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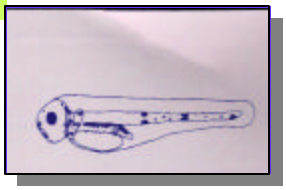
ELHS Newsletter
AFS.

stages



President's Message

Inside this issue:

Nov. 5-10, 2000
24th Annual Larval Fish Conference: Gulf State Park, AL
(Details in this issue)

Dec 3-6, 2000. Walleye Management Symposium. Part of Midwest Fish and Wildlife Conference, Minneapolis, MN
Contact: Joe Larscheid 712/336-1840 or Dave Lucchesi, 605/362-2716

Our organization is about communication among people interested in all aspects of the early life history of fishes; indeed, communication is one of our principal missions. We accomplish communications through our excellent ***STAGES***. But is not publication in more formal and widely distributed media, also a valid form of communication?

In the beginning, some of our members were experiencing difficulty in finding a medium for the publication of purely descriptive work on life history stages, and our organization held as an objective and served its membership, by finding and providing media. In these early years, our organization routinely published the Proceeding of our Annual Larval Fish Conferences, first as grey-literature , Conference Proceedings, then as dedicated issues, or sections of the Transactions of the American Fisheries Society. More recently, symposia organized at our Annual Larval Fish Conferences and focused upon process-oriented research, have been published as AFS Symposia, in dedicated or special issues of various journals (Bulletin of Marine Science, Freshwater and Marine Research, and Marine and Freshwater, Behaviour and Physiology), as Technical Series (NOAA Technical Reports or Canadian Technical Reports in Fisheries and Aquatic Sciences), or as volumes printed by Publishing Houses (Kluwer Academic Publishers). A complete listing of our publications can be found on Early Life History of Fishes Website, but the point here is that most recently, this function has fallen fallow. There were no publications in 1990, 1993, 1996, 1997 1998, or 1999 and this, perhaps, signifies a curious trend.

This falling-off of publications is due to numerous problems. First among these difficulties was publication financing. Although some money within the General Account of the Early Life History Section is earmarked for publications and is held in escrow for this purpose, the onus of publication cost fell upon the Local Committee, which at times had difficulties budgeting its own Conference, let alone finding a source of money to support publication. Money held in escrow for publications has grown through royalties on the sales of past publications, but in the beginning money held in that gathers definitive information and

President's Message Continued

publishes complete and comprehensive results. Yet, we hold a competition for the Best Student Paper, the Sally Leonard Richardson Award, which maintains thoroughness and comprehensiveness as criteria for selection. Is there not room for both kinds of presentation at our Annual Larval Fish Conferences; thought provocative, but incomplete studies, and comprehensive and fully developed papers?

It is my opinion that the publication of well organized, well advertised, and well executed symposia, would accomplish a substantive mission of our organization, the communication of information about the early life history of fishes. Publication money held in escrow is now over $6000. While this would not cover the publication costs of even a single Symposium, it would serve as match for collateral funding. Our general account is stable at well over $20,000. Could not some of this money be moved to the publication escrow to boost this fund? Would this not constitute service to our membership; aiding in publication? How better to spend some of our money? I invite our membership to the next business meeting of our organization to be held at the 24th Annual Larval Fish Conference in Gulf Shores Alabama, in November, so that we can discuss this proposal.escrow was insufficient to cover the total cost of publication. In addition to problems with financing, some of our members objected to the grey-literature attributes of the early Proceedings publications, while others wanted to participate in Annual Larval Fish Conferences without having to prepare a publishable piece for presentation at the meeting. On the matter of descriptions of larval fishes, there is the present suggestion that our Website publish line drawings, in fact create a library of larval fish descriptions, but there are unresolved copyright issues here. The problem of publishing descriptions is obviated by some of our members who are now Editors of top-shelf journals and who have assured us that they welcome and will publish descriptive work.

The publication of Symposia constitutes a different story. These colloquia have been, by and large, well advertised, and well attended; they were published in top-notch journals or as monographs. Why then have the publication of Symposia fallen off? It must be publication costs. Host Local Committees of the Annual Larval Fish Conference often have too much to do to besides about s drumming-up money for publication.

Many of our members view the Annual Larval Fish Conference as a forum; a time and place to present preliminary data and to solicit comment, not as a meeting

Jeff Govoni

Hoyt Early Life History Bibliography now available on line.

Dr. Hoyt's (1998) two volume bibliography has been "out-of-print" for many years but remains by far the most comprehensive and useful bibliography of fish early life history literature. With Dr. Hoyt's permission, our Section's Bibliography Committee made the bibliography available for creating online searchable files and as a downloadable or diskette file; visit: <http://www.cnr.colostate.edu/~desnyder/elhsbib5.htm> for details.

Two online searchable versions of the bibliography are now available. The original was prepared on a gopher server, and the other, more recently-released version, on a World-Wide-Web (web)

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server. Both are full text indexed (WAIS) and thereby searchable on every word, including author, publication year, and journal (as abbreviated in original bibliography). Search terms are single wordcase-insensitive, and may be combined using Boolean search parameters. Both versions return an abbreviated list of records meeting the search criteria (single line per entry); full records are then displayed one at a time as selected by the user. The newer web version also provides the option of a results list with full-text records (convenient for printing the entire set of results).. The newer web version also provides the option of a results list with full text records. Our Section Web page, <http://www.eos.ubc.ca/afs_early/>, provides links to both versions under the subpage "Other ELH Links"

The gopher-server version, prepared several years ago by Dr. Julian Humphries , is currently accessible through "Biodiversity and Biological Connections" gopher at url<gopher://biodiversity.uno.edu:70/77/.indices/fishbib/bib. With a background information document at <gopher://biodiversity.biodiversity.bio.uno.70/00/project_information/faunas/hoyt>. Links to both the searchable file and background document are provided on the web at <http://biodiversity.uno.edu/> under the subpage, "Ichthyology"

The web-server version of the online bibliography was prepared by Peter Brueggman of the Scripps Institute of Oceanography Library , and is located at url <http://scilib.ucsd.edu/sio/indexes/hoyt.html>.

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Our Next Meeting … 24th Annual LFC - Gulf Shores, AL

The 24th Annual Larval Fish Conference will be held in Gulf Shores, AL on 5-10 November 2000. The conference program will begin with a 1-day theme session (organized by R.F.Shaw, Louisiana State University, 225-388-6734) designed to critically review, evaluate and focus the evolving hypotheses from previous Global Climatic Change (GCC) research as they pertain to impacts on coastal Essential Fisheries Habitat (EFH), followed by a 1-2 day "working group meeting" for those interested.

A second 1-day theme session (organized by J.H. Cowan, Jr. 334-861-7535 and D. DeVries 334-844-9322, University of South Alabama and Auburn University, respectively) will be devoted specifically to GCC, EFH and fish early life history stages, and will focus on habitat-related recruitment bottlenecks and other issues related to the interaction between habitat and factors that limit population size. Theme session 1 and 2, and working group results will be published in a reviewed and edited book or special issue journal. Timely turnaround of said publication (within one year) will be aided by pre-distributed briefing documents and invited symposium speakers arriving with disciplinary "white papers" and manuscripts in hand. The symposium and its proceedings will provide a forum for consensus, and a single source of information detailing the potential problem, its likely impacts, and methods to investigate, identify and mediate these impacts.

Finally, a third 1-day theme session (organized by J. Shardo, USA, 334-460-7523) will be devoted to fish embryology and larval development. The remainder of the conference will be comprised of contributed papers, with many of these expected to address conference topics.\par \par A website describing conference location,facilities, and registration procedures will appear shortly, linked to the ELHS website {http//www.eos.ubc.ca/afs_early/" }, with additional links to the Dauphin Island Sea Lab (www.disl.org/main.html/), the USA Department of Marine Sciences (www.southalabama.edu/marine_sciences/index.html) and the LSU Coastal Fisheries Institute (http://chaos.cceer.lsu.edu/, look under Research Units, then go to Coastal Fisheries Institute).

The first call for papers and early registration will occur in April; abstracts for contributed papers will be due by 1 September, 2000. The conference will be held in a self-contained, 144-room conference center located at Gulf State Park, on the northern Gulf of Mexico\rquote s \ldblquote emerald coast\rdblquote in Gulf Shores, AL. Room rates will be $39/night. Room registration will be made directly with the conference center once the website is activated. The conference center can be reached by flying either into Pensacola, FL or Mobile, AL and is about a 1-hour drive from each. The weather in early

November usually is in the low to mid-70s, with cool nights in the low 50s. Surf temperatures also are usually in the low 70s; fishing, scuba diving, golf and tennis are located nearby. For more information, feel free to phone or e-mail Jim Cowan at 334-861-7535 or {jcowan@jaguar1.usouthal.edu" }

Regional News, Western Region
Dan Margulies

The Polish Plankton Sorting and Identification Center
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You may have read in the acknowledgments section of a plankton paper authored by scientists from the National Marine Fisheries Service (NMFS) something like Aplankton samples were sorted, and fish larvae identified, enumerated and measured at the Polish Plankton Sorting Center in Szczecin, Poland@. Like Butch Cassidy asked the Sundance Kid incredulously of the trackers who were following them, you may have asked yourself Awho are these guys?@ Well, these "guys@ are a group of about 35 professional women who are world experts in zooplankton and ichthyoplankton taxonomy. They work in a laboratory in Szczecin, Poland, that is part of the Sea Fisheries Institute of Poland. The work done in this laboratory is supported in part by a U.S.-Poland Joint Studies Project. Poland=s collaboration in this cooperative project is primarily processing plankton samples collected during fisheries assessment and ecological research cruises conducted by NMFS. This processing includes sorting fish eggs and larvae from invertebrate plankton, identifying the fish larvae, counting them and measuring a subsample . The invertebrate zooplankton specialists do the same type of processing for invertebrates, and also identify microzooplankton which serve as prey for larval fish species. Through this partnership the scientists in Szczecin process about 6000 plankton samples per year for NMFS.

The expert professional staff of this laboratory (ZSIOP: Zak»ad Sortowania i Oznaczania Planktonu) has been working with NMFS for 26 years. If you consider the radical political and economic changes that have taken place in Poland during this period, it becomes apparent how remarkable our work with this laboratory is. When it started we were in the depths of the cold war: Poland was one of the Eastern Block satellite states of the U.S.S.R. Then came the Solidarity movement, and Poland started on the long and convoluted road toward an independent democracy and a free market economy. Along the way were labor strikes, food shortages, a period of martial law, and run-away inflation. In spite of all this ZSIOP continued its work. Now Poland is a vibrant, independent, democratic country. The standard of living is changing so rapidly that each visit there, at two-year intervals, seems like visiting a different country. ATMs are now on every corner, outdoor advertisements are everywhere, shops are full of goods from around the world, and cell phones abound in this once secret society.

The professional staff at ZSIOP, under the long-time director, Dr. Leonard Ejsymont, is composed of university trained ichthyoplankton and zooplankton specialists, a computer support person, and an archivist/record keeper. There is also a branch of ZSIOP in Gdynia that specializes in Continuous Plankton Recorder silks. Several of the staff have been working at ZSIOP since it opened. Most started work at the laboratory just after completing technical degrees in fisheries at the college where the laboratory is located. We just learned that one of these long-term employees is now a grandmother!

Southeast Region

Lee Fuiman
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Two new people joined Team Fuiman this year. Maria Alvarez, winner of the best poster at last year's LFC joined us last summer (1999). She received her master's degree at Kyoto University, under Masaru Tanaka's supervision.She will be working on the effects of xenobiotics on larval behaviour and metabolism for her PhD. Ian McCarthy came on board last October as a postdoctoral fellow. Ian received his PhD in Dominic Houlihan's lab in Aberdeen University and most recently worked at the Glasgow University Field Station on Loch Lomond. He brings a keen interest in physiological processes to our lab and will be examining contaminant effects on sciaenid larvae.

For the past few years there have been two main themes of work at our lab. One is the effect of several endocrine-disrupting chemicals (EDCs) on a number of species of marine fish larvae. The second is dealing with the assessment of individual variability in specific traits that might result in higher survival of larvae as a possible clue for predicting the future of an entire cohort.

We have approached the first research topic in two ways. One is assessing the effect of parental exposure to different pollutants on the behavioral and physiological performance of their offspring. For this project we are working with Atlantic croaker (*Micropogonias undulatus*). The hypothesis pursued here is that because of the lipophilic nature of the EDCs tested, maternal exposure to environmentally realistic levels of these chemicals via food will have an effect on their progeny. Females loaded with contaminants will transfer significant levels of these to the growing oocytes through the yolk. During the early larval stages the yolk is absorbed and this is when the effects of the carried xenobiotics can be observed. We believe that, although development might be apparently normal, ecological survival skills will be impaired. For this period, ecological performance, metabolism, growth and development of control and contaminated larvae are measured. The performance trials include measurements of routine swimming and burst responses to acoustic and visual stimuli in order to evaluate their abilities to find food and evade predators. As for the metabolism and growth evaluation, measurements of oxygen consumption, RNA/DNA and protein turnover are planned.

Cindy Faulk's master's degree research (1997) showed that the performance of larvae from parents exposed with DDT was significantly impaired, and Dan Sabath's master's research involves similar experiments using a parental DDE exposure. Ian McCarthy and Maria C. Alvarez are analyzing the performance of PCB exposed larvae. Following the same line of experiments, we will be performing studies on the effects of methyl mercury and 4-nonylphenol parental exposures on larvae. So far our results show that levels of pollutants considered "safe" do have a profound effect on the survival skills of larvae.

As part of the study on the variation in traits of individual larvae (in collaboration with Dr. James H. Cowan, Jr., University of South Alabama), we were asking the question: *"are survivors of a cohort of larval fishes exceptional individuals in some way, or are they just lucky enough not to encounter predators at a time in their development when they are highly vulnerable to predation?"* In the laboratory component, doctoral candidate Michael Smith has been investigating the potential causes and behavioral consequences of individual variability in growth rates of red drum larvae as well as larva condition in terms of RNA/DNA ratios. His work can be summarized as follows:

1)Michael is examining differences in behavioral performance between fast and slow growing red drum larvae of the same sizeand ontogenetic stage. The measurement include routine swimming and burst responses to acoustic and visual stimuli. He has also performed these behavioral experiments on field-collected red drum to see if laboratory-reared performance trials are representative of the abilities of wild fish.

(2) The effect of cohort density on red drum growth variability was examined by rearing red drum individually and in groups for three weeks, and comparing the variance in total lengths of the two treatments. He found that lengths of individually-reared red drum decreased in variance while lengths of group-reared larvae increased in variance over time (termed growth depensation). A significant increase in size variability occured between 7-15 days posthatching. This increase may have resulted from differential timing of switching from rotifers to *Artemia*, but in trials in which only rotifers were provided as a food source, the increase in variability still occurred.

(3) Michael is also analyzing the variability in egg size. Individual red drum eggs are measured and incubated until yolk absorption to examine the relationship between egg and oil globule size (maternal effects) and size of larvae at time of first feeding.

(4) In collaboration with Sharon Herzka (Joan Holt's lab), Michael is examining relationships between RNA:DNA ratios and behavioral performance. These behavioral experiments were done with both fast and slow growing red drum larvae of the same size. Routine swimming speeds were greater for larvae with higher RNA:DNA ratios, but this trend was only evident in slow growing larvae. While there was a significant correlation between RNA:DNA and growth rate for slow growing larvae, there was no significant relationship in fast growers.

(5) As a complementary study, Michael is also developing an individually-based model to simulate predation mortality on red drum larvae. Specifically, he is examining three questions: How does individual variability in growth rates influence survival? Can variability in individual escape performance affect larval survival in model outcomes? How do temporal shifts in total length variance influence larval survival?

In the field side of this project, we are working in collaboration with Jonathan O'Neal (Jim Cowan's lab, University of South Alabama). Jonathan is undertaking mesocosm experiments to compare the data obtained in the laboratory by Michael Smith to a more environmentally realistic situation. He has been working on the idea of growth rate as an indicator of better fitness in larvae. For this, he raised concurrent cohorts of larvae that were approx. 10 days apart in age, and waited for them to reach a specific size (approx. 8 mm). In this way the fastest and the slowest growers (from the younger and older cohort, respectively) could be tested in the same mesocosm experiment with a single predator fish. In this experiments, a population of similar sized larvae with different growth rate histories was tested. Estimates of instantaneous daily mortality of fast and slow growers were obtained and compared to see if there was any significant difference. These data are currently being analyzed and compared to results obtained using individual based modeling to investigate longer-term cumulative mortality that could not be obtained in the field. Currently, Jonathan is attempting to screen larvae for particular behavioral traits (namely, routine swimming speed),. separate out fast and slow swimming larvae, and then follow the same mesocosm procedure in order to see if this behavioral trait is an indicator of better anti-predator skills leading to a higher probability of survival to adulthood, as suggested by the laboratory results.

Grace Kilbane (an undergraduate intern from Loyola University) conducted experiments to determine whether the spectral sensitivity of the red drum scotopic visual system changed during the larval peeriod. Her results confirmed those of Brendan Delbos (an undergraduate intern from Southampton College), who previously showed a dramatic improvement in overall sensitivity when rods began to

to appear (*Copeia* 1998: 936-943). She also found that all stages of larval and juvenile red drum were least sensitive to wavelengths of 640-630 nm (blues) and most sensitive to wavelengths of 410-460 nm (reds). Grace doesn't think that's why they're called *red* drum!

Debbie Rosier (undergrad intern from University of Texas at San Antonio) is conducting several comparative studies on the growth rates of *Brachionus plicatilis* fed a number of commercially available rotifer feeds. The aim of her research is to select the most suitable food to maximize the rotifer production and rotifer quality in our laboratory.

Lee is also working on marine mammals, but that's another story.

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Here and there…INTERNATIONAL News
Iain Suthers, Australia

at the Australian Museum –

Behavioural research by Jeff Leis and Brooke Carson on larvae of coral-reef fishes continues to reveal surprising things. For example: larvae of at least one pomacentrid species use a sun-compass, whereas larvae of a chaetodontid species swim offshore during the day, a number of species swim at different depths in different locations, and many alter swimming speed to suit different locations or swimming directions. We are awaiting word on funding for work on the ontogeny of swimming capabilities. Jeff is applying this behavioural information to the question of 'openness' of marine populations as member of a working group at the National Center for Ecological Analysis and Synthesis at UC Santa Barbara. Collaborative work on larvae that complete their pelagic phase in atoll lagoons in French Polynesia is nearing completion.

Our new, 1000-page book "**Larvae of Indo-Pacific Coastal Fishes**" has just been published by Brill (www.brill.nl). We are continuing other taxonomic work on larvae of lutjanids and sparids. Tom Trnski is finishing up his PhD on recruitment of sparid larvae into a coastal lake (=estuarine lagoon). Check out www.austmus.gov.au for other details and a publication list.

Summary of Larval fish research at Fish Ecology Labs, University of Technology, Sydney

1. Tom Trnski ((Doctoral Student) is studying advection of sparid and girellid larvae into Lake Macquarie, a shallow estuarine water body north of Sydney. Larval influx and settlement have been linked to a combination of larval swimming behaviour, nearshore oceanographic processes and habitat distributions.

2. Matt Lockett (Doctoral Student) is sampling for larvae of 2 exotic gobies in Sydney Harbour and Port Phillip Bay, Melbourne to establish whether these ballast-water introductions are able to complete their life cycles locally or need to be continually reintroduced to maintain local populations.

3. Andrew West (Doctoral Student) is researching early life history of billfishes off Kona, Hawaii, in order to investigate links between larval supply and adult densities.

4. Andrew Moore (Doctoral Student): Is researching the genetics of dispersal of the long-finned eel on the east coast of Australia and the south Pacific, with the goal of describing stock structure along the east coast of Australia.

5. Veronica Silberschneider (Doctoral Student) is researching the supply of glass eel stages of the long-finned eel in eastern Australia.

6. David Booth: links have been established between the condition of incoming reef fish larvae (Pomacentridae) and settlement success at 2 locations on the Great Barrier Reef. Manipulative experiments have shown that low-condition fish are more susceptible to predation in the first few days post-settlement. The link between spatial patterns of larval supply and subsequent recruitment can thus be modified by spatial variation in larval condition.
See http://www.science.uts.edu.au/depts/des/dbhome.html

Ichthyoplankton news from the Western Australian Marine Research Laboratories.
May 2000

In May 1999 dedicated sampling for the larvae of bluefish produced the first recorded occurrence of this species in Western Australia. The samples were collected by Richard Steckis. Bluefish larvae were collected from surface tows at stations where the water depth was 200m or more. It was postulated from the literature that the most likely place to find the larvae of bluefish was along the continental slope and this seems to be the case, although samples collected inshore of the shelf break may yet reveal further bluefish larvae.

Data collected in a one month cruise in 1994 suggest a potential for *Sardinops* larvae to be transported ~1000 km prior to metamorphosis along the southern coast of Australia, thus possibly moving between separate management units in Western and

South Australia. Results are still being evaluated by Dan Gaughan and others. Relatively straightforward techniques applied to larvae collected in conjunction with oceanographic data can contribute significantly to our understanding of population dynamics and also identify new management issues.

Gary Jackson's group has been applying DEPM techniques to the recreationally important sparid *Sparus auratus* in Shark Bay. As well as obtaining estimates of spawning biomass, the seasonally intensive sampling is gathering interesting information on the relationship between adult spawning behaviour and distribution of eggs.

A recreational fisher recently caught a dolphin fish /mahi-mahi off Perth which had eaten a very small (about 6 cm, body length from lower jaw) broad billed swordfish. Not a larva, but close to that end of the lifecycle. Also interesting, the specimen had been preserved in a jar of gin.

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Larval fish research at the University of New South Wales

Iain Suthers' laboratory continues to examine the oceanographic relationships of larval condition (RNA-DNA, recent otolith growth with PhD student Augy Syahailatua), stable isotope analysis of carbon, nitrogen and sulphur (PhD student Troy Gaston), red tides of *Noctiluca* (PhD student Jocelyn Dela Cruz) and plankton particle size analysis (PhD student Dave Rissik). The work centres around cruises through two classic massive upwelling events off the north coast during the El Nino summer of 98/99, compared to the far smaller but chronic discharge off Sydney. This work was spurred on by our earlier discovery of distinctive stable isotope signatures of planktivorous fish near and far from sewage outfalls – when our oceanographer colleagues said that the amount of Sydney's discharge (1,000 Ml/day) was "just a drop in the bucket". We were also excited by finding an oscillation in the zooplankton community and stable isotope signature off Sydney during the massive upwelling of '97/98 (Steve Rutten, honours student). We repeated this work in nearby Jervis Bay last summer, spanning at least two upwelling events.

Our yard stick for comparison on the cruises are two larval *Trachurus* species. We have established a microplate method now for estimating RNA-DNA levels, which can even examine within-larva variation! With honours student Patrick Driguez I am looking similar questions of *Spratelloides robustus* and *Engraulis australis*, and some otolith-RNA and stable isotope validation experiments using *Pagrus auratus*. A really vexing question for us now is to determine the biological significance of larval condition – are predator arenas the way to go? See upcoming comment on this in Canadian J. Fisheries and Aquatic Sciences, or our web site http://www.life.unsw.edu.au/famer/

Port Jackson shark—taken from the web page of the Australian Museum. This species is considered to be one of the most, if not the most, primitive surviving elasmobranchs in our seas today.

Upcoming Meetings

Conference Announcement and First Call for Papers: International Conference on Restoring Nutrients to Salmonid Ecosystems

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April 24-26, 2001; Eugene, Oregon, USA

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Around the North Pacific Rim, the ocean is productive yet rivers tend to be naturally oligotrophic. Salmon are a unique vector by which marine nutrients are captured and carried against the force of gravity far intofreshwater ecosystems. Although this "anadromous nutrient pump" has been recognized for decades, its importance - not just to fish production, but to the entire ecology of the Northwest -- is just coming into focus with the application of new research questions and techniques.

If the inland spread of nutrients by salmon is imagined as a shadow over the landscape, that shadow has been severely truncated and faded by anthropogenic impacts such as dams, roads, resource extraction, and overfishing. Can managers restore this landscape and its functions without somehow compensating for diminished nutrient inputs? When and where is it appropriate to add nutrients? What techniques are best for restoring natural nutrient regimes in aquatic ecosystems - now and into the future?

Can we eventually rebuild the "anadromous nutrient pump"? This conference will provide insight and answers to these questions.

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The International Conference on Restoring Nutrients to Salmonid Ecosystem will be hosted by the Oregon Chapter of the American Fisheries Society and sponsored by other regional AFS chapters and agencies. Its purpose is to capture and showcase the latest information on one of the most pressing issues affecting the recovery of Pacific salmon and their ecosystems. A plenary session will include invited presentations by key researchers in the field of nutrient dynamics and management in lakes and streams, and throughout the North Pacific ecoregion. In addition, contributed papers and posters that describe case histories, hypotheses, or research related to the North Pacific Rim and the following topics are welcome: A description and management of historical and current nutrient regimes and ecological linkages between salmon and productivity of freshwater ecosystems should emerge.

Other topics: ecological impacts of a diminished salmon nutrient shadow; nutrient dispersal mechanisms; effects of hatcheries, harvest, and other resource management on nutrients and their dispersal; incorporating nutrient management into ecosystem restoration;contrasting good vs. bad nutrients and mechanisms; re-assessing salmon escapement for restoring ecosystem productivity goals.

Proposals for contributed papers (oral presentations) and posters must be received by December 1, 2000.

Submit all proposals to: Richard Grost, PO Box 128, Idleyld Park, OR 97447; 541-496-4580; rgrost@compuserve.com

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Registration is $195 US ($75 US for students and retirees), with a $25 US late fee added after March 1, 2001. Registration forms will be available in October 2000. Conference lodging, at special rates, can be arranged at the Eugene Hilton,

800-937-6660.

For more information, call Richard Gros.
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Background for this conference

"...salmon are among the oldest natives of the Pacific Northwest, and over millions of years they learned to inhabit and use nearly all the region's freshwater, estuarine and marine habitats. ...From a mountaintop where an eagle carries a salmon carcass to feed its young, out to the distant oceanic waters of the California Current and the Alaska Gyre, the salmon have penetrated the Northwest to an extent unmatched by any other animal. They are like silver threads woven deep into the fabric of the Northwest Ecosystem. The decline of salmon to the brink of extinction is a clear sign of serious problems. The beautiful ecological tapestry that Northwesterners call home is unraveling; its silver threads are frayed and broken."
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Excerpt from:"Salmon Without Rivers: a history of the pacific salmon crisis."
by Jim Lichatowich, 1999. Island Press.

Other dates to remember

Dec 3-6, 2000. Walleye Management Symposium:
Recruitment, stocking, and regulations. Held during Midwest Fish and Wildlife Conference, Minneapolis, MN. Contact: Joe Larscheid 712– 336– 1840.

Aug 19, 2001. 131st AFS annual meeting. Crowne Plaza Hotel, Phoenix Arizona. Contact: Betsy Fritz, 301-897-8616 ext. 212; bfritz@fisheries.org

Perspectives

Perspectives are occasional essays contributed too *STAGES* largely by members of the Early Life History Section that review developments within our discipline, express opinion, off fodder for rumination and thoughtful criticism, project ideas, or foster discussion.

Fish Habitat and the Early Life History of Fishes

By Jeff Govoni

The perception is presently that fishery management practice focused on the management of populations or stocks of single species has failed, and that focus should shift to the management of multiple species, communities, and ecosystems, and the habitats embedded within these ecosystems (Fluharty, 2000). It seems so simple that any discussion of habitat will inevitably turn out as an exercise in expounding the obvious. Yet Charles Darwin himself claimed that “looking back, I think it was more difficult to see what the problems were, than to solve them.”The problem before us to be solved, it would seem, is just what can be readily isolated, identified, and described as fish habitat, but the practicality of solving the problem often rules to the extent that first principles in a consideration of “fish habitat” from the perspective of early life history, without expounding the obvious, and to point to two perceived current omissions or oversights that are emergent in the application of current laws to the conservation and restoration of fish habitat.

Definitions of habitat as an ecological entity abound. Many general ecology text books offer some sort of definition; others do not. Perhaps the definition in most common use, because of its pragmatic appeal, is that of E. P. Odum: habitat is the

Where an animal or plant normally lives or grows, usually characterized either by physical features, or by dominant plants." (Odum, 1971) This definition focuses simply on where an organism is or where one would go to find it (Peters and Cross, 1992), aand implicitly emphasizes tangible structure. More comprehensive definitions, and ones that engage niche theory, focus not only on where the animal lives, but what it does (e.g., Southward, 1976. Sstill other ecologist speak of habitat in the pejorative, as a useless term, and rather opt for some construct of the environment that meets the requirements of life, without using the term habitat (Pearse, 1939; Andrewartha and Birch, 1954). The emphasis here shifts tot the ecological organization of life— populations, communities, and ecosystems - with some specific environments that support populations embedded within ecosystems.

As a matter of first principles, why not consider the principal attributes and necessities of life in a definition of habitat? A more comprehensive, yet I hope not a more cumbersome definition of habitat, might go sooomeeething like this: "the location in time and space, where plants and animals live optimally, i.e., those environments within ecosystems that contain the necessities for self preservation and propagation of life, space and shelter, nutrients or food, and the requisites for successful reproduction." With regard to fishes, this definition then directs attention, as developed by Ryder and Kerr (1989), on the physical environment, both tangible and intangible, that provide a center for biological activity, booth what an organism does and where it does it. This definition is not simply a contrivance to fit the early life histories of fishes, but embraces first principle, the requisites of life, in an evolutionary sense, and doing so, it embodies early life histories.

Where do fishes live? In almost every aquatic environment on earth, from high alpine lakes and steams to the abyss; from lightless caves and equally lightless habitats around thermal vents on abyssal sea-floor to abundantly lite desert potholes and springs. But what do fishes do? They survive, reproduce, and grow in these spaces. Fishes have evolved to exploit habitats for reproduction, i.e. spawning, and for the survival and growth of their embryos, larvae, and juveniles, i.e. nursery habitats. No other vertebrate, even the amphibians that share larval development, accomplish this feat. Fishes develop from eggs and larvae, measured in mm and ug dry weight, to adults measured in m and kg, and they do so largely as free-living animals. Sometimes they do it in unique habitats, the specialists; sometimes they do it in more generic and difficult to characterize habitats, the generalists (Balon, 1984).

So from the perspective of early life histories, fish habitats must provide proper space for spawning, appropriate temperature and exygen for the development of embryos within eggs, and energy for survival and growth of larvae and juveniles. Early life histories have evolved through time, as have habitats used for spawning and nurture changed through time. For fishes (excluding the mouth, pouch, and auxiliary-structure bearers), spawning habitats can be roughly dichotomized into those that accommodate substrate spawners and those that accommodate broadcast spawners. Substrate spawners, of course, release eggs to tangibly structured habitats; broadcast spawners release eggs into the pelagia. i. e. into the water in and of itself. Morphological and physiological adaptations hat have evolved are clearly evident in fishes of low fecundity that spawn large eggs and that hatch precocial larvae, typically the larvae of substrate spawners. Adaptive morphological attributes are perhaps less conspicuous aong fishes of high fecundity, that spawn small eggs and that hatch altricial larvae, typically the larvae of broadcast spawners, but physiological adaptations are resolvable, and adaptive spawning straegies, beyond high fecundity alone, are evident (precocial and altricail

Sensu Balon, 1981).Spawning and nursery habitat of this latter group of fishes, those that release eggs to the pelagia, are then structured by physics of temperature, salinity, and circulation. Thus water masses, specific parts of lakes and oceans, or persistent physical features such as frontal zones and eddies, become essential , if nt critical, fish habitat along with tangibly structured habitats, reefs or banks and vegetated areas, so long as they provide the requisites for successful fish reproduction.

A functional habitat that supports reproduction and development is thus both critical and essential. There are on the books presently, legislation that forces consideration of fish habitat before alterations of those perceived habitats can proceed or calls for the rehabilitation of perceived habitats after alteration. If the Law is to influence the conduct of peoples' lives, as all laws are intended to do, then we had better identify and describe the substance upon which the Law impinges, in this case fish habitat. This takes research and research requires support. In the marine environment the Law is the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act—"Essential Fish Habitat (Benaka, 1999). In freshwater, the principal law is the Endangered Species Act and its provisions for—"Critical Habitat" (Beechie and Bolton, 1999) There are others with language that include habitat concerns: National Environmental Policy Act, the Clean Water Act, the Coastal Zone Management Act. Without getting into a morass of legal jargon and complication, what is substantive for those who study early life history is that these laws should result in the provision of research support, i. e. funding, for basic research aimed at identifying and defining fish habitats, as either "essential" or "critical". Again, what could be more essential or more critical than habitat in which to spawn and grow larvae?

The Endangered Species Act as it was applied first to fishes, provided for the identification and definition, and protection, of "critical" salmonid spawning habitat. The amended Magnuson Species Act defines essential fish habitat as "the waters and bottom (such as sand, sea grass , or coral) that are necessary to a species spawning, breeding, feeding, or growth to maturity". The Endangered Species Act and the amended Magnuson-Stevens Act provide the mandate to identify and define spawning and nursery habitat, but the necessary research support has not yet fully materialized, particularly especially in the marine environment. The verbiage of these Laws captures the need for the bare essentials for life (Fluharty, 2000)- fishes must have the essentials to survive and reproduce; they must have habitat in which to spawn and in which to survive to become adults, i. e. habitat for their early life histories.

There are two apparent and current trends in the application of these Laws that may have arisen simply by pragmatics, but they constitute either omission, oversight, or misguided planning. These warrant consideration .

Inordinate attention has been given totangibly structured habitats, perhaps because Odum's definition, in such common use, emphasizes implicitly tangible physical features and plants in habitat characterization. Habitats suspected of being essential or critical are often those that can be most easily identified and described; those with tangible and readily observable physical structure. These habitats have been stream and lake beds in fresh water and banks, reefs, sea-grass meadows, *Sargassum* rafts, and kelp forests in the ocean. But what about spawning and nursery habitats in the pelagia that are defined physically by temperature, salinity, and hydrodynamics, i. e. water masses, frontal zones, and eddies (Peters

And Cross, 1992; Hoss and Thayer, 1993)? There has been limited and inadequate support for research to identify and describe these pelagic habitats.

The other oversight in the implementation of these Laws may lie in the lack of consideration of the effects of habitat modification or destruction. It seems that consideration has focused on organismal-level effects, rather than population-and community-level effects. In terms of early life histories, fishes that do not survive to reproduce, or that do not reproduce successfully, do not contribute to population production. Recruitment, the survival and growth of the embryonic, larval, and juvenile fishes to adult populations, is a basic parameter in most population dynamic models. In the marine environment, habitats are identified as essential, often because they might provide some spawning substrate or refuge for eggs, larvae, or juveniles, perhaps for some segment of a population, but seldom are the influence of a habitat alteration considered for a whole population. This owes, in part, to the impracticality of resolving population level effects against the background of the inherent variability of fish populations (e.g., Engel et al., 1999; Rose, 2000). This oversight of total population effects, however, can result in the closure of an apparently innocuous fishery for *Sargassum* off the southeastern coast of the U. S. , because the fishery might harvest a small portion of an immense habitat and thereby limit, in an infinitesimally small way, the populations or fish communities that inhabit this habitat! This oversight also begs the question of habitat plasticity, whereby fishes, if deprived of a spawning habitat, can use another without any measurable impact at the population level—the generalist versus specialist question.

Two theme sessions, and one workshop at the upcoming 24th Annual Larval Fish Conference of our Early Life History Section will be devoted to global climate change, habitat and early life history of fishes. We look forward to this consideration, and hope that some of these concerns will be addressed.

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Addendum (by editor)

My apologies for errors in the first issue which came out last month. If you were one of the authors whose work I fractured due to omissions, or typos, or both, please have patience. I hope to improve. Thanks for the contributions to this Issue, and keep them coming. See you in Alabama!