an often employed yet affectatious term, in my opinion, has enjoyed renewed interest of late among ichthyologists who work with adult fishes. Larval and juvenile fishes are dynamic, developing organisms, and the question of when, how, and to what advantage organ systems "come on-line" and function are keys to understanding of the ecology of these fascinating animals.

We can all look forward to whatever emphases emerge at the 24th Annual Larval Fish Conference, the 24th, in November 1999, at Gulf Shores, Alabama.

J. Jeff Govoni
ELHS President

Larval 2000

4th International Larval Biology Meeting
Santa Cruz, CA
June 24th to 28th, 2000

The larval biology meetings started in 1993 as a biennial forum for work on the ecology and evolutionary biology of larval stages (or progagules) of all aquatic organisms. The first meeting was by the State University of New York, Stony Brook. The second meeting was in 1995 at Harbor Branch Oceanographic Institution in Florida (*see STAGES - May 1996)* The third meeting was held in Melbourne, Australia in 1998. The meetings are quite informal and consist of mini-symposia and reports on research in progress. The aim is to cover a wide taxonomic range.

The 2000 meeting will be held at the University of California, Santa Cruz (UCSC). The campus is built on a hill over-looking Santa Cruz, a coastal town of about 60 000 people just south of San Francisco in California, USA.

The organizing committee is Pete Raimondi (UCSC, Convenor), Anthony Boxshall (UCSC, Campus Organiser), Donal Manahan (University of Southern California), Dick Zimmer-Faust (UCLA), Rich Emlet (University of Oregon), Mark Carr (UCSC).

Details of the conference are available at http://www.biology.UCSC.EDU/larval2000. The site includes a preliminary schedule, and registration information.

Past Larval Biology meetings have been extremely good. Although larval fish are not the sole focus, ELHSers will find lots to interest them in Santa Cruz. There are common issues, such as ontogenetic habitat and diet shifts, that face all aquatic animals. Hearing how researchers address these questions in other taxa will enrich our own field

NEWS FROM THE REGIONS

Northeast Region — Ben Letcher, S. O. Conte Anadromous Fish Research Center, 1 Migratory Way, P. O. Box 796, Turner Falls, MA 01376. (Phone: (413) 863-8995 ext 34, Email: bletcher@ external.umass. edu).

Howard Marine Sciences Laboratory. National Marine Fisheries Service Sandy Hook, New Jersey, USA

The National Marine Fisheries Service Laboratory on Sandy Hook, NJ, is home to a number of researchers who are investigating the early life history stages and recruitment processes of marine fishes. The Laboratory is one of five NMFS research facilities in the Northeast Fisheries Science Center with the Directorate located at Woods Hole, MA (www.wh.whoi.edu/noaa.html). The Sandy Hook facility opened in 1961. A new seawater laboratory was in 1993 that replaced the previous laboratory that was destroyed by fire.

Research on early life stages of fishes is being conducted by members of the Behavioral Ecology and Coastal Ecology Branches, with supplemental contributions by members of the Marine Chemistry Branch. This contribution to STAGES covers part of the early life history research underway at Sandy Hook.

The Behavioral Ecology Branch is committed to the research goal of determining the mechanisms that affect recruitment, distribution, and abundance patterns in fishery resource species of the Northeast region. Allan Stoner and his research group made up of Allen Bejda, Beth Phelan, Linda Stehlik, Carol Meise and John Manderson examine issues related to habitat utilization, predator-prey relationships, movement and migration patterns, spawning behavior, and all types of behavioral process that influence distribution and abundance in fish and macroinvertebrates. The group uses a combination of field surveys and experiments, and considers all ontogenetic stages (ages) from early post-settlement through adult.

Currently, the behavioral ecology investigation is engaged in a long-term, comprehensive analysis of habitat use by bottom-dwelling juvenile fishes and invertebrates in coastal and estuarine habitats of the Northeast USA. Physical and biological factors including sediments, macrophytes, bathymetry, currents, foods, predators, and spatial relationships between wetlands, open water, and geomorphological structure of the coastal and estuarine environment are all considered for their potential role in defining essential habitat for fishery species. These variables are being analyzed with a combination of a multivariate statistical approach and geographic information systems (GIS) for visual display of the spatially complex data sets. Field and laboratory experiments are used to elucidate mechanisms affecting the distribution and abundance patterns observed in field surveys. All of the descriptive and experimental analyses are made within a generic context such that predictions related to essential habitat can be tested in and expanded to other estuarine systems. The research is made in a community context, setting it apart from many studies in fish biology.

A related study used laboratory and field results to focus on the role of substrate selection in the habitat associations of juvenile winter flounder, *Pseudopleuronectes americanus*. Flounders and sediments were collected in the Navesink River/ Sandy Hook Bay estuarine system. Regression and GIS analyses showed that spatial variation in newly settled winter flounder abundance and distribution was related to sediment grain size and organic content and that substrate selections changed with time and with increases in young-of-the-year winter

Location http://www.eos.ubc.ca/afs_early

Welcome to the

EARLY LIFE HISTORY SECTION

of the American Fisheries Society

The purpose of these pages is to provide a rapid means to disseminate information to ELHS members and anyone looking for information about the ELHS section. As such, these pages will complement Stages, our official ELHS Newsletter.

WHAT'S NEW?

GALLERY UPDATE: 12 new images added to the ELHS Gallery on May 05, bringing the total number of image files to 48.

STAGES ONLINE: The latest issue of Stages is now available.

THE ELHS GALLERY: Thanks to Dan Faber, we finally have some elh figures to post in our new ELHS Gallery. This is a new feature, so let us know what you think. We're currently looking for any other elh line drawings, photos, videos or anything else of the sort to add to the gallery. If you'd like to contribute something, send it along to me via email. PLEASE (!!!) compress any large images or video files before sending them (or my system administrator will get mad at me again).

UPDATED MEMBERSHIP LISTS NOW AVAILABLE: The Early Life History Section membership lists have finally been updated (Many thanks to Tom Miller and Kathy Lang!). The lists are now available as downloadable Adobe pdf documents. Just follow the link to "Membership List".

OTHER NEWS: Also, if you know of any appropriate job advertisements or are looking to hire someone yourself (*i.e.* postdocs, grad students, field assistants,etc.) please pass the ads along to me and I'll post them on the Jobs/Opportunities page. Finally, if you have an ELH web-page you would like to see linked under the Other ELH Links section, please email me. We accept institutional listings, links to individual research labs, and personal web-pages for ELHS members.

Artwork by Bill Rugen

DIRECTORY	How to Join
ELHS Home	Membership List
About ELHS	Jobs/Opportunities
ELHS Newsletter	AFS Homepage
Meetings	Other ELH Links

The new NMFS laboratory at Sandy Hook, NJ. The new 32,000 sq ft laboratory housing experimental seawater, analytical chemistry, and microbiology laboratories is directly across the street from the renovated 35,000 sq ft converted Army barracks that houses offices, conference rooms, and the Lionel A. Walford Marine Science Library. The new laboratory was completed in October 1993. Renovation of the historic 1890s army building was completed in 1994. Design of the new building and renovation of the old were carefully planned to retain the unique historical character of Fort Hancock (a historic landmark), while meeting rigorous technical standards demanded by scientists and conforming to environmental and safety requirements.

flounder size. In the laboratory, ontogenetic changes in substrate choice were investigated using different sediment types. Small individuals (<40 mm SL) preferred fine-grained sediments while larger individuals (>40 mm SL) preferred coarse-grained sediments. All flounders avoided sediments that prevented burial. Subsequent laboratory experiments revealed that the presence of live food (*Mya arenaria*) changed the preferred sediment selection for older fish (60-69 mm SL) indicating that food is another significant factor in habitat choice and field distribution.

Concurrently, winter flounder from the Navesink River and Sandy Hook Bay, New Jersey were collected for dietary analysis. The stomach contents of 1299 non-empty fish were analyzed by cluster analysis. Fish separated into three size classes: 15-49, 50-299, and >300 mm TL. Fish in the smallest size class fed primarily upon spionid polychaetes, the calanoid copepod *Eurytemora affinis*, and ampeliscid amphipods. Fish in the middle size class ceased feeding upon copepods but added various polychaete and amphipod species, and the bivalve, *Mya arenaria*, to their diets. The largest fish ate mainly *M. arenaria* and glycerid polychaetes. Large-scale spatial differences in diet were most apparent for the smallest size class; diets in the river were different than in the bay. Chesson's index of selection showed that winter flounder select certain prey taxa, even in the presence of other suitable food.

The selective predation on two calanoid copepods by newly settled winter flounder (20-24 mm) is being investigated in laboratory experiments by Pat Shaheen as part of her Ph.D. research for the Institute of Marine and Coastal Science, Rutgers University. She initiated the experiment because her zooplankton samples from the Navesink River-Sandy Hook Bay estuary showed the simultaneous presence of the calanoid copepods, *Eurytemora affinis* and *Acartia tonsa*. Stomach analyses of newly settled winter flounder collected concurrently, however, found that *E. affinis* was the only calanoid copepod consumed. During the laboratory experiments, newly settled winter flounder will be fed natural *E. affinis* and *A. tonsa*. Pat plans a spring 1999 zooplankton survey to ascertain if the apparent food selection persists. Pat's zooplankton surveys are part of the on-going ecological study of demersal fish conducted by the Behavioral Ecology Branch.

Predation by striped searobin, *Prionotus evolans*, on young-of-the-year winter flounder was examined by Branch members using a combination of field work and laboratory experiments. Although mysids and bay shrimp, *Crangon septemspinosa*, were the numerically predominant prey, winter flounder (15-57 mm TL) accounted for an average of 17% of prey by weight in the diets of 69% of striped searobins collected in June. In the laboratory, searobins presented with a range of winter flounder selected prey < 70 mm TL, but fed opportunistically in choice tests with an alternate prey (bay shrimp), consuming prey in proportions similar to initial abundances. Both field and lab data indicate that striped searobins consume large numbers of juvenile winter flounder in vulnerable size classes (15-70 mm TL) in habitats where the two species co-occur.

Recently completed collaborative research at the Howard Laboratory with investigators at the Milford, CT, NMFS Laboratory and Rutgers University compared selected habitats across three northeastern U.S. estuarine systems in New Jersey and Connecticut. Results showed that abundance of winter flounder (15-80 mm TL) was usually higher in eelgrass and its adjacent unvegetated areas but was not consistent across macroalgae and its adjacent unvegetated areas or marsh creek habitats between study years. Growth rates of caged young-of-the-year winter flounder (12.0-60.4 mm, SL) and tautog, *Tautoga onitis*, (21.4-73.8 mm, TL) as measure by length and RNA concentration varied with fish size, habitat, estuary, and year. Comparisons across nominal habitat types within and among estuaries did not show any one habitat with consistently higher growth. Growth rates were relatively independent of whether a habitat was vegetated or adjacent to vegetation. Episodic habitat-specific environmental changes (e.g., dissolved oxygen) influenced growth rates. The growth rates of the two species varied temporally and were dependent on the interaction of both the specific estuary and habitat in which it lived. Variability among habitats across estuaries between years indicates the conservative use of nominal habitat designations and the importance of a multi-year, interdisciplinary approach to habitat evaluation.

Jeff Buckel (NRC post-doc) and Al Stoner are examining predator-prey and competitive interactions between juvenile bluefish, *Pomatomus saltatrix*, and striped bass, *Morone saxatilis*. A negative correlation between landings data of these two species has led to speculation that biotic interactions are driving their population dynamics. Functional response and switching experiments were conducted in the laboratory with age-0 bluefish as predators and age-0 striped bass as prey to

Be a Part of A Success Story ! Contribute to STAGES !!

STAGES is recognized as one of the best newsletters within AFS. The regional reviews are the foundation of STAGES, bringing you updates on ELH research. If you have not submitted anything for STAGES, or have not talked to your regional rep, please contact them. They will be delighted to hear from you.

aid in identifying density-dependent mechanisms. Bluefish did not exhibit a type III functional response or switching behavior suggesting that these mechanisms do not explain the observed density-dependent selectivity pattern observed in field data. Competitive interactions were examined between age-0 bluefish and age-1 striped bass. Juvenile bluefish and striped bass showed little habitat and diet overlap during summer months in western Long Island, NY, marine embayments. A 60-d growth experiment found that, within bluefish or striped bass, there were no significant differences in growth between single- or mixed-species tanks. These field and laboratory observations provide little evidence for interference competition. Other research conducted with Geoff Bell (Rutgers University, NOAA-CMER intern) found that the presence of alternative prey could have a major influence on cannibalism by age-1 bluefish on age-0 bluefish.

Fred Scharf arrived at the Howard Laboratory in September, 1998, to begin work on his Ph.D. research with Francis Juanes, University of Massachusetts-Amherst, and in cooperation with the Behavioral Ecology Branch. Fred spent the previous year working in Galveston Bay, Texas, for the coastal fisheries division of Texas Parks and Wildlife. While in Texas, he studied the feeding habits of red drum, focusing on seasonal diet variation, prey selectivity, and predator size-prey size relationships. He also examined interannual patterns of variation in abundance, growth, and mortality of juvenile red drum across several estuaries along the Texas coast to assess the importance of processes operating in the juvenile stage to year-class strength. Fred completed his M.Sc. at UMass in 1997 where he studied predator-prey size relationships of piscivorous fishes in the Northwest Atlantic and worked in collaboration with Jeff Buckel and Dave Conover of SUNY, Stony Brook, NY, to examine size-structured predation by juvenile bluefish in the Hudson River. His Ph.D. research will use a combination of controlled laboratory experiments and individual-based modeling to determine mechanisms of prey selection by juvenile bluefish and striped bass and to evaluate the potential effects of variation in the size structure of predator and prey populations on predator growth and prey survival during the juvenile estuarine period.

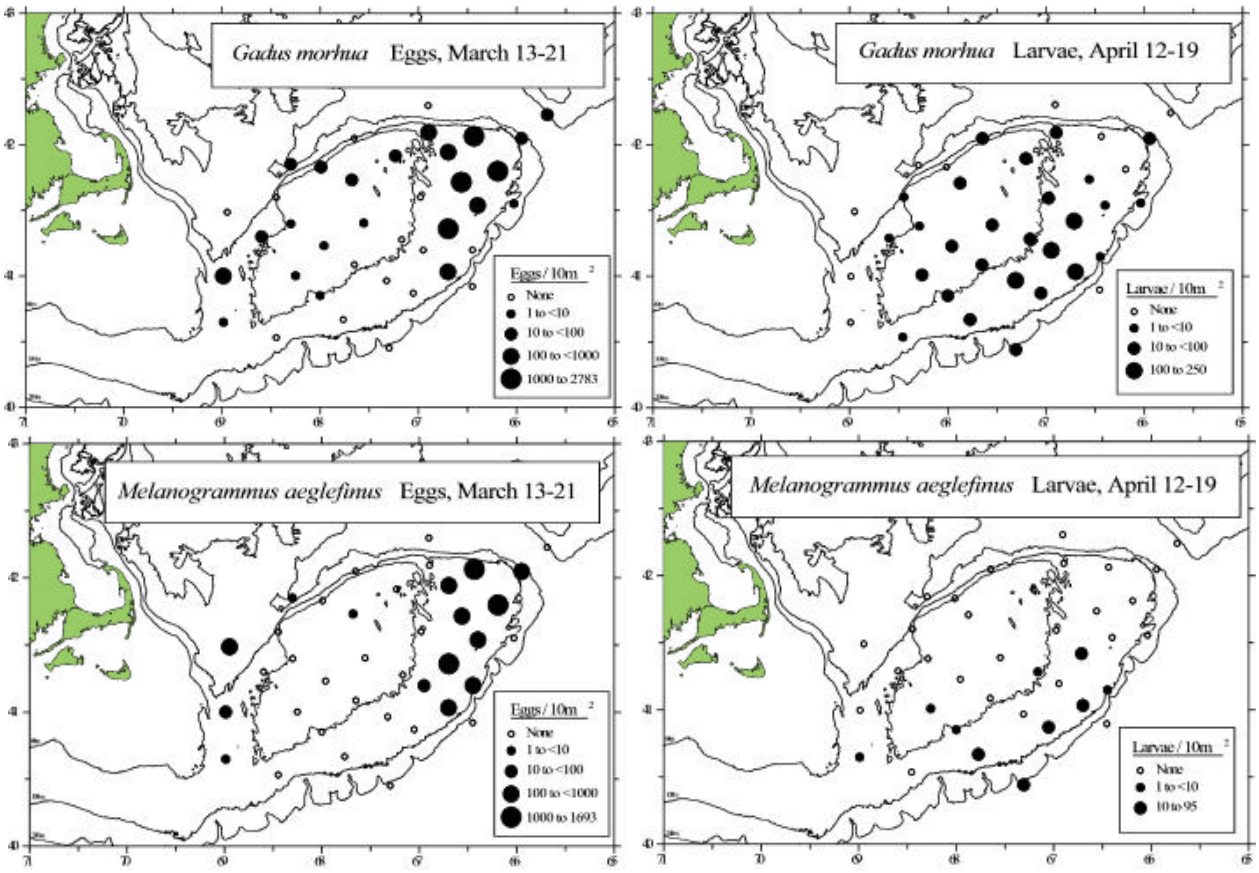
The Coastal Ecology Branch supports research on the life history and environmental requirements of economically important species of the Northeastern USA, with particular emphasis on recruitment processes and habitat function. Within this framework are both large-scale and local field projects as well as experimental laboratory studies. At the largest scale is the GLOBEC Program. GLOBEC researchers at Sandy Hook include Pete Berrien, Mike Fahay, Donna Johnson, and John Sibunka (contact: Peter.Berrien@noaa.gov). Their GLOBEC-related work is part of the GLOBEC Broadscale Project centered on Georges Bank, an area which is a productive extension of the continental shelf east of Southern New England. This is a cooperative multi-disciplinary effort, in conjunction with other NMFS workers at Woods Hole and Narragansett, RI, Laboratories as well as workers at WHOI, URI, Dartmouth, UNH, University of Oregon and other labs and universities in the Northeast US.

Major goals of this component of GLOBEC are to describe areal and temporal distributions and retention of eggs and larvae, and find possible biotic and abiotic factors that influence recruitment of Atlantic cod, *Gadus morhua,* and haddock, *Melanogrammus aeglefinus*, whose populations on Georges Bank are presently depressed. Monthly surveys from January to June conducted in Georges Bank waters sample and measure a variety of factors including nutrients, chlorophyll, zooplankton, fish eggs and larvae, juvenile fish, as well as physical and chemical variables and are coordinated with satellite imagery of surface conditions. Circulation models originating from the GLOBEC Modeling Group will be utilized to approximate trajectories of transport for planktonic forms of species in question. Four species are targeted for particular emphasis; two finfish, Atlantic cod and haddock, and two species of copepods which are important prey items for these

gadids.

Broadscale surveys are in the fifth and final year of field work. Counts of eggs and larvae from some of the early surveys are 'in hand' and can be displayed as in the accompanying figure of egg and larval densities. As samples are processed and the data become available investigators will be increasingly able to work towards the goals of describing and understanding factors in the recruitment process. Otoliths from cod and haddock larvae are being examined for daily growth rings and eggs are being categorized by developmental stage. Both of these aging efforts will allow estimation of daily growth and mortality rates as well as the back-tracking of origination locations through the circulation model mentioned above. When data from all years of the study are available and analyzed it is expected that interannual variation in growth and survival will be better understood.

Mike Fahay (Mike.Fahay@noaa.gov) has been involved in several local and regional projects. Recent fieldwork has focused on spawning and settlement patterns of winter flounder. Mike and Pete Berrien sampled ichthyoplankton in the Navesink-Sandy Hook Estuary during late-winter through spring, 1999, and will be comparing distributions of pelagic larvae with those of early settlement stage juveniles, presently being intensively sampled with beam trawls. Age distributions (birth dates) of these early settlers will be determined, and will provide insight into which part of the spawning season produces surviving juveniles, and where that spawning occurs. Early observations suggest a spawning pattern different from Pearcy's Rhode Island model. Specifically, spawning appears to have originated outside the Navesink River (downstream) and larvae accumulate upriver, as recent models of the circulation in this flood-dominated system predict for inanimate particles. Stage analysis of the larvae will further elucidate this spatial pattern.



In other field studies, Mike Fahay is working with Bob Cowen and Mark Sullivan (University of Miami) and Ken Able (Rutgers University Marine Field Station) to evaluate the effects of scallop dredging on habitat quality and growth rates in early settlement stages of *Limanda ferruginea* and *Merluccius bilinearis*. Using the submersible "Delta" they will make thorough video transects and beam trawl collections immediately before, immediately after, six weeks after, and one year after "saturation dredging" of test plots located within the Hudson Canyon closed area. In addition to evaluating relative densities of the two species, otoliths will be analyzed to determine whether recent growth patterns change after this habitat alteration.

Chris Chambers (Chris.Chambers@noaa.gov) joined the Branch in 1996 and has been a key figure in expanding the laboratory's experimental capability to include studies of early life history stages of marine and estuarine fishes. The research of his Life History & Recruitment Group has focused on the causes and consequences of phenotypic variation in life history traits in general and variation in growth, development, and survival rates in particular. These analyses include reproductive attributes of adults and a suite of ontogenetic and condition measures of offspring through their first year of life. Although several research topics are called out below with an identified lead researcher, the research in Chambers' lab has been a collective effort due largely to the contributions of Dave Witting, Steve Lewis, Michelle Walsh, Heather Hamlin, and Stephanie Barbeau. Summarized here are two general research areas that have received much of their attention over the last several years.

Reproductive output. Reproductive contribution to the subsequent generation along with offspring survival determine the level of recruitment of a yearclass. Fisheries ecologists are only beginning to place this problem in a Darwinian context and to understand the factors that influence fitness components. Efforts in this project are directed towards better understanding of how and why individuals vary from one another in their reproductive output and how reproductive output varies during the lifetime of the individual. To date, study subjects include summer flounder, *Paralichthys dentatus*, winter flounder, and Atlantic tomcod, *Microgadus tomcod*, with plans to incorporate Atlantic cod into the initiative. Analyses have focused on egg quality, as quantified by egg size, and how this varies among females and influences (covaries with) subsequent early life history traits. In all species presently analyzed, egg diameters vary significantly among females; the explained variance due to female generally running in the 60 to 90% range but is usually not related to female size. The Group is currently evaluating the consequences of this 'head start' afforded individuals from large eggs. Future work includes investigating the reproductive output of Atlantic cod from New Jersey waters (the southernmost spawning population of Atlantic cod worldwide), and evaluating the effects of thermal environments experienced in early life on the age, size, and gender at maturation in Atlantic tomcod. This latter species was chosen because it matures within one year in local waters and all life stages of tomcod have proven to be hardy under laboratory conditions.

Life stage & habitat transitions. The transition from one life stage to another in marine fishes is not only a time of marked morphological and ecological change but is often coincident with changes in habitat. Studies at the Howard Lab have focused on the duration of egg and larval life stages and the status of fish as they exit one stage and enter another. To this end, Chambers' Group has evaluated parental and environmental (temperature and salinity) effects on the duration of the embryonic, yolk-sac, and larval periods and on sizes and condition of fish at hatching and at metamorphosis. Study subjects have included summer flounder, winter flounder, windowpane (*Scophthalmus aquosus*), Atlantic cod, and haddock. Although developmental rates increase linearly or nearly so with temperature over all but the extremes of viable temperatures, body sizes at life stage transitions appear maximal at the cooler temperatures. This

holds true for both size at hatching and size at metamorphosis. Parental identity also influences size and age at life stage transitions, although not in a way that is obviously correlated with parental phenotype.

Work on life stage and habitat transitions also includes several studies aligned with the investigations of life stage duration mentioned above. These associated studies include one designed to better describe and quantify the morphological change in component features that contribute to the overall complex that we call metamorphosis. A second aligned study seeks to more accurately quantify the time course of mortality during larval life and evaluate the evidence for or against periods of exceptionally high mortality (i.e., critical periods). That work, outlined by Steve Lewis in a talk at the LFC'99 in Beaufort, NC, demonstrates that detecting critical periods is predicated on two conditions. First, age-at-death or lifespan data are needed for a fair appraisal of mortality patterns in the early life history of a cohort. Second, the statistical method applied to the data must be suited for the job. Specifically, a period of punctuated mortality will likely be smoothed out at best or overlooked at worst by parametric survival models. We recommend a nonparametric modeling approach that allows for rapid changes in the distribution of lifespans.

A third thrust of the Group related to life stage transitions evaluates the size range over which recently metamorphosed flatfish are vulnerable to predation. A series of one-on-one and one-on-many (functional response) trials have been conducted using various sizes of young juvenile winter flounder as prey and various sizes of either bay shrimp or summer flounder as predators. To date, results suggest that the demarcation between sizes of winter flounder that are vulnerable to sizes that are invulnerable is both clear and linear when confronted with either predator. The functional response studies indicate that young summer flounder can have a substantial impact on the abundance of recently metamorphosed winter flounder, e.g., a summer flounder juvenile of 50 mm TL can consume as many as 30 just metamorphosed (8-12 mm TL) within a 24-hr period.

Lastly, in collaboration with Keith Bosely and Sam Wainright, Rutgers University, the Group has been establishing rates of trophic transitions in larval and juvenile fishes. They are using stable isotope methodology to monitor assimilation and tissue turnover rates of predators. Their studies are providing the data needed to validate these and related techniques under best-case scenarios where the investigator is evaluating analytical methods by using fish of known age, feeding, and temperature histories. These baseline data can be applied to field situations for the purpose of inferring residence time and trophic position of a fish in a habitat beyond that which could be concluded based on habitat and gut contents at time of capture.

Dave Witting (Dave.Witting@noaa.gov) joined the Group in 1997 as an NRC postdoctoral fellow. His research has focused on the effect of environmental factors on rates of growth and development of young fishes, with particular interest in differences in morphological and meristic traits that may result from fish experiencing different environmental regimes during egg and larval development. For example, Dave is currently investigating how development under different temperatures can affect fish body proportions, the number of meristic elements, and the age and size at which an individual reaches developmental landmarks (e.g., hatching, metamorphosis, or maturation). His work is designed to identify the period in development when a suite of meristic and morphological variables are sensitive to temperature. The work has three primary components. First, a retrospective analyses of existing field data is being used to identify the magnitude and scale of variation in meristic and morphological traits. Second, laboratory experiments are being performed to validate the specific response of morphological traits to different rearing temperatures. Third, environmentally induced morphological variation is being related to the potential of an individual to survive. Several important applications are anticipated from Dave's work. Through an understanding of the environmental

component of morphological variation, it would be possible to more realistically interpret geographic variation in these traits for stock identification. In addition, the results could be used to infer the environmental conditions experienced during early development by fish in nature. Finally, these results may provide a link between environmental conditions experienced by young fish and their probability of recruitment.

Stephanie Barbeau (Stephanie.Barbeau @noaa.gov) is an M.Sc. student in the Graduate Program in Ecology and Evolution at Rutgers University. Her research, conducted at the Howard Laboratory, focuses on the effects of relative body size of predator and prey on the duration of the period of vulnerability to predation of recently settled juvenile summer flounder. In late autumn and winter in New Jersey waters, summer flounder undergo their larval-to-juvenile metamorphosis and ingress into estuaries where they settle and potentially encounter predators such as bay shrimp. The duration of time summer flounder juveniles are vulnerable to predation by bay shrimp depends on how fast they grow which in turn is influenced by temperature. Stephanie has demonstrated the effect of temperature on summer flounder growth rate by raising recently settled juveniles at 4, 7, 10, 13, and 16° C and monitoring their growth. By conducting over 160 one-on-one predation trials matching a wide variety of predator and prey sizes, she was able to determine the effect of relative size of predator and prey on the outcome of an encounter. These data, presented at LFC'99, have allowed her to estimate the duration and magnitude of risk of summer flounder juveniles to predation by bay shrimp.

In closing, we at Sandy Hook are excited by our research on the ecology, life history, recruitment, and habitat of fishes. We look forward to sharing our results with the community and promoting future collaborations with researchers elsewhere. In that vein, we would like to cordially invite the STAGES readership, ELH Section members, and other interested parties to the Larval Fish Conference in 2001 which will be hosted by research and support staff of the Howard Lab at Sandy Hook. We can guarantee an exciting research and recreational venue for all attendees.

Winter Flounder

Affiliate Members!

We have completed a project to update our database of full and affiliate members to make contacting section members more efficient. This list will allow us to contact voting members at election time and to send out reminder notices to affiliate members in a more timely and efficient manner. Until now, we have had a policy of sending out copies of STAGES to all affiliate members in good standing as of December 1995. Now all affiliate members will be receiving dues reminder notices as their membership expires. We ask that you please submit your dues to Kathy Lang, the section treasurer. Kathy is continuing to find ways to ease payment for our foreign affiliates, until that time, checks and money orders only please. If we do not hear from you we will stop sending the newsletter!

Wondering what's going on in the North Central, Western and Southern Regions ??

So are we! Our regional reps have been asking, begging, nay threatening, - but all to no avail. If you are in the ELHS and have not submitted anything to STAGES for the last 2 years, the section would love to hear what you are doing. You can contact any of the following people who would be only to happy to pass your news along:

North Central Region: David Culver, Department of Zoology, The Ohio State University, 1725 Neil Avenue, Columbus OH 43210-1220. (Ph: (614) 292-6995, Email:culver.3@osu.edu)

Western Region. Dan Margulies, Inter-American Tropical Tuna Commission, Scripps Institute of Oceanography, 8604 La Jolla Shores Drive, La Jolla CA 92307. (Ph: (619) 546-7120, Fax: (619) 546-7133, Email:dmargulies@iattc.ucsd.edu.

Southern Region: Jon Hare, NOAA/NMFS, Beaufort Laboratory, 101 Pivers Island Road, Beaufort, NC 28516. (Ph: (919) 728-8732, Email:jhare@hatteras.bea.nmfs.gov)

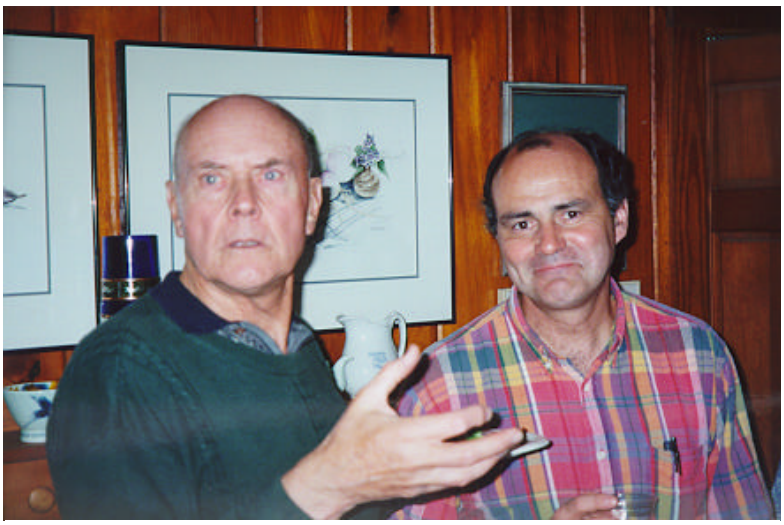
Alternatively, you can send the material directly to the editor

Changes for the New Millenium for STAGES

Tom Miller has been editor of Stages since 1995. He will stand down as editor in 2000. Beginning with the January edition the new editor will be Dr Perce Powell. With the change of editor will also come elections the Fall for new regional representatives. Together, the new team of editor and representatives will take the ELHS newsletter into the 21st Century.

They have a big job ahead of them. It is one that they can not do alone. They will need your support. You can help most by sending material to the regional representatives in a timely fashion. Almost 500 copies of STAGES gets sent to individuals and libraries all over the world. We believe it is one of the better "small-scale" newsletters produced by AFS. We can only maintain that standard if you, the membership, continue to support and encourage its development.

Good Luck Perce!



Perce Powell. (*left*) with Jeff Govoni after accepting the editorship of STAGES. The magnitude of what both has done is sinking in!!

International Section. Tom Miller, Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science, P. O. Box 38, Solomons, MD 20688. (Ph: +1 (410) 326-7276, Fax: +1 (410) 326-7318. Email: miller@cbl.umces.edu).

Asia-Pacific Region. Iain Suthers, School of Biological Sciences, University of New South Wales, Sydney, Australia. (Ph: +61 2 385-2065, Email:I.Suthers@unsw.edu.au).

University of New South Wales

What is the relative significance of sporadic, massive upwelling versus the chronic discharge of Sydney sewage? Troy Gaston and Iain Suthers have already found distinctive stable isotope signatures of carbon and nitrogen in a planktivorous fish (*Atypichthys strigatus*) off Sydney, compared to more distant sites. While the Sydney "poo" isotope signature is distinctive, there are some puzzling seasonal changes at all three major discharges. To get to the details of upwelling, Iain and a new PhD student, Augy Syahailatua had two very successful cruises on the R.V. Franklin off northern NSW during December '98 and February '99, both within textbook upwelling conditions! (supported by a new ARC grant). We observed a predictable alongshore gradient (south towards Sydney) in vertical structure (from 27°C water), phytoplankton, zooplankton and possibly in the larval fish community (60% sorted already). More importantly we collected abundant late stage carangid larvae for recent otolith growth, for RNA analyses and for stable isotope analyses to determine the question: where did the better condition larvae get their nutrient from? Last year we received an infrastructure grant to revamp the lab and purchase high-res. camera and a microplate reader for otolith and RNA work. Jocelyn Dela Cruz (PhD student) is determining the distribution of our major red tide causing dinoflagellate, *Noctiluca scintillans*. Iain and Chris Taggart, (Dalhousie University) are still plugging away at the plankton particle size spectrum from some Coral Sea work, and we are now inserting the size distribution of independently sampled larval fish into the same spectrum. Iain and Gudrun Marteinsdottir are also writing up the age and growth work of pelagic juvenile cod from Iceland, for comparison with Norwegian and Canadian growth studies.

Smith, K. and Suthers, I.M. 1999 Displacement of Sydney shelf ichthyoplankton by a coastal upwelling event. Marine Ecology Progress Series 176: 49-62

Smith K., M. Gibbs, J.H. Middleton, and I.M. Suthers. 1999 Short term dynamics of coastal ichthyoplankton off the Sydney coast. Marine Ecology Progress Series 178:1-15.

Murray, S. and Suthers, I.M. 1999 Population ecology of *Noctiluca scintillans*. Marine and Freshw. Research 50: 243-252

Suthers, I.M., T. van de Meeren, and K.E. Jørstad. 1999. Growth histories of three Norwegian cod stocks co-reared in mesocosms, derived from otolith microstructure; the effect of prey size. ICES Journal of Marine Science in press.

Smith, A. and Suthers, I.M. 1999. Effects or sewage effluent discharge on the abundance, condition and mortality of hulafish, *Trachinops taeniatus* (Plesiopidae). Environmental Pollution 106:

Lockert, M., and I.M. Suthers. 1998. Ontogenetic diet shift and feeding activity in a temperate reef fish - *Cheilodactylus fuscus*. Proceedings of the Linnean Society New South Wales 120: 105-116.

Lowry, M.B. and I.M. Suthers. 1998. Home range and homing behaviour of a temperature rocky reef fish, *Cheilodactylus fuscus*. Marine Biology 132: 569-578

Suthers, I.M. 1998. Bigger or fatter - or is faster growth better? Considerations on condition in larval and pelagic juvenile coral reef fish. Australian Journal of Ecology 23: 265-273

For more information please contact:

Iain Suthers
School of Biological Sciences,
University of New South Wales
Sydney
Australia
I.Suthers@unsw.edu.au

University of Technology, Sydney

The Booth lab at UTS is currently engaged in a number of studies directed at larval or newly-settled fishes. Dave Booth is continuing research into the link between food intake, condition and persistence of new recruit coral reef fish at One Tree Island and Lizard Island on the GBR. This study, funded by an ARC Large Grant, aims to determine whether fish condition can affect the link between larval supply and the dynamics of juvenile populations. In association with the study, Honours student Ben Brunton is conducting an experiment on the feasibility of stocking recruit coral reef fishes to enhance juvenile and adult populations. PhD student Tom Trnski is monitoring the flux of larval sparids and girellids into a large coastal brackish lake, and the physical and behavioural mechinsims by which larval influx links to settlement on the seagrass within the lake. PhD student Matt Lockett is investigating the viability of exotic populations of goby and tripterygiid in Sydney Harbour and Pt Phillip Bay, Victoia. Matt has recently found what appear to be larvae of these exotic species, suggesting that they may be able to complete their life cycles locally, and not require continual reintroduction through ballast water. MSc student Judy Upston is researching recruitment of fish to reef and seagrass sites in Botany Bay, Sydney, in part to determine the effects of the airport runways that jut into the bay. PhD studnet Veronica Silberschneider has just commenced research into recruitment of glass eels to estuaries arond Sydney, and PhD student Andrew West has also just started a study of billfish larval dynamics around Kona, Hawaii.

For more information please contact

David Booth
Department of Environmental Sciences
University of Technology, Sydney
P.O. Box 123,
Broadway, NSW. 2007.
+61 2 9514 4053
David.Booth@uts.edu.au

CSIRO Division of Marine Research

Barry Bruce and Russell Bradford are working on an Fisheries Research and Development Corporation project titled 'A synthesis of existing data on the early life history of southern Australian finfish'. Co-investigators include Tony Miskiewicz, Pancho Neira, Al Jordan, and Scott Condie. The project relies on the extensive archives of samples held by various research agencies, including CSIRO. One of the first tasks of the project is to design the database to house all the data. The aim of the database is to eventually make it available to others interested in larval fish as a follow-up to the Larvae of Temperate Australian Fishes by Neira et al. (1998). At this point in time we are targeting commercial species from the south eastern region, but would like to expand the dataset to include other species that may be of particular interest to others in the larval fish field.

For more infomation, please contact

russell.bradford@marine.csiro.au

Australian Museum

We have completed a total revision, combination and enlargement of two larval fish identification books that we originally published in 1983 (Leis and Rennis: Larvae of Indo-Pacific Coral Reef Fishes) and 1989 (Leis and Trnski: Larvae of Indo-Pacific Shorefishes), respectively. The new book deals with 123 families of Indo-Pacific Coastal Fishes, each in a separate chapter, and includes 219 plates illustrating the larval development of each family. The revision involved 32 contributors from all over the world, including Sally Reader and Tom Trnski, and was funded by Fauna Malesiana, a Netherlands-based funding agency. Jeff Leis and Brooke Carson-Ewart assumed the editorial mantle. It will be published early in 2000 by EJ Brill.

We have continued our research on the *in situ* behaviour of the larvae of coral-reef fishes during their pelagic phase under Australian Research Commission funding. We undertook two field trips to Lizard Island and one to Rangiroa in the Tuamotu Islands to work on this project. The

exciting results we have obtained are changing the way larval dispersal is viewed, and have important implications for management. No longer are fish larvae regarded as passive particles totally dependent on current flow in their movements. We now know that larvae are strong swimmers, with remarkable endurance. They are flexible in their behaviour, depending on the circumstances, and unquestionably have considerable control over their trajectories while pelagic and on where they settle at the end of the pelagic phase. An interesting result coming out of the work is the behavioural flexibility of the larvae: for example, the same species may swim faster in open water or when swimming away from the immediate vicinity of a reef than when approaching a reef, or swimming over it looking for a settlement site; and larvae may swim deeper in deep water than in a 20-30 m deep lagoon.

Taxonomic work on larval fish is also proceeding (with apologies to collaborators for the slowness of the progress), including descriptions of the larvae of the perciform fish *Centrogenys vaigiensis*, the sparid *Pagellus bellottii*, lutjanine lutjanids, and bothids. A paper on developmental osteology of caesionine lutjanids is in progress. Other ecological work includes larvae from coral-reef atoll lagoons in the Central Pacific (more apologies), and distribution of larvae on the Great Barrier Reef.

Tom Trnski continues to work on his PhD, funded by an Australian Postgraduate Award (Industry). Tom's scholarship will expire, and he will return to the Museum's fish section, in October 1999.The tentative title of his thesis is: *Physical and behavioural determinants of larval supply and settlement success in four estuary-dependent species*.

Contact information: see our website (www.austmus.gov.au\fish) for more details and images of larvae and of our field work; e-mails are listed in the website;

Australian Museum,
6 College Street,
Sydney, NSW 2000, Australia
phone 61 2 9320 6000; fax 61 2 9320 6059;

Recent Publications:

Bellwood, D.R., J.M. Leis and I.C. Stobutzki. 1998. Fishery and Reef Management. Science 279:2019.

Fautin, D., J.M. Leis and R. K. Cowen. 1998. Larval processes and settlement: session summary. p26-31 *in*: G.P. Jones, P.J. Doherty, B.D. Mapstone and L. Howlett (*eds*), ReeFish 95: *Recruitment and population dynamics of coral reef fishes*. CRC Research Centre, Townsville.

Leis, J.M., D.J. Bray, S. Bullock and K. Lee. 1998. Larval development in the lutjanid subfamily Apsilinae (Pisces): The genus *Paracaesio*. Bulletin of Marine Science 62(1):697-742.

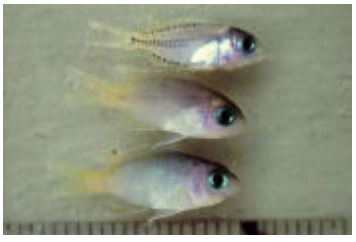
Leis, J.M. and B.M.Carson-Ewart. 1998 Complex behaviour by coral-reef fish larvae in the open water and near-reef pelagic environment. Environmental Biology of Fishes. 53(3):259-266.

Leis, J.M. and R.K. Cowen. 1998. Biases associated with studying the larval stage of fishes from the perspective of adult habitat, developmental stage and taxonomic grouping. P123-126. *in*: G.P. Jones, P.J. Doherty, B.D. Mapstone and L. Howlett (*eds*), ReeFish 95: *Recruitment and population dynamics of coral reef fishes*. CRC Research Centre, Townsville.

Leis, J.M. and I.C. Stobutzki. 1999. Swimming performance of late pelagic larvae of coral-reef fishes: *in situ* and laboratory-based measurements. pp 575-583 *In*: (Séret B. & J.-Y. Sire, eds), *Proceedings of the 5th Indo-Pacific Fish Conference, Nouméa, 1997*. Société Française d'Ichtyologie & Institut de Recherche pour le Développement, Paris .

Leis, J.M., T. Trnski, P.J. Doherty and V. Dufour. 1998. Replenishment of fish populations in the enclosed lagoon of Taiaro Atoll: evidence from eggs and larvae. Coral Reefs 17(1):1-8.

Neira, F.J., Miskiewicz, A.G. and Trnski, T. 1998. *Larvae of Temperate Australian Fishes: laboratory guide for larval fish identification*. University of W.A. Press, Nedlands, W.A. 474 pp.



MEETING REVIEWS

23rd Annual Larval Fish Conference
Beaufort, NC
April 6 - 10

There has been an ongoing debate within the Section of whether we should meet concurrently with other organizations, such as ASIH, or whether we should meet alone. There are certainly benefits to be gained when we meet in a larger forum. But, I think this year's LFC in Beaufort, NC, was a perfect example of the benefits to meeting just as the ELHS.

The meeting was hosted by the NOAA/ NOS Center for Coastal Fisheries and Habitat Research in celebration of the centennial of the Beaufort Laboratory. The Beaufort Laboratory was initially not a year-round institution; scientists made the short boat crossing each summer. But over time, and with the addition of the causeway to Piver's Island the lab became a year-round facility. The lab has gone through many re-organizations in its history, but it has had a consistent focus on the biology of mid-Atlantic Bight fishes, and estuarine habitats which remains today.

The meeting was also held to honour the contributions of Dr. John Blaxter. All participants were sad that John could not attend in person. But his influence was very much present in the talks and posters presented. On the first morning of the conference, there was a special session of talks from people who have collaborated with John, including Masauro Tanaka, Peter Tytler, Bob Batty, Bob Werner, Lee Fuiman, and Kevin Baily. However, John's influence at the conference was not limited to these presentations. It was possible to see his fingerprint on talks on the development of organ systems, anti-predator and reproductive behaviours given by students who probably have not even met John. He has every right to feel proud of the influence he has on our field.

Don Hoss, Jon Hare, Jeff Govoni and their colleagues did an outstanding job of organizing the meeting. The meeting itself was held on the adjacent campus of the Duke University Marine Lab. All talks, posters, coffee breaks and lunches were held on the DUML campus. This meant that over the five days of the conference one had a wonderful opportunity to meet all of the scientists attending the meeting and to discuss their research. It also meant that it was possible to follow up issues arising from talks with the speakers themselves. One did not have to spend time wondering if you would bump into them again – you only had to wait for the next coffee break. The meeting was also organized not to have concurrent sessions. It may have made the meeting slightly longer than other meetings, but it meant that everyone heard all of the talks. You were freed from the need to constantly rush from one session to the next to hear talks. You simply sat and waited.

Those who sat and waited for the full five days of the conference were amply rewarded. The standard of presentations at the conference was exceptionally high. This was true both for oral and poster presentations. The strong science contained in the presentation was matched by a high degree of professionalism in the style of the presentations. I did not envy the Sally Leonard Richardson Award committee their job one bit. They had an extremely difficult task. Their final decision was to award the 1999 SLR Award to Jean Billerbeck for her presentation on the energetics of Atlantic silversides (*see abstract on p XX*). They also awarded four honourable mentions. It would be amiss of me not to mention the contribution of the 10 Japanese graduate students from Dr Masauro Tanaka's laboratory. All of them gave talks, presented with humour in clear and precise English, that detailed

their work on the development of organ systems and on recruitment patterns of Japanese coastal fishes.

Several research themes were prominent in talks at the conference. There were many talks that involved exploring interaction between the physical oceanography and biology of fish larvae. Talks on systems from the West Indies, to the Atlantic Provinces of Canada serve as examples. Dorsey and Cowen presented a summary of their high frequency sampling of settlement in Pomacentridae in Barbados. They found a distinct lunar cycle in settlement. But mesoscale features acted to modify this pattern substantially. Reiss et al. presented results that a simple dynamic height model was a good predictor of larval fish distributions on the Scotian Shelf off of Halifax, Nova Scotia. Other talks on this theme included presentations by Houde et al, Hare et al., McPherson et al., and Settle.

Another popular theme at the conference was energetics. Defined broadly, this covered talks on larval condition, all the way up to energetic-based life history trade-offs. Examples of the former included Burger et al.'s and Groenkajaer et al.'s use of RNA/DNA ratios to look at depth-specific condition of hake, and Heyer and Miller's exploration of the presence of maternal effects in different half-sib families of yellow perch. At the broader scale, a pair of talks from Billerbeck and Conover and Lankford and Conover explored the life history trade off between growth and predation in Atlantic silversides. Niklitschek and Secor used a bionergetic-based model to attempt to define the potential for recovery of Atlantic, based on the distribution of water quality sturgeon in the Chesapeake Bay.

The final theme common to many talks at the conference was development. Examples of talks in this category included Neuman and Able's detailed description and quantification of metamorphosis in windowpane flounder, Hirai et al.'s description of the change in the distribution of gill chloride cells in juvenile Japanese sea bass and Lara's description of the relationship between the development of sensory systems and settlement in Caribbean labroids.

There were simply too many good talks at the conference to mention them all. But there are several developments that point to an equally exciting future for the LFC. Several high tech approaches seem to be making the transition from lab to field and are now allowing researchers to address fundamental ecological questions. Thorrold et al. and Kimura et al. used microchemical analysis of otoliths of young fish determine their natal area. Use of these natural tags has great promise for both applied and basic problems. Herzka et al. used stable isotope analysis to shed light on settlement in red drum larvae by combining detailed laboratory experiments with quantitative sampling from the field. We seem to be making solid progress on our understanding of how physical oceanography influences recruitment patterns. Finally, we are beginning to revisit some old chestnuts – such as what is a critical period, and how would you detect one. These all point to a maturing science and bode well for the future.

Future Venues for the LFC

2000	Gulf Shores,
2001	Sandy Hook, NJ
2002	Bergen, Norway

We are already beginning our planning for upcoming meetings. Next year's meeting, to be hosted by Jim Cowan will be in Dauphin Island, AL. Following that Chris Chambers and Mike Fahay are heading a team to host the LFC in Sandy Hook, NJ. Further into the future, the section has made a commitment to meet in Bergen, Norway in 2002. This meeting may involve a joint meeting with ICES.

See you there!

Abstract of Sally Leonard Richardson Award-winning Presentation

Big Problems for little fishes: energetic conflicts in Atlantic silversides
Billerbeck, JM and DO Conover
Marine Sciences Research Center, State University of New York, Stony Brook

The selective factors influencing the evolution of growth rates in fishes are poorly understood. In the Atlantic silverside (*Menidia meidia*) intrinsic rates of food consumption and growth increase with latitude along the east coast of North America. The sub-maximal growth rates of southern genotypes contradict the "bigger is better" hypothesis, yet may still persist due to physiological trade-offs in energy allocation. One potential trade-off is that between growth and swimming performance. Energy-budgeting conflicts are likely to arise in small fishes that are consuming large meals and growing rapidly while attempting to avoid predators. Yet surprisingly few studies have examined the effects of consumption or growth rate on swimming performance. In this study, we compared critical and burst swimming speeds of laboratory-reared *Menidia* juveniles from two populations (northern vs. southern) at two ration levels (unfed and satiated). Fast-growing northern genotypes consistently displayed inferior swimming capacity compared to slow growing southern genotypes. Additionally, swimming performance was reduced in fish that had recently consumer large meals. These data suggest that rapid growth in northern fish has evolved at the expense of swimming ability and may explain why "bigger" is not always "better" in the early life history of fishes.

Congratulations Jean !!

Background to the SLR Award

The award for the best student presentation at the larval fish conference commemorates the life and work of Sally Leonard Richardson. Sally was a dedicated and formidable woman , whose research focused on the study of larval form and its application to the understanding of fish phylogeny. She died on route to the 1986 Larval Fish Conference in Miami, FL

Sally's early work was on the descriptions of larval bothids which was submitted as a part of her doctoral dissertation at the Virginia Institute of Marine Science From there, Sally's career took her to Oregon, Mississippi and Massachusetts.

Her friends established the award for the best student paper in her memory as "Sally was so involved in stimulating students." The award is accompanied by a handsome plaque, a copy of Sally's obituary that was published in Copeia, and a cheque for $150. Simply stated, the Sally Leonard Richardson award is the most prestigious award the ELHS can bestow.

Previous Recipients of the SLR Award

1998	Sharon Herzka (Port Aransas Laboratory / UT - Austin)
1997	Jennifer Casell-Reinhardt (UC - Santa Barbara)
1996	Jay Rooker (Port Aransas Laboratory / UT - Austin)
1995.	F. Javier Gago and Ilona Stobutzki (Joint Award)

DATES TO REMEMBER

August 29 - September 2, 1999	American Fisheries Society Meeting (www.fisheries.org/annual99)	Charlotte, NC
September 30 - October 2, 1999	Australian Society for Fish Biology (www.zoology.unimelb.edu.au/asfb)	Bendigo, Victoria, Austalia
October. 18-23, 1999	4th International Symposium on Flatfish Ecology	Morehead City, NC
November 30 - December 1, 1999	First Biennial Meeting on the Biology of Tautog and Cunner	Mystic, CT
June 24 - 28, 2000	4th Larval Biology Meeting (www.biology.ucsc.edu/larval2000)	Santa Cruz, CA

AFS-ELHS
Chesapeake Biological Laboratory
University of Maryland Center for Environmental Science
P. O. Box 38
Solomons, MD 20688-0038

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