STAGES

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

Volume 33, Number 2 | Lee A. Fuiman, Editor | June 2012

Inside this issue

Full and Diverse Program Set for 36th Annual Larval Fish Conference

This year's Larval Fish Conference (2 - 6 July) will be held at the Solstrand Hotel and Bad, as it was 10 years ago. The Solstrand Hotel is one of the finest hotels in Skandinavia. Those who attended the conference in 2002 remember it fondly as a magnificent venue, a wonderful combination of sessions, and a well organized meeting. This year, conference organizers Howard Browman and Anne Berit Skiftesvik report that there will be 142 participants (not counting those that register onsite, of course), 121 oral presentations, and 33 posters. There will be sessions for contributed papers as well as four theme sessions:

Assessing the relative contribution of different sources of mortality in the early life stages of fishes organized by Richard Nash, Audrey Geffen and Guðrún Marteinsdóttir

The contribution of mechanistic behavioural and physiological studies on fish larvae to ecosystem models organized by Frode Vikebø and Geir Huse.

Effects of oil and natural gas surveys, extraction activity and spills on fish early life stages organized by Sonnich Meier, Bjørn Einar Grøsvik and Erik Olsen.

Quality indicators for larval fishes: wild vs. cultured organized by Lee A. Fuiman and Amos Tandler.

A complete list of conference abstracts is available at the Larval Fish Conference website: larvalfishcon.org or click here. §

ELHS Back Then

10 years ago: Howard Browman organizes 26th annual Larval Fish Conference near Bergen, Norway.

15 years ago: Darrel Snyder creates Section's first website.

20 years ago: Dave Bengtson organizes 16th annual Larval Fish Conference at the University of Rhode Island.

25 years ago: Bob Hoyt publishes a 2-volume Bibliography on Early Life Stages of Fishes. *It goes out of print very quickly.*

30 years ago: President Dan Faber assembles a directory of ELHS members and "adherents" and distributes it in 1982.

President's Message

This is my last message as President of the ELHS, as I now turn the lead over to Catriona Clemmesen-Bockelmann. At the upcoming meeting in Bergen, Catriona will shift her duties from Secretary to President and Frank Hernandez will become our new Secretary. A big thanks go to both for volunteering to take on these responsibilities.

I have much enjoyed my tenure as President. This is an excellent organization with many dedicated members that put in a lot of time behind the scenes to keep everything functioning and running smoothly. We are a small group, but I think that is a real advantage in keeping us cohesive and supportive of our science and each other. For those of you that are new to the section, I hope you will stick with us and benefit from the great positive atmosphere surrounding our membership.

Many of us have been hit in various ways by the worldwide economic downturn. With shrinking budgets and fewer job opportunities it is often challenging to keep science programs going and maintain the level of communication and interaction we would like to have as a scientific society. The American contingent at this year's meeting will be fewer in number largely due to disappearing travel budgets, but I hope many of us will be able to recoup and make it to the 2013 meeting in Miami. The economy will recover at some point and we will all need to be ready to take advantage of renewed opportunities when they come.

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

September 7, 2012

News from the Regions

European Region

Audrey Geffen

Hubert Keckeis (Hubert.Keckeis@univie.ac.at), from the Department of Limnology, University of Vienna, reports on progress in a large three-year project on larval dispersal in the River Danube. Both laboratory and field experiments are included, and they have also successfully marked and recaptured fish in the main stem of the river. The project is called MODI, Modelling dispersal patterns of fish larvae in a large river. Funded by the Austrian Science Fund (FWF; www.fwf.ac.at), Keckeis and his colleagues are studying the dispersal patterns of larval fluvial fishes at different hydro-morphological habitats in the main river channel of the Danube (Fig. 1). Spatial and temporal distributions of marked larval fishes of two different ontogenetic stages are studied under

Fig. 1 Main channel of the River Danube

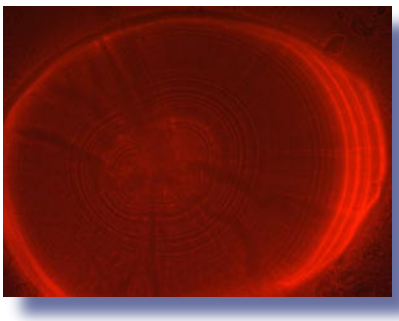

Fig. 2 Alizarin marking of larval carp otoliths for mark-recapture experiment

natural conditions by conducting mark-recapture field experiments (Fig. 2). To identify possible effects of hydraulics, morphology, and behaviour on dispersal patterns, the field approach is accompanied by drift experiments in a flume. Using an integrated habitat modelling approach, the observed patterns are superimposed by particle traces derived from the application of a three-dimensional hydrodynamic model in order to define the triggers and mechanisms of larval dispersal patterns. Implications about the connectivity of spawning and nursery habitats are made based on this approach; this knowledge can be used in applied restoration ecology for large-scale restoration concepts. The project started in January 2010 and is an inter-university collaboration between the University of Vienna (Hubert Keckeis), the University of Natural Resources and Life Sciences of Vienna (Helmut Habersack, Michael Tritthart) and the Charles Sturt University, Albury, Australia (Paul Humphries).

Two PhD students are involved in the project: Aaron Lechner is investigating the distribution patterns of marked

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Northeast Region

Dave Richardson

Ken Able of Rutgers University Marine Field Station reports that this year, the Rutgers University Marine Field Station is celebrating the 40th anniversary of its establishment. Of relevance are the last two decades which focused on the study of the early life history of fishes.

The Coastal Collaboration On Recruitment (CCOR) effort is continuing. This is a U. S. east coast wide effort to determine recruitment patterns for estuarine dependent fishes based, primarily, on time series of larval fish ingress. As examples, we have published a manuscript that includes aspects of timing and location of reproduction, larval supply, ingress into estuarine inlets and post settlement habitat for the speckled worm eel, *Myrophis punctatus* (Able et al. 2011). In a related project led by Dennis Allen (Baruch Marine Field Laboratory, University of South Carolina), many of the same individuals have decided to target *Leiostomus xanthurus* in a similar analysis. In another study, we are evaluating the multiple sources of larvae spawned in the ocean to Barnegat Bay, New Jersey (Little Egg Inlet – our long term study site, Barnegat Inlet, and the Inter Coastal Waterway from the Manasquan River estuary). Special attention is focused on ingressing *Anguilla rostrata* glass eels and their accumulation below dams and the means to provide for eel passage to upstream habitats.

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Section Officers

HELP US UPDATE OUR RECORDS...

Verify your email with our ELHS Secretary.

Northeast Region...cont'd from p. 2

As part of a broader interest in small piscivores, we are evaluating predator-prey interactions between *Conger oceanicus* elvers and the glass eels and elvers of *Anguilla rostrata* in the laboratory. To date, in one-on-one trials, *Conger* is a predator on all these stages of *Anguilla* and other *Conger* while *Anguilla* only occasionally preys on other *Anguilla.* These interactions between *Conger* and *Anguilla* are likely limited to the lower estuary where they overlap in time and space.

Other recent publications include an evaluation of New Jersey surf zones as nurseries (Able et al. in press), and the response of *Lutjanus griseus* to winter mortality and climate change (Wuenschel et al. in press).

We are accepting applications for a one-year (with a possible extension depending on funding) postdoctoral fellowship. Individuals with interests in fish and fisheries ecology, with an emphasis on species declines (e.g. winter flounder, weakfish) based on long-term time series, are invited to apply. At RUMFS, these time series include larvae (weekly for 21 years) and juveniles (weekly for 18 years). Ability to work with a team of faculty, graduate students, undergraduate summer interns, and staff is an important qualification. For information concerning this position, please send a C.V. and contact Ken Able.

Recent and Pending Publications

Able, K. W., D. M. Allen, J. A. Hare, D. E. Hoss, K. E. Marancik, G. Bath-Martin, P. M. Powles, D. E. Richardson, J. C. Taylor, H. J. Walsh, S. M. Warlen, and C. Wenner. 2011. Life history

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Western Region

Dan Margulies

Swimming ability in larval and pelagic juvenile rockfishes (*Sebastes* spp.)

Neosha Kashef, a student at Moss Landing Marine Laboratories, recently completed her M.S. thesis research on the ontogeny of critical swimming ability in larval and pelagic juvenile rockfishes (*Sebastes* spp.). Rockfishes are viviparous and unique in having a long pelagic phase, remaining in the water column for weeks to months after metamorphosis before settling to demersal habitats. Movements of larvae and pelagic juveniles during this period are largely unknown although it is traditionally assumed that young rockfishes are planktonic, moving at the mercy of ocean currents. In this study, critical swimming capabilities of six rockfish species — blue (*S. mystinus*), yellowtail (*S. flavidus*), brown (*S. auriculatus*), kelp (*S. atrovirens*), gopher (*S. carnatus*), and splitnose (*S. diploproa*) — were evaluated to determine their ability to behaviorally influence dispersal.

Results indicate that swimming ability increases throughout ontogeny, and postflexion rockfishes can swim faster than mean current speeds along the California coast. *Sebastes* spp. critical swimming speeds are substantially lower than those obtained from larvae and juveniles of tropical fishes at similar body sizes. Rockfishes, however, have comparable swimming speeds to some tropical species at settlement, since rockfishes settle at larger sizes. The increasing ability of rockfishes to swim faster than current velocities throughout their pelagic life history phase, acting as nekton rather than plankton, enhances both retention and dispersal potential and has important implications for survival and distribution. Neosha was co-advised by Dr.

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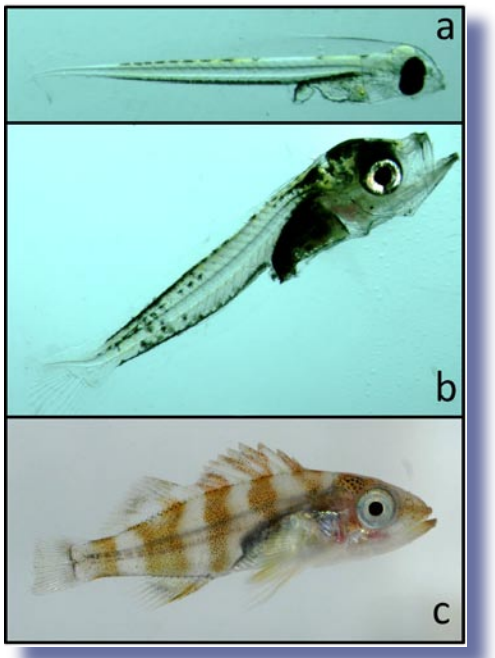
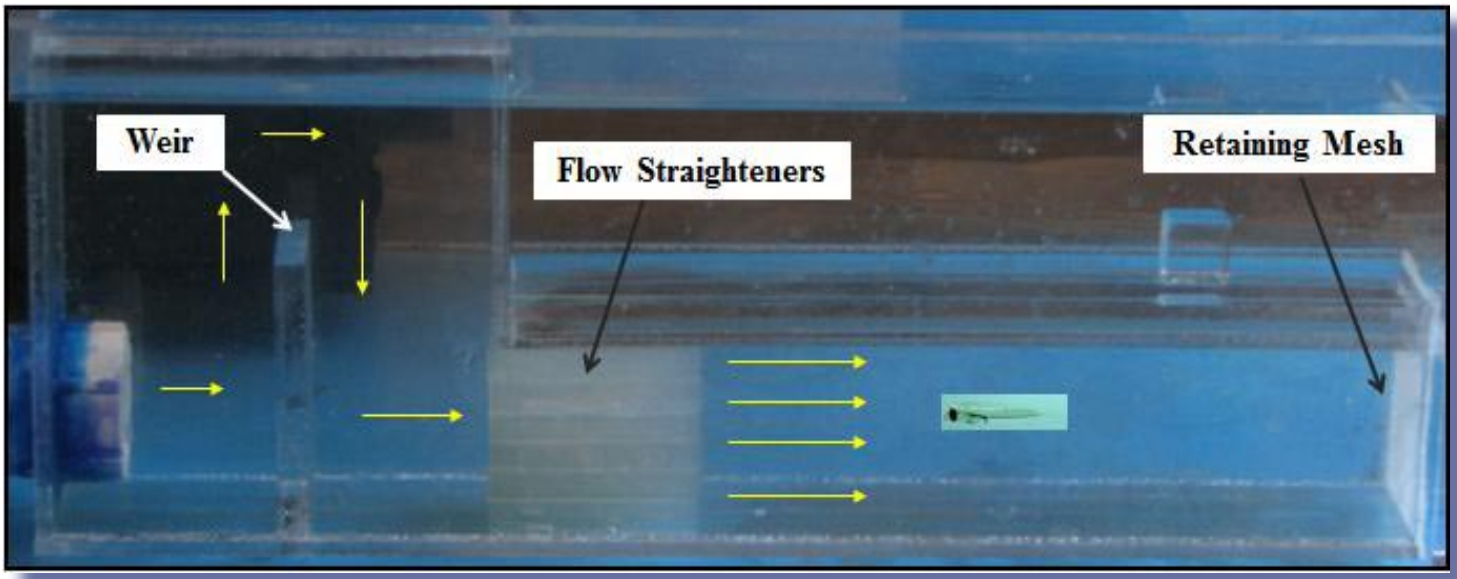
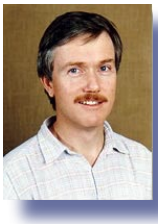


Rockfish development. a) Kelp rockfish larva at parturition, which lacks fully developed fins (5 mm TL); b) Larval brown rockfish at flexion, showing caudal fin rays forming and development of more muscle mass (9 mm TL); c) Pelagic juvenile kelp rockfish at settlement stage have all fin rays and resemble miniature adults (20 mm TL).



Miniature flume used to swim larval stages (27 cm length). Water enters the flume and hits a weir, which spreads the flow. The straws act as flow straighteners creating laminar flow and the mesh at the end retains the larva at exhaustion.



Pacific Rim Region

Iain Suthers

Workshops on growth–survival paradigm in early life stages of fish: The paradigm needs a synthesis

Akinori Takasuka[1] (takasuka@attrc.go.jp), Dominique Robert[2], Jun Shoji[3], Pascal Sirois[4], Ichiro Aoki[5], Louis Fortier[2], Yoshioki Oozeki[1]

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Growth and survival are tightly coupled in early life stages of fishes. Larger and/or faster-growing individuals (or populations) are more likely to survive than smaller and/or slower-growing conspecifics. This "growth–survival" paradigm (originally the "growth–mortality" hypothesis; Anderson 1988) was given much attention in studies on recruitment dynamics of fishes. However, attempts to predict year-class strength from early growth dynamics have generally failed.

Nevertheless, much progress has been achieved through numerous field, laboratory, and modeling studies, since the landmark publication of Anderson (1988). For example, different functional mechanisms have been proposed to explain the relationship between growth and survival (Hare & Cowen 1997, Takasuka et al. 2003, Leggett & Frank 2008). In general, field studies tended to support the paradigm/mechanisms (e.g. Meekan & Fortier 1996, Hare & Cowen 1997, Sirois & Dodson 2000, Takasuka et al. 2003, Shoji & Tanaka 2006, Robert et al. 2007). On the contrary, some experimental studies provided evidence contrary to the paradigm (Litvak & Leggett 1992, Lankford et al. 2001, Munch & Conover 2003). Moreover, recent studies revealed variability in the direction of selection occurring in the field (Robert et al. 2007, Sponaugle et al. 2011, several recent works from our teams). Processes driving recruitment seem to be more complex than assumed by the paradigm. We now consider that there is a need for synthesizing these apparently contrary results into a new conceptual framework.

To tackle this issue, we held a Japan–Québec collaboration workshop on "Growth–survival paradigm in early life stages of fish: Theory, advance, synthesis, and future" in Yokohama, Japan, from October 26 to November 1, 2011, with the support of Grant-in-Aid for Young Scientists (A) from the Ministry of Education, Culture, Sports, Science and Technology of Japan, and Québec-Océan programs. The follow-up workshop was then held in Vancouver, Canada, from May 23 to 26, 2012, with partial support from the Research Chair on Exploited Aquatic Species. These workshops were designed to produce a review paper in which we will expose our ideas and perspectives on the paradigm through synoptic reviews.

A scene from Japan–Québec collaboration workshop in Yokohama from October 26 to November 1, 2011. From left to right: Jun Shoji, Akinori Takasuka, Pascal Sirois, Dominique Robert, Yoshioki Oozeki (adviser); top panels from left to right: Ichiro Aoki and Louis Fortier (advisers).

First, we reviewed recent advances in studies on the paradigm and its functional mechanisms. Second, we synthesize published results of field and experimental tests of the paradigm/mechanisms through comparisons among different geographic regions, ecosystems, taxonomical groups, and life history strategies. Finally, we provide a list of recommendations for the direction of future studies toward predicting recruitment success. Through these topical discussions, we also found a strong trend for publication bias in paradigm test studies.

As products of these workshops, a review paper will be submitted for publication in the primary literature. This review will be preceded by the publication of an essay paper on the issue of publication bias, which will be presented at the 36th Annual Larval Fish Conference in Bergen, Norway (Sirois et al. 2012).

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Leggett, W. C., Frank, K. T. 2008. Paradigms in fisheries oceanography. *Oceanography and Marine Biology: An Annual Review* 46:331–363.

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Pacific Region...cont'd from p. 4

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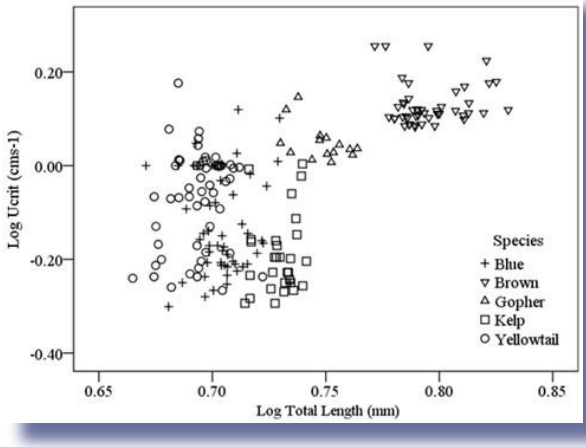
Sirois, P., Takasuka, A., Robert, D., Shoji, J., Aoki, I., Fortier, L., Oozeki, Y. 2012. Size- or growth-selective mortality during early life history of fishes: publication bias and the need for a new conceptual framework. The 36th annual Larval Fish Conference, Bergen, Norway, July 2–6, 2012.

Sponaugle, S., Boulay, J. N., Rankin, T. L. 2011. Growth- and size-selective mortality in pelagic larvae of a common reef fish. *Aquatic Biology,* 13: 263–273.

Takasuka, A., Aoki, I., Mitani, I. 2003. Evidence of growth-selective predation on larval Japanese anchovy *Engraulis japonicus* in Sagami Bay. *Marine Ecology Progress Series* 252: 223–238. §

Western Region... cont'd from p. 3

Greg Caillet of Moss Landing Marine Labs and Dr. Susan Sogard of NOAA Fisheries and this work is in collaboration with Dr. Rebecca Fisher. A manuscript is in preparation. §



Relationship between absolute critical swimming speed log U_{crit} (cm s^{-1}) and size of five species of larval Sebastes *spp. at parturition.*

European Region...cont'd from p. 2

drifting and settling larvae in the main channel of the River Danube. It is generally assumed that the longitudinal distribution of larval and juvenile fishes is random and mainly related to hydrodynamic forces. Recent studies showed that movement by fish larvae in riverine nearshore habitats is not completely passive via drift, suggesting active dispersal and habitat choice. For this purpose, he observes travel paths of released fish larvae at a natural and a regulated shore of the Danube. A comparison of these paths with those from passive particles is being used to shed new light on the mode of transport (active or passive). Lechner is also studying the effect of different habitat conditions on growth patterns of recaptured larvae. Finally, he intends to predict the optimal range between the spawning area and the next nursery area based on the travel paths for the different developmental stages and mesohabitats.

PhD student Martin Glas is analysing larval dispersal patterns with a 3D numerical model in combination with a particle-tracing model with the objective of improving the predictive capacity of modelling larval dispersal processes. He is using measurements of flow velocity fields and water levels of laboratory and field experiments for the calibration and validation of the numerical model. The accompanying flume experiment (Fig. 3) serves as calibration of the particle-tracing model, which is applied in the field experiment. The particle-tracing model, representing only a passive particle without mass, is extended by a newly developed larval module, which represents swimming properties (e.g., swimming behaviour, swimming ability) of larvae. Observed larval travel paths within the flume are used to validate the developed larval module (Fig. 4). The findings of the flume experiment are tested in the field and spatio-temporal patterns of larval dispersal processes are investigated. §

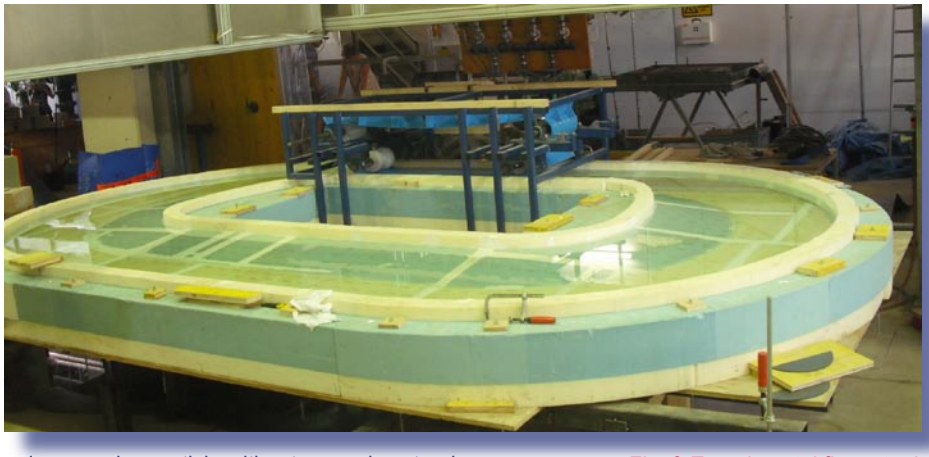


Fig. 3 Experimental flume tank.

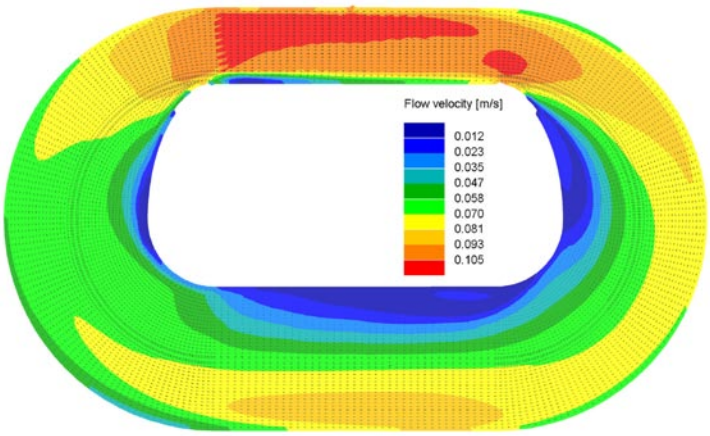


Fig. 4 Hydrological model for flume.

Northeast Region...cont'd from p. 3

and habitat use of the speckled worm eel, *Myrophis punctatus,* along the east coast of the United States. *Environmental Biology of Fishes* 92:237-259.

Able, K. W., T. M. Grothues, P. M. Rowe, M. J. Wuenschel, and J. M. Vasslides. 2011. Near-surface larval and juvenile fish in coastal habitats: Comparisons between the inner shelf and an estuary in the New York Bight during summer and fall. *Estuaries and Coasts* 34:726-738.

Able, K. W., M. J. Wuenschel, T. M. Grothues, J. Vasslides, and P. Rowe. (In press.) Do surf zones in New Jersey provide "nursery" habitat for southern fishes? *Environmental Biology of Fishes*.

Grothues, T. M., and K. W. Able. (In prep.) The larval and pelagic fish assemblage of Delaware Bay.

Wuenschel, M. J., J. A. Hare, M. E. Kimball and K. W. Able. (In press.) Gray snapper (*Lutjanus griseus*) distribution and climate change: I. Quantifying juvenile thermal tolerance and its constraint on adult range. *Journal of Experimental Marine Biology and Ecology*. §

Special Report

How Well Do We Know the Early Life Stages of Our Freshwater and Anadromous Fishes?

In Spring 2010, we, the authors listed below, did a survey of 47 guides and other selected publications or reports describing or summarizing descriptions of the early life stages of fishes in the fresh waters of the continental United States and Canada. We did this to document the extent of coverage and quality of illustrations and descriptive text and data therein and provide an initial overall assessment of the current state of such information. The results were summarized in the lead presentation for a topical session on *Descriptions and Identification* held during the 34th annual AFS-ELHS Larval Fish Conference (Santa Fe, New Mexico, 31 May to 2 June 2010 — www.larvalfishcon.org/Conf_home.asp?ConferenceCode=34th; see also article on that topical session in the October 2011 issue of STAGES). The PowerPoint file (slides and text) for the presentation is available for download or viewing at our ELHS website (www.elhs.cmast.ncsu.edu). An extended abstract for the presentation and a tabulated summary of selected results for larvae by family follow.

An Initial Assessment of Descriptive Information Available for Embryos, Larvae, and Early Juveniles of Fishes in Fresh Waters of the United States and Canada

by

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The embryos, various larval phases, and early (usually young-of-the-year) juveniles of fishes are morphologically and often ecologically distinct from each other as well as later juveniles and adults. Accordingly, knowledge of fish early life history is often essential to better understanding aquatic ecosystems and communities, assessing environmental impacts, monitoring reproduction and recruitment, and more effectively protecting, recovering, or managing fish populations and habitat. Acquisition of that knowledge and pertinent study data through field investigations usually requires accurate identification of collected specimens. But even today, the eggs, larvae, and early juveniles of most species remain undescribed or inadequately described for identification purposes.

Of over 800 species of freshwater and anadromous fishes in the continental United States and Canada, it was estimated that only about 15% had been adequately described as larvae for identification purposes by the mid-1970's (Snyder 1976) and still less than 25% by the mid-1990's (Snyder 1996), but neither estimate was well documented. By the mid-1990's, much of that descriptive information had been provided or selectively compiled and summarized in about 20 regional freshwater and estuarine larval fish or early life-history manuals. Several more guides have been published since 2003 (and a few more are currently in preparation).

To better document and provide an initial assessment of the current state of our knowledge of the early life stages of freshwater and anadromous fishes in the continental United States and Canada, we assessed the contents of 47 publications or reports, including nearly all pertinent guides and several other, opportunistically selected, descriptive documents. Our species list was borrowed with permission from the "Fish-Traits" database of Frimpong and Angermeier (2009) and supplemented with additional Canadian species and estuarine species known to frequently use adjacent fresh waters as spawning or nursery grounds. Using identically formatted spreadsheets, we coded our assessments for the quantity and quality of illustrations and descriptive text and data in each species account for each of four developmental intervals: the embryonic period (including egg characteristics); the yolk-sac and post yolk-sac phases of the larval period; and the early, young-of-the-year, portion of the juvenile period. To compile and summarize the data, all spreadsheets were incorporated as worksheets in one large three-dimensional spreadsheet (workbook). The maximum code values for assessed quantity and quality categories from among all sources were used to determine how well each species was described for each developmental period (embryonic, larval and juvenile) and overall for all three periods combined. Finally, array bins and frequency functions were used to determine the number and percentage of species that were minimally, moderately, or well described by developmental period and overall within selected families and for all families combined.

Overall, we found that 43% of the 823 freshwater or anadromous fishes in the United States or Canada have been at least minimally described for at least one early developmental period, but possibly only as few as 5% have been well described (assessed as good to excellent in coverage and quality of that coverage) for all three periods, embryonic, larval, and early juvenile (bottom of Table 1). For the larval period, 26% of all species have been well described – probably well enough for identification purposes. However, among families with at least several species, the percentage varies dramatically from 6% for Petromyzontidae and 15% for Cyprinidae to 75% for Clupeidae and Acipenseridae (Table 1). For the embryonic period, descriptions for only 6% of the species were assessed as good to excellent. However, embryology may actually be well described for a significantly greater percentage of species because many early life history guides note the existence of embryological descriptions but do not include much, if any, of the details or illustrations in their species accounts. For early juveniles, only 21% of the species descriptions were assessed as

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Special Report...cont'd from p. 6

Family, phylogenetic order	Number of species	Percentage (%) of species described as larvae			
		Min.[a]	Mod.[b]	Well[c]	Total (sum)
Petromyzontidae	16	25%	13%	6%	44%
Acipenseridae	8	-	13	75	88
Polyodontidae	1	-	-	100	100
Lepisosteidae	5	20	-	60	80
Amiidae	1	-	-	100	100
Hiodontidae	2	-	-	100	100
Osteoglossidae	1	-	-	-	-
Notopterigidae	1	-	-	-	-
Clupeidae	8	-	13	75	88
Cyprinidae	245	7	3	15	25
Catostomidae	65	-	2	46	48
Cobitidae	1	-	-	-	-
Characidae	6	-	-	-	-
Loricariidae	5	20	-	-	20
Ictaluridae	40	3	10	35	48
Clariidae	1	-	-	-	-
Osmeridae	6	17	33	33	83
Salmonidae	36	19	3	39	61
Esocidae	5	-	-	80	80
Umbridae	4	-	25	50	75
Percopsidae	2	-	-	50	50
Aphredoderidae	1	-	100	-	100
Amblyopsidae	6	50	-	-	50
Gadidae	2	-	-	100	100
Atherinopsidae	6	17	-	50	67
Adrianichthyidae	1	-	-	-	-
Belonidae	1	100	-	-	100
Aplocheilidae	1	-	-	-	-
Goodeidae	4	-	-	-	-
Fundulidae	28	14	7	29	50
Cyprinodontidae	14	-	-	7	7
Poeciliidae	20	-	-	10	10
Gasterosteidae	4	-	-	100	100
Syngnathidae	1	-	-	-	-
Synbranchidae	1	-	-	-	-
Scorpaenidae	1	-	-	-	-
Cottidae	26	4	4	23	31
Moronidae	4	-	-	100	100
Serranidae	1	-	-	-	-
Callichthyidae	2	50	-	-	50
Centrarchidae	31	3	-	65	68
Percidae	165	17	2	22	41
Sciaenidae	1	-	-	100	100
Elassomatidae	6	-	17	17	33
Cichlidae	23	9	-	-	9
Embiotocidae	1	100	-	-	100
Blenniidae	1	-	-	-	-
Gobiidae	5	60	-	-	60
Osphronemidae	3	-	-	-	-
Channidae	4	-	-	-	-
Overall, Larvae	823	9	3	26	39
(For comparison using comparable criteria:)					
Overall, Embryos	823	27	4	6	38
Overall, E. Juveniles	823	16	5	21	42
Overall, All ELS	823	35[d]	4[d]	5[d]	43

Table 1. *Percentage of continental United States and Canadian freshwater and anadromous fish species by family assessed as minimally (Min[a]), moderately (Mod[b]), or well-described (Well[c]) as larvae, and the sum thereof (percentage of species at least minimally described, the remainder being undescribed). Also, at bottom, comparable overall assessments (all families combined) for descriptions of larvae, embryos, and early (young-of-year) juveniles, as well as for all three developmental intervals (early life stages, ELS) combined .[d] A conservative appraisal based on an initial review of 47 publications or reports including most pertinent guides and some other opportunistically selected descriptive literature available through 2010.[e]*

Notes:

[a] Minimal description—for larvae, at least some info but either illustrations or text (or data) lacking, limited, or assessed as poor in quality; inadequate for identification purposes.

[b] Fair (intermediate) description—for larvae, at least 2 illustrations (usually at least 1 yolk-sac and 1 post-yolk-sac larva) and at least some text (or data) with either illustrations or text assessed as only fair in quality and the other as fair or better; may be adequate for identification.

[c] Good to excellent description—for larvae, at least 2 illustrations (usually at least 1 yolk-sac and 1 post-yolk-sac) and good text (or data) coverage, both assessed as at least good in quality; probably adequate for identification.

[d] Min—at least one early developmental interval (embryonic period, larval period, or early, usually YOY, phase of juvenile period described, but at least one interval only minimally described or undescribed.. Mod—all intervals at least moderately described, but at least one only moderately described. Well—all early developmental intervals well described.

[e] Assessed literature (full citations available upon request): Able and Fahay 1998; Auer 1982; Chapman 2006; Conrow and Zale 1985; Elliot and Jimenez 1981; Fahay 2007; Hardy 1978a; Hardy 1978b; Jones et al 1978; Kay et al. 1994; Lippson and Moran 1974; Martinez 1983; Martinez 1984; May and Gasaway 1967; McGowan 1984; McGowan 1988; Minton 1985; Muth 1990; Perry and Menzel 1979; Reyes 2008; Reyes 2010; Scripter 2009; Simon and Wallace 2004; Simon and Wallus 2006; Snyder 1988; Snyder 1981; Snyder 1983; Snyder 1998; Snyder 2002; Snyder and Douglas 1978; Snyder and Muth 1988; Snyder and Muth 2004; Snyder and Ochman 1985; Snyder et al 1977; Snyder et al 2005; Sturm 1988; Taber 1969; Wallus and Simon 2006; Wallus and Simon 2008; Wallus et al. 1990; Wang 1986; Wang 1991; Wang 2006; Wang 2007; Wang and Kernehan 1979; Wang and Reyes 2007; Wang and Reyes 2008.

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good to excellent. However, adult descriptions and diagnostic criteria should be adequate for identification of most juveniles.

In conclusion, we still have a lot of work to do. Based on the literature surveyed and focusing on the larvae only, about 60% of our freshwater and anadromous fishes have yet to be even minimally described and about 74% remain to be well described for identification purposes. In the past 35 years, the percentage of species that have been well described as larvae has increased from an estimated 15% in 1976 to only about 26% in 2010.

This initial assessment is probably quite conservative. Although most regional guides have been included in our survey, the species accounts in many of them are based at least in part on previously published descriptions and often include only selected illustrations and data from those more detailed descriptions. Also, some described species have yet to be included in regional guides. This is particularly true for species endemic to the Pacific Northwest (e.g., the Columbia and Klamath River Basins) and the deep South. Still, we now have a much better feel for the current state of the art.

Postscript: The authors intend to publish more detailed results of this assessment, including which and how well species are covered in the assessed literature. They also plan to include assessments for at least a few other publications (e.g., guides by Holland-Bartels, et al. 1990 and Sturm 2004) and are working on a user friendly, updatable database for online access. Until then, specific results can be made available upon request.

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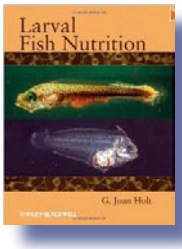

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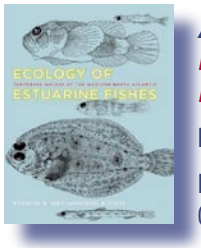

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Fishery Science: The Unique Contributions of Early Life Stages. Edited by Lee A. Fuiman and Robert G. Werner. Published by Blackwell Publishing. ISBN 0-632-05661-4. 2002. §

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

We have made several important changes to the section in the last couple of years. Perhaps the most obvious is the switch to an electronic version of STAGES. It's even easier now to get your intriguing results and new ideas out to the membership, so don't forget to respond to those requests from your Regional Representatives and submit a short article or two, complete with those great photographs. It doesn't really take that much time and STAGES is also an excellent venue for students to get some exposure for their work and their talents as they enter the job market. Another change is the smooth transition to providing a Paypal option for affiliate members directly on the website. I hope this will encourage more affiliate members to join and keep their dues up to date. We have strengthened our numbers overall this year and we are in good financial shape with the increased revenue in dues and the decreased costs for producing STAGES.

I have worked hard to get our membership information in order and clean up our files. I believe we now have accurate lists of full members and affiliate members. However, the more we shift to electronic communication, the more important it is that we have correct email addresses. This will be a continuing challenge as new members join and old members change their addresses. If your email changes, think about all of those organizations for which you will suddenly disappear and remember to contact them!

Thanks to all of the officers and committee chairs for their gracious service. Your contributions are key to the solid foundation and integrity of the ELHS. §

— Susan Sogard, President

Newsletter Production Team

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

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Editor's Ramblings

Getting Used to the New Format

I may be starting to get the hang of this electronic format! Actually, it's more of a lack of format. For instance, the print version we published for many years required each issue always to have a total number of pages that was a multiple of four. You can imagine how difficult it was if the content in hand came out to just over 8 or 12 pages. But that's a worry of the past. The current issue of STAGES, for exmaple, actually contains an odd number of pages. I will continue to experiment with this new format, but it still take a lot of time to assemble an issue of STAGES. So, I may be looking for ways to cut back on the time.

That said, it would be impossible to have a newsletter at all if I did not receive content. I always rely on our Regional Representatives to comb their territories for material to include in the newsletter. For this issue of STAGES, I want to extend special thanks to two people who sent detailed reports about the activties of their collegial groups. Akinori Takasuka's summary of a workshop on the growth-survival paradigm is in Iain Suthers' report from the Pacific Rim. Darrel Snyder's report on the state of knowledge of early life stages in North American fresh waters is so large, it required it's own section. I am delighted to have these kinds of reports and I know our membership will find them interesting. §

Join ELHS

Membership in ELHS is open to all persons or organizations interested in furthering ELHS objectives, regardless of membership in the American Fisheries Society (AFS). If you are an AFS member, simply add ELHS membership when you pay your Society dues.

Affiliate membership is open to persons or organizations who are not members of AFS. Affiliate members are encouraged to participate in Section meetings, committee work, and other activities, but they cannot vote on official Section matters, run for or hold an elected office, or chair standing committees. All members receive ***STAGES.***

To become an affiliate member, go to https://www.larvalfishcon.org/ELHSAffiliate/affiliate-triage.asp or mail your name, institutional affiliation (if appropriate), mailing address, telephone and fax numbers, e-mail address, and dues (US $15 per year) for the current and/or upcoming year(s) to the ELHS Treasurer (see page 2).

Please specify the membership year(s) for which you are paying dues. Make checks or money orders payable to "AFS-ELHS."