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ASIH PRESIDENTIAL ADDRESS

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Basic Biology, Good Field Notes, and Synthesizing across Your Career

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Ichthyology and herpetology remain in need of well-done studies in basic biology and ecology, life history, or natural history for many species. Even for well-studied areas in the United States, the percentage of species for which basic information is lacking or for which better information is needed, based on state or regional faunal books, ranged from about 10 to 35% for fish species, and about 5 to 31% for herps. For Mexico the need was even greater, with the basic biology of approximately 45% of the fish fauna poorly known. Part of the need for better information stems from perceptions by some that basic studies are less desirable than works grounded in theory or modeling. But basic biological information is the foundation for and critical to virtually all syntheses or meta-analyses. Thus, publication of good basic biology in appropriate journals is extremely valuable to one's discipline, and many peer-reviewed journals like *Copeia* remain amenable to publishing such information. In recent years, graduate students and faculty have been encouraged to publish in high-profile journals, often as judged by ''impact factors.'' But impact factors are a poor way to evaluate across disciplines, and the degree to which papers are cited should be given more consideration than the impact factor of any particular journal. Papers in *Copeia* or similar journals can be and are highly cited, with several in *Copeia* having been cited 300 to more than 500 times. To the end of high-quality publication of basic information, or its eventual synthesis, suggestions are offered relative to field notes and similar practices. For herpetologists and ichthyologists in mid- to late career, the challenge is to synthesize across one's career, passing to the next generation all that you have learned, by publishing professional books, books for laypersons, or outreach through other media. Contribution to knowledge by publication of basic biological information, and ultimately by synthesizing across one's career, all help meet our obligations to the disciplines that have so shaped our professional lives.

I was honored to give the ''ASIH Past President's Address'' at the opening plenary session of the Joint Meeting of Ichthyologists and Herpetologists in 2014, with the rather cheeky title ''Synthesizing Your Career Data: A Challenge for Old Folks and Suggestions to Young Folks.'' To all in the audience I might have offended by having considered you to be either ''old'' or ''young,'' my profuse apologies. However, I hope that the messages were of some value, or at least gave someone pause to think. I am sure that not all students or their advisors will agree with everything that I propose here, but I hope that the ideas are given some consideration.

My address focused on three themes:

1. Publish everything that you learn about basic biology or life history of any species. (There is a big need for it, and all good biology should be published in appropriate journals.)
2. Plan early in your career for opportunities you may not yet envision, because much of your future career is unknown. (So take really good field notes.)
3. Plan early on so that later in your career you can provide to your profession a synthesis that draws on the knowledge you have accumulated through your years of research. (Don't be the one to die with the most unpublished data or yellow-pad records in a file cabinet—somebody will just have to throw it away for you!)

Part 1: Basic biology and life history, and where to publish.—There is a tremendous need for high-quality basic information on many individual species including life history traits (reproduction, growth, ageing, etc.), food habits, macro- or microhabitat use, seasonality and migrations, and all general behaviors. To assess the continued need for such information, I reviewed well-known books by respected ichthyologists or herpetologists, each of which included species accounts documenting information (or lack thereof) on the taxa in a state or region. From the descriptions of biology or life history, I scored species lacking information in subjective categories describing the information gaps (e.g., ''nothing is known,'' ''little is known,'' or ''minimal information available''), following as much as possible the original wording by the author. To any authors whose work I may have misinterpreted, my apologies.

I first examined Steve Ross' *Inland Fishes of Mississippi* (2001), as a relatively recent and thorough ''state fish book.'' Statements like ''very little is known of the biology of this species'' appeared many times. For 22 species or subspecies the statement was ''biology little known'' or ''very little known;'' for seven there was only a brief summary with minimal information, and another nine species lacked information on important aspects of food habits, reproduction, or life history. To summarize: for the inland fishes in Mississippi, a state very well studied by ichthyologists for more than a century, 38 of 218 freshwater species, or 17% of the fauna, were in need of better information.

I next perused Robert Rush Miller's posthumous *Freshwater Fishes of Mexico* (2005). Not surprisingly, in a country with many remote areas or locally isolated taxa, for 223 of the 500 species (=45%) the biology was poorly known, with 66 species scored as ''nothing is known.'' Similar patterns emerged for *Fishes of Alabama* (Boschung and Mayden, 2004), with 31 of 88 (35%) native minnows and 23 of 77 (30%) darters with little or no information, or ''study is wanting,'' and for *Freshwater Fishes of Virginia* (Jenkins and Burkhead, 1994), in which for 23 minnows, eight darters,

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and several other taxa it was noted that ''life history is poorly known,'' ''natural history scantily known,'' or similar comments. The situation may have improved some in Virginia since 1993, but I doubt it, because of current biases against natural history studies or their publication, which I address below.

Two other fish books also showed the need for better species-specific information. *Fishes of the Middle Savannah River Basin* (Marcy et al., 2005) indicated that for 13 of 69 (18.8%) resident native species ''nothing is known'' or there are ''gaps in knowledge.'' The most recent ''state'' fish book, *Kansas Fishes* (Kansas Fishes Committee, 2014), offered a slightly better picture of knowledge about individual species, with only about 14 out of 144 (10%) species with life history or diets little or poorly known. But on balance, all of the state or regional fish books I evaluated led to the conclusion that a great need remains for well-done, basic life history or natural history information on poorly known species. My choices of fish books were dictated by arbitrary selection of the most recent ones on my bookshelf, but I'll wager that similar examination of many fish books, for many parts of the world, will reveal similar patterns.

Herpetologists seem to do a bit better job of publishing fundamental life history of species, based on several recent herp books. Still, they also have a lot of work to do. In some states, herps are rather well known. In *The Amphibians and Reptiles of Arkansas* (Trauth et al., 2004,) only seven of 137 (5%) state species had ''no life history studies,'' or ''little known about their biology.'' And for the limited fauna of 69 species in New York (*Amphibians and Reptiles of New York State*, Gibbs et al., 2007), only seven lacked information on basic biology. However, for *Amphibians and Reptiles of Georgia* (Jensen et al., 2008), 41 of 170 species (24.1%) had ''life history poorly known'' or similar comments. And for amphibians in Tennessee (*The Amphibians of Tennessee*, Niemiller and Reynolds, 2011), 27 or 88 species (30.7%) had life history ''little known'' or ''poorly known.''

The bottom line is that for fish and herps, even in extremely well-studied areas, there is a critical need for more or better information on life history, basic biology, or fundamental ecology. And in less well-studied areas in other countries or on other continents, the need is likely even more acute.

Why is there a dearth of information on so many species? First, many of the poorly known taxa are scarce, hard to find, and so rarely encountered that discovery of even the most basic facts may be difficult. Secondly, in recent decades, with the advent of molecular tools, numerous taxa have been split so that one ''species'' is now represented by several, with the ''spin off species'' lacking the kind of basic biological studies that applied to the old, broader species of the past. However, there is a more insidious factor that I think is at work in suppressing, or at least discouraging life history studies—the recent tendency of major professors, research committees, job search committees, chairs or deans evaluating faculty, and reviewers for major funding agencies to eschew work considered by some as ''basic,'' in lieu of what they perceive as more desirable ''theoretical'' or ''experimental'' research. Until recently, a M.S. thesis or even a Ph.D. dissertation providing an in-depth study of the basic life history of a specific taxon was highly respected, and students were often encouraged to pursue and publish such information. (We shall return to the question of ''publication'' in a bit.) And these kinds of graduate theses are incredibly valuable to the profession as sources of primary information. For example, in the *Inland Fishes of Mississippi* (Ross, 2001), there are 37 citations of M.S. or Ph.D. theses on some aspect of the biology of a single species or several closely related ones. Many more papers cited by Ross were single-species biological accounts, likely based on M.S. or Ph.D. theses, published in *Copeia*, *Transactions of the American Fisheries Society*, *The American Midland Naturalist*, *The Southwestern Naturalist*, or similar journals. All such information is the raw material from which great syntheses or robust conservation decisions are made. But, unfortunately, the rise of the ''impact factor'' as the yardstick against which many administrators and some faculty measure the value of a given journal, or publications therein, has caused many biology departments to gravitate away from graduate theses in natural history and basic ecology, or publication of such results, in appropriate outlets like state, regional, or taxon-specific journals. Such an attitude overlooks the fact that many of the greatest discoveries or concepts in biology have come, historically, from syntheses of basic information from many different sources, including, most notably *The Origin . . .* by Mr. Darwin.

Who among us have had noteworthy careers begun with or focused on basic ecology or life history studies? I offer two examples: Tony Echelle and Larry Page. Anthony A. (Tony) Echelle's 1970 Ph.D. dissertation at the University of Oklahoma was on ''Behavior and Ecology of the Red River Pupfish, *Cyprinodon rubrofluviatilis*,'' with sections on distribution and habitat, schooling behavior, feeding habits, motor patterns, reproductive behaviors, agonistic behavior, territoriality, courtship and spawning, color patterns and changes, and interactions with other species. Tony has had a hugely successful career (in a great collaboration with Alice), addressing many aspects of ecology and systematics, the cornerstone of which is their continued studies of the systematics of pupfishes. Larry Page, from graduate school onward, published at least nine major works (as Illinois Natural History Survey Biological Notes), ranging from 11–20 pages each, based on his own field work, on the life history of individual darters or groups of darters, with detailed basic information, including habitat, reproductive cycles, spawning, development and growth, demography, movement or migration, diet, and interaction with other organisms. These studies and his basic information on many other darters were subsequently synthesized in and gave rise to overarching concepts in his comprehensive *Handbook of Darters* (Page, 1983). And none could argue but that Larry Page has had a long and highly successful career, including time as a Program Officer at NSF, and service as President of ASIH. Publishing in basic biology clearly was good for both Tony and Larry!

Many other ichthyologists have published excellent papers on basic ecology or life history of fish species. Perhaps the largest publication on a single species of fish was by William E. Fahy (1954), ''The life history of the northern greenside darter . . . ,'' which spanned 67 pages in the *Proceedings of the Elisha Mitchell Scientific Society*. And Fahy also had a long and distinguished career at the University of North Carolina Institute of Marine Sciences. But herpetologists seem to exceed ichthyologists in voluminous publication on some individual species. Henry S. Fitch is noteworthy in this regard, with a 117-page life history on *Coluber constrictor*, and a 156-page life history of *Eumeces fasciatus*. And Donald W. Tinkle's ''life and demography'' of

Uta stansburiana was a 174-page Miscellaneous Publications of the Museum of Zoology at the University of Michigan.

But in the modern research climate, why fret about or continue to publish basic information on biology or life history of individual species? The first answer is the simplest—just because it's not known. Research for the sheer intellectual pursuit of what is not yet known to science, or that might reveal surprises even about organisms that we ''think we know,'' remains an excellent endeavor for any scientist. From a less esoteric viewpoint, basic information on all species, especially those potentially imperiled (and often the most poorly known), is absolutely critical to initiatives for their conservation or for intelligent management or listing decisions. Moreover, good basic information is the requisite starting point for any broad syntheses or meta-analyses across groups or within ecosystems that may generate the most useful models in the future. (Although great care must be taken to use only well vetted, and thoroughly reliable information, rather than simply pulling from ''the web'' whatever one might be looking for. Peer-reviewed, published papers should remain the gold standard.)

Three cases in point can be made, among many others. The most obvious is *The Origin*, in which Darwin based his earth-shaking idea on a wealth of information about morphology or basic biology of individual species or variants that he had accumulated through years of careful observations, or that had been published by his contemporaries. A century later, graduate students in biology grew up on *Animal Species and Evolution* by Ernst Mayr (1966). In this weighty tome, Mayr drew on a huge number of examples of basic biology of species—distributions, morphological variants, ecological traits, and behavioral differences—to address major questions about evolution of animals species. Thirdly, in 1969 in *The American Naturalist*, Donald Tinkle published a major synthesis on ''The concept of reproductive effort and its relation to the evolution of life histories of lizards,'' in order ''to formulate a general theory for the evolution of life history types in lizards'' (Tinkle, 1969). In ''materials and methods'' he specifically stated, ''I have gathered data from the literature on every species of lizard for which some detailed life history information has been published'' (Tinkle, 1969). Finally, there is a wealth of contemporary syntheses or meta-analyses that rely on fundamental ecological traits to address major evolutionary questions within groups, such as Blackburn (2006) and Sites et al. (2011) on lizards and snakes. The value of good, basic biology and life histories in our discipline, historically and now, is undeniable, and publication of such information should be applauded in every possible way.

But, where to publish? For a graduate student wanting a job, or an assistant professor aspiring to tenure, is it wise to publish such information in regional or taxon-oriented journals? Will this be held against them in the current impact factor-driven climate? The answer to this second question should be a resounding ''no!'' But unfortunately, there are chairs, deans, and search committees who do rely on impact factors as a starting point to evaluate publication quality (in lieu of reading the papers to see what they have to say!). I will not repeat the litany of papers focused on ''what's wrong with impact factors,'' as they range widely with many kinds of criticisms. I focus instead on one simple problem that I think we face in publishing in even the most highly regarded taxon-specific journals like *Copeia* (impact factor = 0.901), or *Journal of Herpetology* (impact factor = 0.838), or in excellent specialty journals like *Freshwater Biology* (impact factor = 2.9). The problem is simply that such journals have little hope of ever having an impact factor rivaling that of journals in much larger disciplines, such as neurobiology or cell biology. The journal *Cell* has a five-year impact factor of about 35, and the journals *Nature Neuroscience* and *Neuron* both have impact factors over 14. But the Society for Neuroscience has nearly 40,000 members, whereas ASIH individual membership hovers around 1,500. The sheer volume of potential readers of neuroscience journals so dwarfs the numbers of potential readers of *Copeia* or other taxon-specific journals that we cannot compete in raw impact factor scores with such gigantic disciplines. Thus, if departments of biology that include practitioners from field biology to neuroscience and cell biology compare impact factors to make decisions, the table is tilted badly against field biologists in terms of impact factors for journals where we are most likely to publish.

What is the solution? Should there be a change in the metrics of evaluation for job seekers or for young faculty? I would argue that what is really most important is not some vague number like an impact factor (which represents the hypothetical quality of the journal, not the value of the paper that *you* publish there), but the degree to which your peers cite your research. Good papers do get highly cited, regardless of the journal they are in, so long as that journal is available online through any of many various search engines or providers like JSTOR or BioOne (as almost all now are). And a growing number of departments are turning to citation frequency metrics, such as the relatively new ''h-factor.'' To the end of promoting publication in regional or taxon-specific journals, I point out some of the most highly cited papers in *Copeia*, and then shamelessly offer some of my own publications as proof that if people are interested in your work you will be cited.

A Google Scholar search of *Copeia* citations from 1980 to the present showed that Ross (1986), on resource partitioning in fishes, garnered the most citations at 564. This was followed by Sadovy and Shapiro (1987) on hermaphroditism in fishes, with 395 citations; Toft (1985) on resource partitioning in herps, with 377 citations; and Shine (1994) on size dimorphism in snakes, with 328 citations. When I was department chair sending out promotion packets for review, more than one external reviewer told me that they considered their benchmark for promotion to the rank of professor was that a candidate have papers that were highly cited, with at least one paper with 100+ citations. So it would seem that *Copeia* can be and is a vehicle where aspiring graduate students or faculty can be highly cited. In fact, my quick perusal on Google Scholar showed that a total of 103 other papers in *Copeia* between 1980 and 2014 have been cited more than 100 times.

Taking my own publication history into consideration (Table 1), Google Scholar showed that 25 papers on which I've been senior author or a co-author have been cited more than 75 times, and of those, 14 are in journals I consider regional (*The Southwestern Naturalist, The American Midland Naturalist)*, taxon-specific (*Copeia, Ecology of Freshwater Fish, Fisheries*), or specialty (*Journal of the North American Benthological Society, Freshwater Biology, Hydrological Processes)*. Certainly I have been glad to have other well-cited papers in general journals like *Ecology, Oikos, Oecologia,* or *American Naturalist* (usually as a co-author to an outstanding

Table 1. W. J. Matthews publications with >75 citations (Google Scholar, November 2014).

Journal or source	Reference	Times cited
Book	Matthews (1998)	1100
JNABS	Power et al. (1988)	281
Copeia	Matthews (1986)	207
Freshwater Biology	Matthews and Marsh-Matthews (2003)	205
Book chapter	Matthews (1987)	185
JNABS	Matthews (1988)	173
Copeia	Matthews, Cashner, Gelwick (1988)	122
Ecology of Freshwater Fish	Marsh-Matthews and Matthews (2000)	115
Fisheries	Matthews and Zimmerman (1990)	104
Hydrological Processes	Covich et al. (1997)	102
Amer. Midland Naturalist	Matthews and Robison (1998)	101
Southwestern Naturalist	Matthews and Hill (1980)	101
Envir. Biology of Fishes	Matthews (1986)	97
Copeia	Matthews and Robison (1988)	95
Envir. Biology of Fishes	Matthews, Harvey, Power (1994)	88
Amer. Midland Naturalist	Matthews and Styron (1981)	84

colleague as senior author). But the take home message is that while it is admirable to publish in the broader general journals, and theoretical or experimental works may find their best home in such outlets, it is equally valuable and important (to your discipline and to your career) to publish high quality, basic information in taxon or specialty-specific journals. In fact, to not share with the broader audience of your profession the basic information you glean from your field work seems to me unprofessional. I urge all of us to publish good basic knowledge about fish or herps in excellent journals like *Copeia* that reach a target audience for which such important information is most appropriate and potentially useful!

Now, to be honest, you cannot expect that all information you publish on life history, natural history, or range extensions will be highly cited. I have numerous notes or short papers on topics like ''first Arkansas records of lampreys'' (Harp and Matthews, 1975; four citations), ''new locality records for Kansas fishes'' (Matthews and McDaniel, 1981; six citations), ''changes in the fish fauna of Oklahoma'' (Cashner and Matthews, 1988; ten citations), ''geographic variation in Red Shiner coloration'' (Matthews, 1995; eight citations), or others that will never be highly cited. No matter. If the information is useful to even one person, or contribute to a synthesis in somebody's book (e.g., Matthews and McDaniel, used in the new *Kansas Fishes* book), then it has been worth the time or trouble to put the information into print.

A final question is the practical matter of where to publish basic biology information on herps or fishes. Happily, there are many journals that welcome such work. *Copeia* remains an outstanding outlet for well-done basic research. A Google Scholar search of *Copeia* from 2000 to 2014 showed 14 papers with ''life history'' in the title, four of which were published in the last two years. In addition to general natural history outlets like *The American Midland Naturalist* and *The Southwestern Naturalist*, specialty journals in our discipline that publish good basic biology or life history, or syntheses based on such information (based on Google Scholar search of issues since 2000 for ''life history'' in titles) include: *Journal of Herpetology* (20 papers); *Herpetological Review* (7 papers or notes); *Herpetologica* (9); *Journal of Fish Biology* (about 75); *Ecology of Freshwater Fish* (24, including meta-analyses and models); *Environmental Biology of Fishes* (50, including some modeling or multi-taxon syntheses); *Canadian Journal of Fisheries and Aquatic Sciences* (about 60); and *Transactions of the American Fisheries Society* (53). It seems obvious that there remains as strong an interest in basic biology or life history as ever, and that many journals welcome such submissions.

Part 2: Always take good field notes... because you never know.—When we made the last collections for my M.S. thesis on Piney Creek, Arkansas, in 1973, I would not have envisioned that I would be going back for decades. Fortunately, I had taken crude but detailed field notes in a bound ledger. By 1981 I had completed a Ph.D., taught for two years at Roanoke College, and moved back to the University of Oklahoma (another move that I would never have anticipated when I graduated in 1977). But I was back, and decided to sample Piney Creek again, which I did for some of the sites in 1981. By the next year I decided to do another year-around sampling at all my 12 fixed sites on Piney Creek, and made those collections in August 1982. Then, the biggest flood in the known history of the creek occurred in December 1982, so post-flood sampling was in order (Matthews, 1986). Since then, I've been back about every ten years, with Edie Marsh-Matthews since 1994. In July 2012 we, with Ginny and Reid Adams, sampled at all 12 sites, 40 years almost to the day since the first time I pulled a seine in Piney Creek. I could tell a similar story about Brier Creek, Oklahoma, where I first sampled as a student in Tony Echelle's class at the OU Biological Station in 1976, and which I have since sampled with my own classes and/or colleagues in many summers to the present (Matthews et al., 2013). The point of all this is that I was lucky to have mostly taken good field notes throughout, starting with the initial samples in both systems. And those notes have made it possible to now reconstruct much history of the collections in those systems, as we proceed to publish long-term papers (Matthews et al., 2013, 2014).

I must admit some caveats. Mostly my field notes are good, but there are some, especially when I was leading field trips and busy with students needing attention, for which I took pretty minimal information. I've wished later for more information than I wrote down, but there is simply no way to go back in time. I did take photos at many sampling sites and those help to reconstruct some missing information. But I really wish I had just taken the extra ten minutes at a site to properly record all of the information I now wish I had. I mention all this to urge anybody, especially those in early careers, to resist the temptation to jump back in the truck and head for the next site until you have had time to make good notes . . . like ones you could read 20 or 30 years from now and really understand just what it was you did and how you did it.

General advice on field notes—mostly no-brainers, but easy to overlook in the eagerness to get to the field, make collections, get specimens sorted and archived, and publish results. First, use a standard field form which forces you to think, even if it does sound like ''filling in the blanks.'' But be sure to allow space for other observations about the general setting, instream structure, riparian or local land use and similar items. Draw a map of the site and take an archival photo, ideally for long-term studies consistently using the same camera angle. Immediately back up your field notes and images. Copy them on paper and scan them electronically, and guard the originals with a ferocity owed to family treasures. Never keep all copies, paper or electronic, in the same building. In Oklahoma tornado country, we are acutely aware of how fast everything physical can be lost, and fires or other disasters can happen anywhere. A complete backup set of field notes, safe in a repository or in the electronic cloud, can save your career! And because you will surely archive your field samples in a museum, they will also want you to deposit a copy of your field notes. On a related issue, keep copies of all your collecting permits and IACUC approvals in perpetuity. Most museums will not now accept specimens unless you can provide that documentation, and don't count on the agency or university committee to have a copy if you need it a decade from now.

Part 3: Synthesizing across your career.—Finally, what will you do with the information and knowledge gleaned from your whole career? If you are ''old'' (referring back to my introduction) or getting there, maybe it is time to make a serious effort to synthesize things so that peers and especially the next generation can learn from a ''big picture'' of what you have done. Too many colleagues who have now passed on left behind a huge legacy of collections, field notes, individual published papers, or book chapters, but no real synthesis of everything they knew. If you are ''young,'' at the graduate student or new assistant professor stage, think now about what kinds of documentation and information you might need in, say, 20–30 years, so that you can likewise pass to yet another generation what you have learned in addition to those superb individual papers that you will no doubt publish over the years.

One question is ''what will you synthesize''? For early-career folks, are you now engaged in field work that may morph into long-term studies spanning decades? If you are working on a truly interesting system now, can you plan to somehow return to that system to continue your fundamental sampling, even at considerable trouble or at your own expense? For later-career folks, if you have a long-term study site or system, have you considered bringing in trusted younger scientists who may continue sampling ''your'' system long after you may be too old to go to the field (we all hate to admit that might happen, but it does.) Can you hand off your long-term study by collaboration with younger folks, showing them in detail what and how you have done things in the field, perhaps introducing them to landowners or other key persons so that if you do someday want to ''take it easy,'' you know they will commit to continuing your long-term studies as a critical contribution to the future (Magurran et al., 2010)? So I would argue that ''synthesis'' can include taking efforts to keep the study alive ''in perpetuity.''

Syntheses can take many forms. Some are obvious, like books summarizing more knowledge than can be put into even a large number of individual, specialized papers. Excellent examples include books for professionals like Goulding's (1980) *The Fishes and the Forest*, Pianka's (1986) *Ecology and Natural History of Desert Lizards . . .*, Lowe-McConnell's (1987) *Ecological Studies in Tropical Fish Communities*, Wootton's (1990) *Ecology of Teleost Fishes*, Gerking's (1994) *Feeding Ecology of Fish*, Pianka and Vitt's (2003) *Lizards: Windows to the Evolution of Diversity*, Losos's (2009) *Lizards in an Evolutionary Tree—Anoles*, and Kurt Fausch's forthcoming book *For the Love of Rivers*. In each, the author(s) draw on a wealth of personal research and experience to provide readers with a comprehensive view of a major subject. In my own book (Matthews, 1998) I tried to synthesize broadly across freshwater fish ecology, but added a substantial number of previously unpublished observations, such as information on what fish do during floods, or the ways that wind and wave affect onshore fishes in lakes.

Other syntheses include textbooks for upper division students or for professionals, in which the authors draw on many personal experiences as well as published information, such as Helfman et al.'s (2009) *The Diversity of Fishes*, Tyus's (2012) *Ecology and Conservation of Fishe*s, Ross's (2013) *Ecology of North American Freshwater Fishes*, and Vitt and Caldwell's (2013) *Herpetology: An Introductory Biology . . .*, now in its fourth edition. Popular books for the interested layperson also are ways to inform through one's own observations, such as Moyle's (1993) *Fish—An Enthusiast's Guide*, Smith's (1994) *Fish Watching . . .*, or Rose and Judd's (2014) *The Texas Tortoise*. And C. L. Smith also found time to do the large volume on *The Inland Fishes of New York State* (Smith, 1985). This leads to the fact that ''state'' or regional herp or fish books like those mentioned earlier in this paper, or the massive book on *The Amphibians and Reptiles of Costa Rica*, by Jay Savage (2002), also provide a superb outlet for sharing personal knowledge gained through a career of studying fishes or herps. Finally, there is a growing potential for professional synthesis that also has strong outreach components, such as involvement by Kurt Fausch in the making of the film *River Webs*.

But a slightly younger colleague once told me that he/she was not interested in writing a book, because ''nobody reads them any more.'' Not true. In spite of the wealth of web resources now available, there is nothing to compare to a comprehensive book sitting on one's lap, and good books get cited a lot. The late Bob Wootton's *Ecology of Teleost Fishes* has been cited more than 2800 times. Moyle and Cech's (2004 and earlier editions) *Fishes: An Introduction to Ichthyology* has more than 1400 citations. Rosemary Lowe-McConnell's (1987) book on tropical fish communities and my own book on *Patterns in Freshwater Fish Ecology* (Matthews, 1998) have each been cited more than a thousand times (Table 1). Losos's (2009) relatively new book has already been cited almost 350 times since it appeared. The evidence is clear that even with the web at our fingertips, many scientists still prefer to turn to a substantial book!

Summary.—I began this address with three themes: (1) include basic biology and natural history of fishes or herps (or both) in your career-long program of research, and publish all your good information in appropriate journals; (2) plan ahead for the unknown future and opportunities it may present by taking very good field notes and keeping them safe; and (3) plan ahead (if you are ''young'') or begin now to (if you are no longer ''young'' to the profession) synthesize what you have learned throughout your career in books, monographs, or popular modalities so that the future generations of scientists or laypersons can benefit from all that you have learned. I so often wish that I could now ask some of our late colleagues exactly what they meant by some suggeston in the discussion in a paper, or exactly how they did make certain collections (in that they left no field notes behind).

One of the most shopworn but true expressions in science is that we ''see further'' when ''we stand on the shoulders of giants'' (attributed to Sir Isaac Newton in 1676, but with other attributions as early as the 12^{th} century). But ''standing on the shoulders of giants'' (be there any left in the world of science today) does us less value if those giants shrug (apologies to Ayn Rand), by failing to draw together in a synthesis the many things that they have learned, but that may exist only in scattered publications, crammed file cabinets of raw data, or in their heads! Best wishes for a long and successful career that is meaningful to you, and to your discipline. It has been an honor serving ASIH as your President. Thank you.

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I can claim very few individual original ideas in this address, as most of these ideas were jointly developed by Edie Marsh-Matthews and myself in our daily walks. I also thank the FishLab at the University of Oklahoma for comments and suggestions, and all of those colleagues who have in the past and continue at present to publish good basic biology of herps and fishes.

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