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In his 1971 book, Seuss stated that the Lorax spoke for the trees because they could not do so themselves. The same is true for the American Fisheries Society (AFS) regarding aquatic and marine ecosystems and the fish, fisheries, and fish and fishery scientists that they support. This means that we advocate for those resources and the humans that they support because they cannot freely speak for themselves. By providing strong, scientifically supported positions and policy statements, resolutions, legislative briefs, and letters, we help provide maneuvering space for government scientists, legislators, and nongovernmental organizations to develop policies, laws, regulations, and budgets that may help conserve the resources we value. It is particularly important for scientists and professional societies to speak out when science is misused, misinterpreted, or ignored (Karr 2006), which is particularly difficult when there is so much, often contrary, scientific information available. In the natural resources disciplines, as in the medical and socioeconomic disciplines, values and science are continuously interwoven and confounded in support of contrary sociopolitical perspectives.

We do not appreciate silence by health scientists and doctors when their science supports changes in health care policies. Why should we expect it from fishery scientists?

The AFS represents members who seek a greater AFS presence on fish and fishery policy decisions by government agencies, and others who want the AFS to provide only scientific information. Likewise, some agency partners and employees may appreciate an AFS policy position, and others believe that the AFS must avoid taking a position. This is especially true when an AFS officer is also an employee of that agency or institution. However, it must be remembered that silence represents advocating for the status quo (Cairns 2011). All that is needed for continued resource degradation is for knowledgeable scientists and their professional societies to remain silent when their scientific knowledge supports an alternative position. We do not appreciate silence by health scientists and doctors when their science supports changes in health care policies. Why should we expect it from fishery scientists? In a recent unpublished survey of AFS stakeholders, agency spokespersons supported greater involvement by the AFS. Lackey (2007) also felt that it was necessary for scientists to contribute to policy and not limit their inputs solely to scientific publications, especially if their research was publicly funded (which is likely true of most AFS members). To ensure that AFS advocacy statements represent the will of the membership, the AFS (1996) calls for substantial member support for those positions. However, obtaining that support through AFS policy and position statements and resolutions is too restricting when the AFS is asked to comment on an agency action or legislative bill within a matter of days. The AFS (1996) does support officer review and decision in such situations to ensure that the positions taken represent the AFS and not merely one person’s perspectives. But this function is necessarily limited by the scientific knowledge and values of the officers.

As Lackey (2007) and Boreman (2013) have stated, it is critical that we clearly separate our professional and scientific information from our personal opinions and values when making policy-sensitive statements. Of course, it is important to realize that because science is done by humans, decisions regarding what and how to study, how we interpret the results, and our choice of words all constitute value-laden decisions that are de facto forms of advocacy (Lackey 2007; Cairns 2011). See Lackey (2007) for words to avoid when attempting to separate science from advocacy. Lackey (2007) also argued that science is (or should be) policy neutral, with no preference for any particular ecological condition. However, we can use our scientific knowledge to describe the likely ecological effects and socioeconomic costs of altered ecosystem or fishery conditions. Cairns (2011) went further, arguing that attempts to separate natural and social sciences, humans and nature, and values and science are reductionistic versus holistic thinking that lead to narrowed knowledge and reduced biotic integrity, which Leopold (1949) considered wrong. Wilson (1998) and Holsman (2001) indicated that most major environmental issues combine ethics, policy, and science, making them ethical and value-based choices. Contrary to Lackey (2007) and in agreement with Leopold (1949), I believe that there is ample evidence for using our scientific knowledge to explain why reduced ecological diversity and complexity, highly altered ecosystems, and nonnative invasive species are ecologically and economically undesirable. The taxpayers whom I speak with in my biased surveys when fishing, skiing, hiking, and kayaking expect those insights from us. Fish and fishery advocacy simply means that we value those resources and their supporting ecosystems and that they are worth conserving enough to speak for them. Remaining silent leaves the field to those interests with markedly different values. Generally, that has not been a wise choice, whether the issues centered on the rights of humans or the rights of nature. Of course, advocating for science-based resource management is no guarantee that we will be heard or that AFS positions will outweigh other social, economic, and academic perspectives.

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Catfish Sampling Techniques: Where We Are Now and Where We Should Go

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ABSTRACT: We review the peer-reviewed literature regarding sampling of the three most commonly managed ictalurids: Channel Catfish, Blue Catfish, and Flathead Catfish. For each species, we summarize what is known about data quality (accuracy and precision) and sampling efficiency of the most commonly used gears for surveying these species. We identify research needs and provide information to guide gear selection based on different sampling objectives. To rank gear-specific sampling efficiency (catch/h and catch/person-h), we report median catch rates and the interpolated 25th and 75th percentiles of published means. We also describe the accuracy of relative abundance and size-related metrics for each gear. For Channel Catfish, tandem baited hoop nets provide the most efficient (11–24 fish/net/tandem set, 20–60 fish/person-h) and accurate samples. Low-frequency electrofishing provides the most efficient and the most accurate samples of Blue Catfish (23–373 fish/h, 2.1–11.3 fish/person-h) and Flathead Catfish (19–62 fish/h, 2.1–2.5 fish/person-h) and the most accurate samples of Blue Catfish. No accuracy studies exist for Flathead Catfish. Other gears examined for each species may also be useful for some sampling objectives; however, most are inefficient or lack accuracy.

Growing interest in catfish angling has created a need to better understand ictalurid catfish populations. Unfortunately, inadequate sampling techniques (e.g., low catch or biased size and age distributions) have often precluded efforts to effectively describe catfish populations (Michaletz and Dillard 1999; Brown 2009). Limited knowledge of appropriate sampling gears and methods ranked as one of the more urgent constraints among catfish managers (Michaletz and Dillard 1999). Historically, few management agencies have devoted specific resources to catfish management (Arterburn et al. 2002). This likely contributed to the lack of sampling knowledge for these species. Developing new or improving existing techniques has since been a priority for catfish managers nationwide (Brown 2009).

In 1998, the First International Catfish Symposium provided the first organized platform for fisheries professionals to report research findings and identify future research needs specifically for catfish (Irwin et al. 1999). The symposium proceedings included six articles that examined catfish sampling techniques (i.e., gear comparisons), including one that summarized gear evaluations published prior to 1999 (Vokoun and Rabeni 1999). These six articles, coupled with other published studies, provided fisheries scientists with information necessary to begin designing and implementing effective (i.e., accurate and precise) and efficient catfish sampling procedures.
However, during this time, appropriate sampling procedures were still in the early stages of development (Flammang and Schultz 2007; Brown 2009). Most gear evaluation studies were based on methods needed to increase catch and gave little consideration to potential biases or precision. Although some resource agencies developed internal sampling standards, most were developed with little scientific guidance. Catfish managers still cite gear bias as one of the biggest constraints on ictalurid management (Brown 2009).

Since the first catfish symposium, evaluations of sampling techniques have proliferated (e.g., Micheletz and Sullivan 2002; Dumont and Schlechte 2004; Flammang and Shultz 2007; Buckmeier and Schlechte 2009; Bodine and Shoup 2010; Ford et al. 2011; Stewart and Long 2012). New techniques have been developed, and many existing techniques have been improved. A Second International Catfish Symposium, held in 2010, provided an opportunity for catfish scientists to present and discuss current research findings (Micheletz and Travnicek 2011). During this meeting, the Catfish Technical Committees from the American Fisheries Society’s North Central and Southern divisions determined that there was a need to consolidate the most current information (i.e., including studies published after 1999, when the first catfish symposium proceedings were printed) about ictalurid catfish sampling. This article is the culmination of work from an ad hoc committee formed by these committees to address this need. Herein, we summarize the most current peer-reviewed literature (prior to 2013, with special emphasis on studies published after 1999) related to sampling the three ictalurids most commonly managed (as sportfish) or monitored in regions where these species are exotic or invasive) in the United States: Channel Catfish (Ictalurus punctatus), Blue Catfish (I. furcatus), and Flathead Catfish (Pylodictis olivaris). For each species, we report what is known about gear performance characteristics (i.e., accuracy and precision [data quality] and sampling efficiency [number of fish collected per unit effort]) of the most commonly used gears. We summarize gear performance characteristics (1) within gear groups to identify gear-specific characteristics that improve performance and (2) among gear groups (e.g., tandem hoop nets/hoop nets/gill nets/etc.; group-specific studies pooled) to examine relative differences in performance among general groups. We identify future research needs and provide information to help managers and researchers select the best gear(s) for their sampling objective(s). This review may also help agencies develop standard sampling protocols for ictalurids and can provide information needed to establish accepted catfish sampling procedures for North America.

GEAR PERFORMANCE DEFINITIONS

The goal of sampling fishes is to collect a sample representative of the population being surveyed (i.e., accurate and precise) with the least effort (i.e., highest sampling efficiency). Unfortunately, there is no one-size-fits-all gear that will always meet this goal for sampling ictalurids. The target species and project objectives should be considered against trade-offs for each prospective gear. A particular sampling gear is rarely the most accurate, precise, and efficient simultaneously. Understanding performance characteristics of each gear allows the appropriate quality and quantity of data to be collected to accomplish project objectives. Gear performance can be broadly grouped into two main categories: data quality (accuracy and precision) and sampling efficiency. Definitions of these terms vary in the literature, so it is important to define them as used in this article.

We define **accuracy** as the closeness of a statistic obtained by sampling to the true value of the population parameter (Zale et al. 2012). Size-related metrics (e.g., length frequency) can be inaccurate if a gear is effective at capturing only a portion of the total size distribution (Reynolds 1996). Other metrics commonly used to measure changes in population abundance (e.g., catch per unit effort [CPUE]) can also be inaccurate if catchability (herein defined as the percentage of the true number of fish present in an area that are sampled by a given unit of effort; Bonar et al. 2009) changes between measurements (i.e., CPUE does not consistently correlate with population size). The accuracy of a metric can be affected by two independent factors: sampling gear and sampling design. A sampling gear can accurately estimate a desired metric at each independent sampling location (e.g., one 5-min electrofishing replicate) but still inaccurately estimate the entire statistical population. This occurs when appropriate spatial replication is lacking (e.g., sampling all habitat types), a condition that is more likely if minimum sample sizes are not met (Bodine et al. 2011). Therefore, accuracy of the sampling gear and the sample design must be quantified. To truly quantify accuracy, a gear must be used to sample a population with known characteristics (e.g., population size/density, size structure, etc.). Without known population characteristics, studies with controlled gear comparisons can only assess whether gear types differ. When they differ, it is not clear which is more accurate. Unfortunately, most accuracy studies are limited in this regard.

We define **precision** as the degree of reproducibility of the measurement (Zale et al. 2012). Precision is inversely related to dispersion (e.g., variance, standard deviation, etc.) and is a function of both inconsistent measurement error (i.e., variation in accuracy) and the distribution of values in the statistical population (e.g., the range of possible lengths of the individuals in the population). Precision directly affects the power needed to detect statistical differences (G. P. Quinn and Keough 2002). When comparing precision of multiple gear types, it is tempting to select the gear with lower variability. However, a gear can be highly precise but lack accuracy (e.g., lower variation in mean length sampled may be achieved by excluding smaller or larger fish that actually existed in the population). In these situations, higher precision may not be beneficial.

We define **sampling efficiency** as the number of fish collected per unit of effort from an area (i.e., catch rate). Effort can be expressed in several ways (e.g., catch/h, catch/person-h, catch/net night, etc.), depending on study objectives, and is not always consistently defined in peer-reviewed literature. This is problematic when comparing sampling efficiency across gear
types or gear-specific variables. Sampling efficiency is important because time, cost, and manpower often limit utility of a gear type. Gears that produce higher catch rates are often preferred because the cost of generating data is typically reduced. When comparing efficiency between gears or samples, the same units (e.g., number/person-h or number/h) and study design (e.g., travel time included/excluded) must be used. Some gears produce high catch/hour, but result in low catch/person-hour if excessive manpower is required to conduct the sample. Gears that are efficient often have higher precision because, at a given level of effort, they tend to produce larger data sets (and variance is inversely proportional to the number of data points; Zar 1998). However, highly efficient gears are not necessarily accurate.

In the following sections, we summarize sampling efficiency and sample accuracy within and among gear groups of the most commonly used sampling gears for each catfish species. To describe group-specific sampling efficiency, we report median catch rates and the interquartile range (interpolated 25th and 75th percentiles) of published means (pooled across studies). These values reflect the most common values that biologists could expect to observe, and pooled studies reflect overall gear-specific performance (i.e., across a variety of systems). Gear accuracy is described as defined above. Accuracy was only described from studies that sampled known populations or directly compared gear types in a systematic or controlled study design that allowed for direct gear comparison.

CHANNEL CATFISH

Hoop Nets and Tandem Hoop Nets

Hoop nets are commonly used to survey Channel Catfish in river systems and small impoundments but also have some application in large standing waters (Brown 2009; Photo 1, Photo 2). Hoop nets can be constructed with various designs (e.g., different mesh and hoop sizes) and can be used with or without bait.

Traditionally, hoop nets produce low catch rates (median = 1.8 fish/net-set, range = 0.8 to 4.1; Table 1) and are insufficient for estimating Channel Catfish population metrics (Hanson 1986; Michaletz 2001). To improve catch rates, researchers developed a modified design, termed tandem hoop net (Sullivan and Gale 1999; Photo 3). Tandem hoop nets consist of two to three single hoop nets tied together in a series with a rope bridle (1–6 m between nets). Each tandem series is typically fished overnight for 1–3 days, which composes one replicate sample (CPUE typically expressed fish/tandem-series set). Tandem hoop nets have much larger catch rates than traditional hoop nets (median = 20.7 fish/net-set or 62.1 fish/tandem set; Table 1). Variations in net design and sampling procedures have been examined to identify methods that increase sampling efficiency and accuracy, each with varying degrees of success.

Sampling Efficiency

Tandem hoop nets are more efficient than any other gear used to sample Channel Catfish (Table 1). Catchability is higher than other gears, ranging from 0.2% to 1.2% in Texas and up to 8% in Missouri (Michaletz 2001; Buckmeier and Schlechte 2009). Catch rates in Missouri have exceeded 350 fish/tandem series (Michaletz and Sullivan 2002) and commonly range from 33 to 74 fish/tandem series (median range) for 3-day sets (Sullivan and Gale 1999; Michaletz and Sullivan 2002; Flammang and Schultz 2007; Flammang et al. 2011; Richters and Pope 2011). More important, tandem hoop nets require less total effort (20–60 fish/person-h) for the same sample quality compared to all other gear types (Sullivan and Gale 1999; Michaletz 2001; Table 1).

Variables such as soak duration, season, and net design can affect sampling efficiency. Nets fished for 2–3 days produce higher catch/hour and lower sampling variability than one-day sets (Michaletz and Sullivan 2002; Neely and Dumont 2011).
Table 1. Relative ranking of Channel Catfish sampling gears based on sampling efficiency (catch/gear-effort and catch/person-h) and accuracy of abundance and size-related metrics. Sampling efficiency is ranked by the median value observed in the literature. Percentile values are the interpolated 25th and 75th percentiles of published means.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Gear</th>
<th>Median</th>
<th>Percentiles (25th–75th)</th>
<th>Comments</th>
<th>Literature</th>
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<tbody>
<tr>
<td>1</td>
<td>Tandem hoop nets</td>
<td>20.7</td>
<td>11.0–24.0</td>
<td>Gear effort = fish/net/tandem set (48–72 h)</td>
<td>Michaletz (2001); Sullivan and Gale (1999); Richeters and Pope (2011); McCain et al. (2011); Flammang and Schultz (2007); Flammang et al. (2011); Michaletz (2009); Michaletz and Sullivan (2002); Neely and Dumont (2011); Stewart and Long (2012); Wallace et al. (2012); Schultz and Dodd (2008)</td>
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<tr>
<td>2</td>
<td>High-frequency electrofishing</td>
<td>7.0</td>
<td>2.8–9.2</td>
<td>Gear effort = fish/h</td>
<td>Vokoun and Rabeni (2001); Columbo et al. (2008); Michaels and Williamson (1982); Barada and Pegg (2011); Pegg et al. (2006); Santucci et al. (1999); McCain et al. (2011)</td>
</tr>
<tr>
<td>3</td>
<td>Low-frequency electrofishing</td>
<td>4.9</td>
<td>2.0–12.8</td>
<td>Gear effort = fish/h</td>
<td>Nelson and Little (1986); Barada and Pegg (2011); Cailteux and Strickland (2009); Jolley and Irwin (2011)</td>
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<tr>
<td>4</td>
<td>Gill nets</td>
<td>4.3</td>
<td>1.0–5.7</td>
<td>Gear effort = fish/net-night</td>
<td>Gale et al. (1999): Nelson and Little (1986); Michaels and Williamson (1982); Yeh (1977); M. S. Robinson (1999); Michaletz (2001); Sullivan and Gale (1999); Richeters and Pope (2011); Crandall et al. (1976); Argent and Kimmel (2005); Odenkirk (2002); Mitzner (1999); Jackson (1995); Elrod (1974); Homer and Jennings (2011); Pegg et al. (2006); Santucci et al. (1999)</td>
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<td>5</td>
<td>Slat traps</td>
<td>2.1</td>
<td>0.4–3.8</td>
<td>Gear effort = fish/trap-night</td>
<td>M. S. Robinson (1999); Santucci et al. (1999); Perry and Williams (1987)</td>
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<td>6</td>
<td>Single baited hoop nets</td>
<td>1.8</td>
<td>0.8–4.1</td>
<td>Gear effort = fish/net-night</td>
<td>Gale et al. (1999): Nelson and Little (1986); Kirby (2001); Vokoun and Rabeni (2001); Columbo et al. (2008); Michaels and Williamson (1982); Barada and Pegg (2011); Arterburn (2001); Pierce et al. (1981); W. W. Robinson (1994); Mayhew (1973); Tillman et al. (1997); Gerhardt and Hubert (1989); Jackson and Jackson (1997); Quist and Guy (1998); Holland and Peters (1992); Kubney (1992); Keller (2011); Cunningham and Cofer (2000); Jordan et al. (2004); Yeh (1977); M. S. Robinson (1999); Michaletz (2001)</td>
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<td>7</td>
<td>Angler creel</td>
<td>1.5</td>
<td>0.3–3.0</td>
<td>Gear effort = fish/h</td>
<td>Santucci et al. (1999); Schultz and Dodd (2008); Parrett et al. (1999)</td>
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<td>0.3–1.0</td>
<td>Gear effort = fish/net-night</td>
<td>Arterburn (2001); Pierce et al. (1981); W. W. Robinson (1994); Mayhew (1973); Tillman et al. (1997); Gerhardt and Hubert (1989); Jackson and Jackson (1997); Fratto et al. (2008); Funk (1958); Hesse (1980); Hesse et al. (1982); Hubert and Patton (1994); Parrett et al. (1999)</td>
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<td>9</td>
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<td>Gear effort = fish/hook-set</td>
<td>Gale et al. (1999); Nelson and Little (1986); Kirby (2001); Vokoun and Rabeni (2001); Arterburn et al. 1999; Santucci et al. (1999); Arterburn and Berry (2002); Barabe and Jackson (2011); Jackson and Jackson (1999); Miranda and Killgore (2011)</td>
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Efficiency—catch/person-h

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<td>1.6–5.5</td>
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Accuracy for abundance

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Neely and Dumont (2011) found that total effort needed to achieve acceptable sampling precision (i.e., relative standard error = 0.25, \( \text{RSE}_{25} \)) was 8–10 net nights with 2- to 3-day sample durations compared to 42 net nights with 1-day sample durations. Baits such as waste cheese and soybean cake significantly increase catch compared to nonbaited nets, although researchers disagree on which bait is more effective (Mayhew 1973; Yeh 1977; Stevenson and Day 1986; Stevenson and Day 1986; Gale et al. 1999; Gale et al. 1999; Flammang and Schultz 2007; Wallace et al. 2011). Restricted hoop-net throats (i.e., rear throat tied or clamped about 15 cm from the cod end to restrict the size of the opening; see Porath et al. [2011] for pictures and description) coupled with 25-mm mesh nets maximize catch rates, presumably by minimizing escapement (Hesse et al. 1982; Gale et al. 1999; Michaletz and Sullivan 2002; Flammang and Schultz 2007; Wallace et al. 2011). Other mesh sizes, including variable-mesh nets, result in lower catch rates (Hesse et al. 1982; Holland and Peters 1992; Gale et al. 1999; Sullivan and Gale 1999; Colombo et al. 2008). Typically, lower variability and higher catch rates occur in summer (Flammang and Schultz 2007); lower catch rates occur in spring (Hesse et al. 1982; Cunningham and Cofer 2000; Wallace et al. 2011). However, mixed results relative to season have been observed in other studies (Michaletz 2001; Michaletz and Sullivan 2002). Other gear specifications such as hoop and net size, net length, and bridle length have minimal effect on catch efficiency or produce inconsistent results (Hubert and Patton 1994; Tillman et al. 1997; Cunningham and Cofer 2000; Michaletz and Sullivan 2002; Flammang et al. 2011).

### Sample Accuracy

Tandem hoop nets are also one of the more accurate gears used to survey Channel Catfish (Table 1). Catch rates typically correlate with population density (Michaletz and Sullivan 2002; Flammang et al. 2011), which allows managers to use CPUE to accurately measure changes in population size. Size structure is also accurately represented for fish greater than 250 mm (Michaletz and Sullivan 2002; Buckmeier and Schlechte 2009). In some systems, fish as small as 150 mm are accurately represented (Michaletz 2001). Mesh size can affect estimates of size structure (Holland and Peters 1992; Gale et al. 1999; Colombo et al. 2008), and 25-mm mesh nets yield the most accurate size distribution (Michaletz and Sullivan 2002; Buckmeier and Schlechte 2009).

### What We Don’t Know

Although hoop nets have been well studied, future evaluations may still improve the accuracy and sampling efficiency of this gear. Most evaluations have focused on sampling in rivers and small impoundments (<200 ha); however, sampling requirements in large reservoirs (>200 ha) are not well studied (but see...
What We Don’t Know

Many gill net designs have been used to sample Channel Catfish; however, little is known about the effects of net design (e.g., mesh size and net length) on accuracy, precision, and sampling efficiency. Mesh size often leads to size biases of gill nets (Michaletz and Boxrucker 2009). Fish less than 250 mm are underrepresented, whereas larger fish may be overrepresented (Michaletz 2001; Buckmeier and Schlechte 2009). However, few studies have effectively estimated size selectivity of gill nets for larger fish and only two have evaluated selectivity of smaller fish. Although some size bias exists, gill nets may still be beneficial because they provide a larger range of fish sizes than most other gears (Powell et al. 1971; Yeh 1977; Michaletz 2001; Richters and Pope 2011).
sizes may not be accurately represented if incremental increases in mesh size are too large. Thus, selectivity curves (Hamley 1975) should be developed to allow for correction of length-frequency data from commonly used gill net mesh sizes. Other specifications such as net length and hanging ratio (i.e., how stretched the mesh is; Hayes et al. 1996) also have yet to be evaluated.

Additional catchability and size selectivity studies are also needed. Only two studies (Santucci et al. 1999; Buckmeier and Schlechte 2009) have used known populations to evaluate these metrics; thus, additional studies should be conducted in other lentic and lotic systems to examine reliability of these estimates. Studies should focus on identifying variables that affect sampling efficiency and size bias, as well as consistency between sampling events (e.g., between days, seasons, or years). Specifically, there is a need to evaluate the potential catch bias of gill nets for Channel Catfish greater than 460 mm total length (TL).

Other Gears

High-frequency electrofishing (HEF; 60 to 120 pulses per second [pps] DC or 60-Hz AC) is the third most commonly used gear to sample Channel Catfish (Brown 2009). Samples are typically conducted by boat near the shoreline and produce higher catch rates (typically 2–10 fish/h; Michaels and Williamson 1982; Santucci et al. 1999; Vokoun and Rabeni 2001) than other gears, except for baited tandem hoop nets. These moderately high catch rates make HEF attractive, especially in cases when HEF is already being used to sample other species, allowing Channel Catfish to be collected with little additional effort. However, biologists should be cautious about using this gear because high-frequency electrofishing typically selects smaller Channel Catfish, yielding inaccurate estimates of population size structure and abundance (Santucci et al. 1999; Vokoun and Rabeni 2001). Additionally, catch per person-hour from HEF (0.3–1.1 fish/person-h; Pugh and Schramm 1998; Santucci et al. 1999; Vokoun and Rabeni 2001) is well below the sampling efficiency of tandem hoop nets, making it inefficient unless HEF is already being used to sample other species. Santucci et al. (1999) reported that HEF catch/person-hour values are similar to those reported for gill nets, slat traps, or angling methods.

Angler creels are also used to survey Channel Catfish (Photo 5). Santucci et al. (1999) found that creels were fairly efficient and accurate; angler catch rates were slightly lower (1.5 fish/h) than HEF catch rates (3.4 fish/h), but catch/person-hour was similar to other gears (Santucci et al. 1999). However, these catch rates are still lower than those reported for tandem hoop nets (Table 1), which were not evaluated in this study (Santucci et al 1999). In addition, Santucci et al. (1999) found that angler creel data correlated with population density and accurately represented size structure of channel catfish.

Trap nets, slat traps, and hook-and-line methods are also used to survey Channel Catfish (Houser 1960; Jacobs and Swink 1982; Stevenson and Day 1986; Topp et al. 1994; Santucci et al. 1999). Unfortunately, utility of these gears is limited because they are not well studied, biased, or less effective than other gears; therefore, these gears are not often used. However, each can be useful if biologists account for known biases and limitations. Some biologists have used these gears to supplement other sampling methods (Coon and Dames 1991; Vokoun and Rabeni 1999); however, biologists must use caution when combining data from multiple gears.

BLUE CATFISH

Low-Frequency Electrofishing

Low-frequency, pulsed-DC electrofishing (LFE) is one of the more common gears used to survey Blue Catfish (Photo 6). In a 2006 survey of catfish managers and researchers, Brown (2009) reported that LFE was used in 67% of Blue Catfish studies. Recently, LFE has been incorporated into standard sampling protocols in states such as Kansas, Oklahoma, and Texas. However, official standardized LFE sampling techniques have yet to be recognized in North America (Bonar et al. 2009).

Many variations of LFE techniques have been employed among researchers (see Corcoran 1979; Justus 1996; Buckmeier and Schlechte 2009; Cailteux and Strickland 2009; Bodine and Shoup 2010; Greenlee and Lim 2011; Schloesser et al. 2011). Samples are typically conducted during daytime by a boat equipped with a 5,000- to 9,000-W, generator-powered pulsator or variable-voltage pulsator electrofisher with output settings ranging from 7.5 to 30 pps, 340 to 1,000 V, and 1 to 5 A (based on electrofisher metering). Sampling usually occurs in pelagic...
(open water) habitats where Blue Catfish are mostly abundant (Graham 1999; Bodine and Shoup 2010). Often, additional chase boats and personnel are used to collect fish that surface away from the electrofishing boat (Photo 6).

Ictalurids respond to LFE quite differently than they do to HEF techniques. For example, it takes about 30–90 s before fish begin surfacing (Bodine and Shoup 2010). Fish rarely surface near the electrodes and commonly surface up to 100 m from the electrofishing boat. Electrotaxis and narcosis are rarely observed. Typical surfacing behaviors include swimming in circles or along an erratic path, swimming directionally (but not necessarily toward the anode), or tetany (immobilization) and are not always consistent between systems or sampling events. It is unclear whether the fish response is involuntary (e.g., directional taxis and tetany) or voluntary (e.g., the absence of directional taxis and tetany but still physiologically affected by the electric field).

**Sampling Efficiency**

Compared to other studied gear types, LFE is the most efficient gear for surveying Blue Catfish (Table 2). Catch rates commonly range from 23 to 373 fish/h in freshwater systems (Jons 1997; Boxrucker and Kuklinski 2006; Cailteux and Strickland 2009; Bodine and Shoup 2010; Evans et al. 2011) and have exceeded 6,000 fish/h in tidal rivers (Greenlee and Lim 2011). Variability of abundance data is typically low (reported range exceeded 6,000 fish/h in tidal rivers (Greenlee and Lim 2011). Despite potential inaccuracies in estimating relative abundance, LFE does produce accurate estimates of size structure of fish from 200 to 1,000 mm TL (Buckmeier and Schlechte 2009; Bodine and Shoup 2010). However, schools of Blue Catfish typically contain similar size fish, so a minimum of 10–20 replicate samples (each producing at least one fish) coupled with 200–800 total fish sampled are needed to accurately represent most populations (Bodine et al 2011). Unfortunately, LFE is not effective at sampling fish less than 200 mm (Buckmeier and Schlechte 2009).

**What We Don’t Know**

Although we determined that LFE is currently the most efficient and accurate Blue Catfish sampling gear, limited scope in recent evaluations warrants further study. Catchability and size selectivity studies should be replicated in a variety of water bodies throughout the country. Environmental (e.g., conductivity and temperature) and biological (fish morphology, physiology, and behavior) factors can affect electrofishing catch (Reynolds 1996) and have not been fully examined for LFE. Researchers should identify these variables and develop catchability models that incorporate one or more variables.

When developing catchability models for Blue Catfish, future evaluations should focus on understanding the mechanisms causing the unique response of this species to LFE. It is unclear what power threshold is necessary to consistently immobilize Blue Catfish (at varying water conductivities, temperatures, etc.), or whether power-based goals are even the appropriate standardizing metrics given the atypical response exhibited by this species (i.e., being affected so far away from the boat). Alternative electrofishing control units (with fully adjustable output waveform settings) may need to be explored, especially when there is a need to standardize electric output (Neebling and Quist 2011).

Researchers should also identify additional methods to increase sampling efficiency. Future evaluations should quantify benefits of using a chase boat (or multiple chase boats). Sampling efficiency should be evaluated by calculating catch/person-hour. In addition, researchers should identify appropriate sampling durations because this can sometimes affect accuracy and precision of population metrics.
Gill Nets

Experimental gill nets are the second most commonly used gear to survey Blue Catfish (Brown 2009; Photo 4). Similar to sampling Channel Catfish, gill nets can provide a low-cost sample if gill nets are already being used to sample other species. Unfortunately, accuracy and precision of gill nets is lower than LFE (Buckmeier and Schlechte 2009; Evans et al. 2011; Table 2).

Sampling Efficiency

Experimental gill nets are up to 1,000 times less efficient than LFE when estimating relative abundance (Evans et al. 2011; Table 2). Evans et al. (2011) reported that in 13 Oklahoma reservoirs, catch rates ranged from 0.70 to 0.88 fish/net-night for gill nets, whereas LFE ranged from 61 to 848 fish/h. Other researchers found that catch rates typically range from 1 to 5.1 fish/net-night with a median of 4 fish/net-night (Crandall et al. 1976; Gale et al. 1999; Goeckler et al. 2003; Bartram et al. 2011; Homer and Jennings 2011). Wilde (1993) found that 25 sites were needed to achieve RSE30. Unfortunately, median catch rates suggest that 75 replicate samples are needed to collect at least 300 fish (Table 2). Catchability is also low; Buckmeier and Schlechte (2009) reported that mean gill net catchability was 0.005%/net-night ($N = 46$ net nights, net length was 38.1 m long $\times$ 2.4 m high) in Lake Livingston, Texas.

Accuracy

Although no studies have directly evaluated the accuracy of abundance estimates, gill nets may still provide reliable estimates of Blue Catfish abundance. We found only one study that examined catchability (see Buckmeier and Schlechte 2009), and they did not report changes in catchability between sampling events. Consistent catchability suggests that this gear may accurately reflect abundance. Additionally, Evans et al. (2011) found that gill net CPUE correlated with LFE CPUE, suggesting...

Table 2. Relative ranking of Blue Catfish sampling gears based on sampling efficiency (catch/gear effort and catch/person-h) and accuracy of abundance and size-related metrics. Sampling efficiency is ranked by the median value observed in the literature. Percentile values are the interpolated 25th and 75th percentiles of published means.

| Rank | Gear                  | Median | Percentiles (25th–75th) | Comments                                      | Literature                                                                 |
|------|-----------------------|--------|-------------------------|------------------------------------------------|
|       | Efficiency—catch/gear effort |        |                         |                                                |                                                                           |
| 1    | Low-frequency electrofishing | 252.0  | 23.0–373.0              | Gear effort = fish/h                           | Nelson and Little (1986); Cailteux and Strickland (2009); Jolley and Irwin (2011); Bartram et al. (2011); Evans et al. (2011); Greenlee and Lim (2011); Bodine and Shoup (2010); Boxrucker and Kuklinski (2006); Schloesser et al. (2011); Kuklinski and Patterson (2011); Mauck and Boxrucker (2004); Jons (1997) |
| 2    | Gill nets             | 4.0    | 1.0–5.1                 | Gear effort = fish/net-night                   | Gale et al. (1999); Crandall et al. (1976); Jackson (1995); Homer and Jennings (2011); Goeckler et al. (2003); Bartram et al. (2011); Evans et al. (2011) |
| 3    | High-frequency electrofishing | 0.9    | 0.9                     | Gear effort = fish/h                           | McCain et al. (2011)                                                                                          |
| 3    | Hoop/trap/fyke nets   | 0.4    | 0.1–1.3                 | Gear effort = fish/net-night                   | Gale et al. (1999); Nelson and Little (1986); McCain et al. (2011); Jons (1997)                                 |
| 4    | Hook and line         | 0.1    | 0.01–0.15               | Gear effort = fish/hook-night                  | Gale et al. (1999); Barabe and Jackson (2011); Miranda and Killgore (2011)                                       |
|       | Efficiency—catch/person-h |        |                         |                                                |                                                                           |
| 1    | Low-frequency electrofishing | 6.7    | 2.1–11.3                |                                                | Pugh and Schramm (1998); Jons (1997)                                                                                   |
| 2    | High-frequency electrofishing | 0.5    | 0.5                     |                                                | Pugh and Schramm (1998)                                                                                               |
| 3    | Hoop nets             | 0.2    | 0.08–0.39               |                                                | Pugh and Schramm (1998); Jons (1997)                                                                                   |
|       | Accuracy for abundance |        |                         |                                                |                                                                           |
| 1    | Low-frequency electrofishing |        |                         | No systematic bias, but catchability varies seasonally | Buckmeier and Schlechte (2009); Bodine and Shoup (2010)                                                                 |
| 2    | Gill nets             |        |                         | Correlates with low-frequency electrofishing but is more variable | Evans et al. (2011)                                                                                               |
|       | Accuracy for size-related metrics |        |                         |                                                |                                                                           |
| 1    | Low-frequency electrofishing |        |                         | No bias for 250- to 1,000-mm fish               | Buckmeier and Schlechte (2001); Bodine and Shoup (2010)                                                                 |
| 2    | Gill nets             |        |                         | Overrepresents fish > 305 mm and underrepresents fish < 250 mm | Buckmeier and Schlechte (2009); Evans et al. (2011)                                                                 |
| 3    | Hook and line         |        |                         | Overrepresents fish > 635 mm                   | Gale et al. (1999)                                                                                                  |
that it is at least similarly accurate to LFE. Further evaluation is necessary to determine whether catchability remains constant between annual samples and in different systems.

Only one study has evaluated the accuracy of experimental gill nets for estimating size-related metrics of Blue Catfish and found fish less than 250 mm were underrepresented, whereas fish greater than 350 mm were overrepresented (Buckmeier and Schlechte 2009). Although no studies have examined the number of replicate sites needed to accurately estimate size-related metrics, biologists can develop minimum sample sizes based on existing knowledge of Blue Catfish behavior. For example, Bodine et al. (2011) reported that Blue Catfish congregate with fish of similar size and, therefore, about 10–20 sites and 200–800 fish are needed to accurately estimate size-related metrics with LFE. This logic could also apply to other sampling gears; however, these sample sizes should be considered the minimum until a full evaluation is conducted with gill nets. Unfortunately, an unreasonably large number of gill net replicates may be necessary to collect the minimum of 200 fish that are needed to precisely describe size structure (Dumont and Schlechte 2004), given that average catch rates are typically less than 5 fish/net night.

**What We Don’t Know**

Net specifications (e.g., mesh size, mesh type, net length, and hanging ratio) needed to accurately and efficiently measure Blue Catfish population metrics should be identified. Gill nets are routinely constructed with generalized specifications (Hubert 1996; Miranda and Boxrucker 2009) and are intended to collect a variety of fish species in a single sample. These nets may or may not contain mesh sizes suitable for collecting all sizes of Blue Catfish, which grow larger than many other species. Alternative mesh sizes (larger, smaller, or both) may be necessary to accurately measure Blue Catfish abundance and size structure. Identifying these specifications would improve gill net collection methods for Blue Catfish.

Sampling should be evaluated seasonally to identify when accuracy and efficiency are highest or to identify biases that occur during periods of preferred sampling. Gill nets are a passive sampling gear that requires high fish activity for optimal effectiveness (Hubert 1996). Blue Catfish movement varies according to environmental conditions (e.g., water temperature and spawning period; Lagler 1961; Pfieger 1997; Fischer et al. 1999; Graham 1999), and movement patterns may not be uniform across all fish sizes. To maximize efficiency, samples should be conducted during periods of peak movement when all size groups are active. Future studies should also examine sampling efficiency in terms of catch/person-hour, which is needed to effectively compare efficiency among gear types and determine overall effort needed to collect data.

**Other Gears**

Hook-and-line gears such as trotlines and jug lines have been used to sample Blue Catfish, but evaluations of accuracy and sampling efficiency are rare. Gale et al. (1999) recommended trotlines baited with cut Gizzard Shad (Dorosoma cepedianum) on 7/0 hooks along with 76-mm mesh gill nets be used to capture larger (>381 mm) Blue Catfish in the Harry S. Truman Dam tailwater in Missouri. They observed that catch/hour of larger fish ranged from 0.19 to 0.33 fish/h for trotlines and 4.37 to 11.96 fish/h for 76-mm mesh gill nets. Although more labor intensive, trotlines collected the largest Blue Catfish. However, trotlines were ineffective at collecting fish less than 381 mm. Miranda and Killgore (2011) also used trotlines baited with worms on size 2/0 hooks to efficiently capture Blue Catfish 75–1,122 mm TL (median = 371) in the Mississippi River. However, these authors did not compare sampling efficiency or accuracy to other gear types. Jug lines (anchored or free floating) have also been used to target larger Blue Catfish (Missouri Department of Conservation and Texas Parks and Wildlife Department, unpublished data). Although jug lines might prove useful to meet specific study objectives or supplement primary sampling gears, scientific evaluations are lacking; therefore, biologists should use caution when using this gear for routine sampling.

Other gears such as HEF (60–120 pps) and hoop nets have also been used to collect Blue Catfish (Brown 2009). However, because of low catch rates (0.9 fish/h for HEF and 0.1–1.3 fish/net-night for hoop nets), high sampling variability (CV > 0.40), and unknown size selectivity, these gears are primarily used to supplement other, more effective (or at least better studied) gears (Nelson and Little 1986; Jons 1997; Pugh and Schramm 1998; Greenlee and Lim 2011; McCain et al. 2011). In some situations, these gears may be more desirable because they tend to capture more species compared to alternative gears (Jons 1997).

**FLATHEAD CATFISH**

**Low-Frequency Electrofishing**

Like Blue Catfish, the most common gear used to sample Flathead Catfish is LFE (49% of researchers use LFE; Brown 2009; Photo 7). Electrofisher output settings are similar to supplement other, more effective (or at least better studied) gears (Nelson and Little 1986; Jons 1997; Pugh and Schramm 1998; Greenlee and Lim 2011; McCain et al. 2011). In some situations, these gears may be more desirable because they tend to capture more species compared to alternative gears (Jons 1997).

**Photo 7. Low-frequency, pulsed-DC electrofishing for Flathead Catfish.**

Photo credit: Craig Gemming.
to those used for Blue Catfish (i.e., similar pulse frequency, duty cycle, current, and voltage). Studies using LFE have been conducted in lotic (e.g., Cailteux and Strickland 2009; Ford et al. 2011; Kaeser et al. 2011; Travnichek 2011) and lentic systems (Gilliland 1988; Cunningham 1995, 2000, 2004). Lotic sampling is usually conducted in a downstream direction during base flow conditions, and a chase boat is almost always used. Lentic sampling is also usually conducted with a chase boat (Gilliland 1988; Cunningham 1995, 2000), but chase boats may not necessarily increase sampling efficiency (Cunningham 2004).

**Sampling Efficiency**

Most studies addressing LFE for sampling Flathead Catfish have focused on factors related to gear efficiency (Table 3). Low-frequency electrofishing is the most efficient gear type in terms of overall catch rate and catch/person-hour. Reported catch rates typically range from 38.5 to 58.0 fish/h (median = 47.8) in lentic systems (Gilliland 1988; Cunningham 2000, 2004) and from 19.0 to 44.2 fish/h (median = 41.6) in lotic systems (S. P. Quinn 1986; Stauffer and Koenen 1999; Vrtiska et al. 2003; Bonvechio et al. 2011; Ford et al. 2011; Kaeser et al. 2011). Reported catch/person-hour rates range from 2.1 to 3.99 (Pugh and Schramm 1998; Stauffer and Koenen 1999). However, Stauffer and Koenen (1999) included travel time in their catch rate calculations; thus, caution must be taken when comparing catch rates between these studies.

Several studies identified factors that affect Flathead Catfish gear efficiency. Maximum catch rates are achieved during summer months, when water temperatures exceed 20°C, and for river habitats, when water levels are low (S. P. Quinn 1986; Justus 1996; Travnichek 2011). Travnichek (2011) found that a wider size distribution was encountered in late summer (September) compared to early summer (June–August). Precision of LFE samples is typically low (CV > 0.50) but is highest in summer (CV = 0.34–0.36 in July and August; Travnichek 2011). Cunningham (1995) reported CVs ranging from 0.23 to 0.46 in 10–22 replicate samples. As with Blue Catfish, many researchers use additional boats to collect fish that surface away from the electrofishing boat (J. W. Robinson 1994; Bonvechio et al. 2011; Ford et al. 2011; Travnichek 2011). However, the efficiency of using a chase boat is higher in lotic systems (Daugherty and Sutton 2005) and may not provide meaningfully higher catch rates in lentic systems (Cunningham 2004). Though the

### Table 3. Relative ranking of Flathead Catfish sampling gears based on sampling efficiency (catch/gear effort and catch/person-h) and accuracy of abundance and size-related metrics. Sampling efficiency is ranked by the median value observed in the literature. Percentile values are the interpolated 25th and 75th percentiles of published means.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Gear</th>
<th>Median</th>
<th>Percentiles (25th–75th)</th>
<th>Comments</th>
<th>Literature</th>
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<tr>
<td></td>
<td>Efficiency—catch/gear effort</td>
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<tr>
<td>1</td>
<td>Low-frequency electrofishing</td>
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<td>19.0–62.0</td>
<td>Gear effort = fish/h</td>
<td>J. W. Robinson (1994); Stauffer and Koenen (1999); Cailteux and Strickland (2009); Jolley and Irwin (2011) Porter et al. (2011); S. P. Quinn (1986); Travnichek (2011); Vrtiska et al. (2003); Bonvechio et al. (2011); Cunningham (2000, 2004); Gilliland (1998); Kaeser et al. (2011); Ford et al. (2011)</td>
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<td>2</td>
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<td>0.2–2.1</td>
<td>Gear effort = fish/net-night</td>
<td>Yeh (1977); Argent and Kimmel (2005)</td>
</tr>
<tr>
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<td>High-frequency electrofishing</td>
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<td>0.1–3.0</td>
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<td>4</td>
<td>Hoop/trap/fyke nets</td>
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<td>0.03–0.33</td>
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<td>Michaels and Williamson (1982); Pierce et al. (1981); J. W. Robinson (1994); Yeh (1997); McCain et al. (2011); McCain et al. (2011); Fratto et al. (2008); Funk (1958); Ford et al. (2011)</td>
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<td>Hook and line</td>
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<td>0.002–0.15</td>
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<td>Stauffer and Koenen (1999); Miranda and Killgore (2011)</td>
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<td>2.1–2.5</td>
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effect of sample design on sampling efficiency has not been studied, most authors used fixed sites or a modified predator approach (sensu Vokoun and Rabeni 1999) as opposed to random site selection.

Sample Accuracy

We are unaware of any published studies specifically addressing accuracy of LFE for sampling Flathead Catfish. However, anecdotal evidence suggests that LFE may be selective for fish less than 600 mm (Pugibet and Jackson 1989; Pugh and Schramm 1998; Brown 2009; Ford et al. 2011; McCain et al. 2011).

What We Don’t Know

Appropriate methods to obtain an accurate sample of Flathead Catfish in lotic or lentic habitats are essentially unknown. Potential factors affecting LFE catch of Blue Catfish may also be applicable to Flathead Catfish, but none have been specifically addressed in published literature. Future studies should focus on specific variables (e.g., habitat, season, depth, conductivity, etc.) that affect estimation of abundance and size-related metrics and develop catchability models to account for potential biases.

More studies are also needed to examine sampling efficiency of LFE for Flathead Catfish. Most LFE studies have been conducted in lotic systems; gear specifications and optimal sampling conditions relative to sampling efficiency (i.e., season, water temperature, and boat movement) have not been evaluated for lentic habitats. Finally, appropriate sampling designs and sample durations need to be addressed.

Hoop Nets

Hoop nets are the second most commonly used gear to survey Flathead Catfish; 23% of respondents used hoop nets as their primary sampling gear for this species (Brown 2009). Single hoop nets are more commonly used than tandem hoop nets and are typically used in lotic habitats (Photo 8). We found only one study that used tandem hoop nets to collect Flathead Catfish (McCain et al. 2011). When deployed in flowing water, the cod end was usually tied to a natural snag or anchor and the mouth faced downstream (Pierce et al. 1981; Ford et al. 2011). The most common mesh sizes were between 25 and 38 mm; however, mesh as small as 19 mm has been used. Hoop nets were commonly baited with soybean cake, waste cheese, or live fish but were sometimes left unbaited. Nets were typically set for 24 or 48 h.

Sampling Efficiency

Hoop nets are less efficient than other gears for sampling Flathead Catfish in rivers (Pugibet and Jackson 1989; Pugh and Schramm 1998; Stauffer and Koenen 1999; Ford et al. 2011; McCain et al. 2011). Catch rates typically range from 0.03 to 0.33 fish/net-set (Stauffer and Koenen 1999; Ford et al. 2011; McCain et al. 2011; Table 3). Pugh and Schramm (1998) reported a catch rate of 1.51 fish/person-h for hoop nets compared to 2.1–3.99 fish/person-h for LFE (Pugh and Schramm 1998; Stauffer and Koenen 1999). Unbaited hoop nets catch considerably more Flathead Catfish than baited hoop nets (Pierce et al. 1981). Little is known about the effect of season on the catch rates of Flathead Catfish, but Ford et al. (2011) found no differences for fish greater than stock size sampled from May to July. Most hoop net sampling has been conducted from May through October (Pierce et al. 1981; Stauffer and Koenen 1999; Fratto et al. 2008; Ford et al. 2011), which includes the prespawn and spawning season for this species (i.e., water temps of 26°C–28°C; Turner and Summerfelt 1971; Travnichek 2011). Therefore, it is possible that reproductive behavior influences catch rates of this gear.

Sample Accuracy

We are unaware of any published studies that address accuracy of hoop nets for sampling Flathead Catfish. Each study referenced in the previous section concluded that sampling with hoop nets yields a larger mean length and will catch more large fish (e.g., greater than preferred size) than LFE. However, these studies did not have populations with a known size distribution, so it is speculation as to which gear provides more accurate size-structure data.

What We Don’t Know

Optimal net specifications, bait types, depth of set, season, water temperature, and river stage need evaluated to identify methods for improving hoop-net sampling efficiency for Flathead Catfish. Additionally, abundance and size-selectivity studies should be conducted to determine the accuracy of sampling with hoop nets. Catch rates should be reported as fish/person-hour so that sampling efficiency can be compared among gears.

Other Gears

Passive set-line gears such as trotlines and limb lines have been recommended for supplementing samples from other gears because of their tendency to capture larger Flathead Catfish.
Stauffer and Koenen (1999) reported that trotlines were the second most efficient gear for sampling Flathead Catfish in the Minnesota River. They reported catch rates of 0.16–0.85 fish/person-h compared to 2.1–3.99 fish/person-h for LFE (Stauffer and Koenen 1999; Pugh and Schramm 1998) and 0.02–0.69 fish/person-h for hoop nets (Pugh and Schramm 1998). However, others found that trotlines and bank poles required excessive person-hours and had very low catch rates (Ford et al. 2011). Using set-lines as a primary sampling gear is not recommended because of their low sampling efficiency and unknown biases; however, they may be useful for supplementing data collected by other gears in specific situations where large fish are needed and accurate size structure data are not required.

Channel Catfish are the most studied of these species, and researchers have substantially refined the various techniques for sampling them. Although many gears are available for sampling Channel Catfish, we recommend using tandem baited hoop nets (Table 4), especially in small impoundments (≤200 ha). By far, this gear is the most efficient and produces the most accurate and precise estimates of all population characteristics. Catch rates are usually higher than other gears and less overall effort (i.e., person-h) is required. We also recommend that biologists incorporate these components into their methodology: (1) nets should be deployed for three continuous nights during summer, (2) cheese or soybean bait should be used, (3) the size of the mesh netting should be 25 mm, and (4) restricted throats should be used. These variables have been systematically tested and significantly improve sample accuracy and efficiency. In situations where samples are lacking some fish sizes (e.g., samples for age and growth), tandem hoop nets can be supplemented with other methods such as HEF or hook and line. Although other variables may also affect tandem hoop net performance, reported results varied among studies and, thus, these variables need further investigation before incorporating them into a sampling protocol. To further improve tandem hoop net design, future studies should use a systematic and controlled study design to evaluate variables. Future evaluations of tandem hoop nets should also focus on identifying efficient and accurate sampling methodologies for large reservoirs because these studies are rare.

Table 4. Recommended sampling gears for collecting various data types for each catfish species (THN = tandem baited hoop nets, LFE = low-frequency electrofishing).

<table>
<thead>
<tr>
<th>Data type</th>
<th>Channel Catfish</th>
<th>Blue Catfish</th>
<th>Flathead Catfish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundance</td>
<td>THN</td>
<td>LFE</td>
<td>LFE</td>
</tr>
<tr>
<td>Gill nets</td>
<td>Gill nets</td>
<td>Single hoop nets</td>
<td></td>
</tr>
<tr>
<td>Size structure</td>
<td>THN</td>
<td>LFE</td>
<td>LFE</td>
</tr>
<tr>
<td>Gill nets</td>
<td>Gill nets</td>
<td>Single hoop nets</td>
<td></td>
</tr>
<tr>
<td>Age and growth</td>
<td>THN</td>
<td>LFE</td>
<td>LFE</td>
</tr>
<tr>
<td>Gill nets</td>
<td>Gill nets</td>
<td>Single hoop nets</td>
<td></td>
</tr>
<tr>
<td>Hook and line</td>
<td>Hook and line</td>
<td>Hook and line</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>THN</td>
<td>LFE</td>
<td>LFE</td>
</tr>
<tr>
<td>Gill nets</td>
<td>Gill nets</td>
<td>LFE</td>
<td></td>
</tr>
<tr>
<td>Recruitment</td>
<td>THN</td>
<td>LFE</td>
<td>LFE</td>
</tr>
<tr>
<td>Gill nets</td>
<td>Gill nets</td>
<td>LFE</td>
<td></td>
</tr>
</tbody>
</table>

For Blue Catfish, we recommend sampling with LFE (Table 4). This gear provides an efficient means to monitor Blue Catfish populations because it produces extremely high catch rates that accurately represent population size and age structure, so long as minimum sample sizes are met. We recommend sampling (1) with 15 pps, (2) when water temperatures are 18°C–28°C, and (3) in a minimum of 10–20 replicate sites (with 200–800 total fish collected). These variables have been systematically tested and significantly improve sampling efficiency and accuracy. Use of a chase boat will undoubtedly increase catch rates; however, further studies (measuring catch/person-h) are needed to determine whether the additional manpower required will reduce the overall sampling efficiency. We do advise caution when using LFE to examine relative abundance until further research can determine whether catchability is constant or variable. Further research is needed to identify the power threshold needed to immobilize Blue Catfish so that power-based standardization can be achieved and consistent catchability ensured (Reynolds and Kolz 2012).

Flathead Catfish are the least studied of these catfish species. Based on current knowledge, we also recommend the use of LFE when sampling Flathead Catfish (Table 4). This gear provides the most efficient and precise samples. Highest sampling efficiency will be achieved (1) with 15 pps and (2) during

DISCUSSION

Managing or monitoring catfish has become a priority to resource agencies across the United States. To effectively manage catfish, biologists must be able to accurately and efficiently measure population characteristics. Unfortunately, the lack of appropriate sampling techniques has inhibited the ability to measure these characteristics (Michaletz and Dillard 1999) and thus has hampered development of effective management strategies. Fortunately, recent evaluations of sampling gears have improved the ability to survey catfish populations.

Here we provided a comprehensive summary of ictalurid sampling information published prior to 2013. Most notably, we characterized gear performance attributes associated with the most commonly used gears for surveying ictalurids. Based on information from more than 80 scientific studies, we ranked each sampling gear by sampling efficiency (median catch rate) and accuracy for sampling each species and provided recommendations for preferred sampling gears for each data type.
late summer at water temperatures higher than 20°C. However, no studies have evaluated LFE with known Flathead Catfish populations, so accuracy of abundance and size-structure metrics are unknown. Quantifying LFE accuracy should be a top priority because LFE may select against larger fish (>600 mm; Ford et al. 2011), which could introduce bias when estimating some population demographics. Until this information is known, it may be advantageous to supplement LFE samples with other gears (e.g., hoop nets) to fully examine Flathead Catfish populations. Additional research is also needed to determine the appropriate way to standardize power output.

Our sampling recommendations are based on methods needed to maximize gear performance (accuracy, precision, and sampling efficiency); however, biologists should strongly consider trade-offs of each gear and its associated performance characteristics, as well as project objectives, management needs, data needs (e.g., acceptable accuracy or confidence levels), and cost before selecting a sampling gear. Depending on study objectives, some sampling gears may become more or less desirable. For example, we recommend tandem hoop nets for sampling Channel Catfish because gear performance is highest. However, if project objectives require a multispecies or community structure evaluation, other gears such as gill nets or HEF may be more appealing because they collect a wider variety of species. Project cost may also factor into gear selection. Although tandem hoop nets are most efficient at sampling Channel Catfish, gill nets may be more attractive to biologists who already use gill nets to survey other species. Adding tandem hoop nets to a sampling schedule may be costly or time prohibitive. In this case, biologists may consider choosing a gear with a slightly lower gear performance to reduce sampling cost, as long as they understand the trade-offs.

Summaries provided in this article are based on the best available knowledge of gear performance for each gear and species combination. This summary includes 64 Channel Catfish, 28 Blue Catfish, and 35 Flathead Catfish gear evaluations encompassing 167 small impoundments, 923 reservoirs (>200 ha), and 100 rivers from 27 states. However, some performance characteristics (e.g., most accuracy studies) lack appropriate spatial replication among geographic regions or habitat types (i.e., rivers, reservoirs, and small impoundments); thus, summaries presented here should be interpreted accordingly. To effectively characterize and compare sampling efficiency among gear groups, we pooled all similar gears within a particular gear group (e.g., all tandem hoop net studies were pooled), despite somewhat differing gear specification (e.g., 48- and 72-h soak duration). The purpose of these data is to provide an overall picture of group-specific sampling efficiencies. We also advise readers to interpret these data accordingly and refer to the Sample Accuracy and Sampling Efficiency sections for each gear-specific combination to understand how group-specific characteristics can affect gear performance.

We also recommend considering a few additional aspects before developing a sampling protocol. First, all sampling gears discussed in this manuscript are ineffective at surveying young-of-the-year catfishes, a problem shared by most gears used to sample sportfish. Brewer and Rabeni (2008) found that positioned electrofishing grids were effective for sampling juvenile Channel Catfish (9–245 mm) and juvenile Flathead Catfish (16–277 mm) in a river; however, they did not evaluate gear performance. Future studies should determine whether this gear provides accurate and efficient samples of young of the year catfishes. Second, gear performance attributes may differ between river and reservoir habitats as well as system-specific variables (e.g., habitat and fish population density). Few studies have addressed these aspects and we suggest that future research should focus on these issues to modify or improve sampling procedures.

Regardless of species or gear type, future studies should focus on quantifying sampling accuracy, especially for sampling Channel Catfish in reservoirs and Blue Catfish and Flathead Catfish in all habitat types. Although these studies are logistically and economically challenging, these data are lacking yet are essential to both describing population demographics and effectively managing ictalurid populations.

This article is intended to provide a review of gear performance of the most commonly used catfish sampling gears. Although other sampling gears (e.g., wire baskets, seines, and trawls) have been previously documented, these gears are seldom used. Thus, we felt that it was not necessary to include them in this article. However, it is possible that alternative gears not discussed in this article could provide adequate or improved samples of ictalurids. We encourage further research to either improve existing gears or develop new ones.

ACKNOWLEDGMENTS

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REFERENCES


Barada, T. J., and M. A. Pegg. 2011. Population characteristics of Chan-


Gale, C. M., K. Graham, K. DeiSanti, and J. S. Stanovick. 1999. Sam-


So I’m barely getting settled into my new role at the American Fisheries Society (AFS). Still working out of a temporary office until the carpet is replaced and some new furniture is delivered. We did some bargain office furniture shopping and got some good deals on chairs at Office Max for half price and will be replacing a desk and conference table that seemingly has been around since the 1970s. But that is all superficial. Here are some observations on how your office is working and some thoughts for the weeks and months ahead.

LITTLE ROCK FROM THE INSIDE

So I’ve been to my share of AFS meetings, starting with Hilton Head in 1982 while in graduate school at Virginia Tech—but this is the first time as a staff member with some responsibility and a real stake in the outcome of the event. From the day I walked in the door of the AFS office, the full court press was on to get everything ready for the Annual Meeting. Shipping crates were being packed with all of the awards, briefing books, computers, printers, meeting materials, and everything else needed to support an event for over a thousand people. It was great to see every staff person working like a team of rock concert roadies who knew exactly what needed to be done to get things out the door on time. Believe it or not, one of the most fun parts of the Little Rock meeting for me was working the AFS book sale table and just talking to people, meeting new members, and getting back in touch with old friends. The downside of the meeting was that I made it to about five presentations. Several of them were among the last presentations of the entire meeting, and I felt like I needed to be there for moral support if nothing else (the talks were all great, right to the last one).

We’re well on the way to planning for Québec City, Portland, Kansas City, and Tampa. Four years ahead seems forever, but it will go quickly.

MUTUAL FUNDS ARE OUR BEST FRIEND

Like many of you, I’ve managed budgets for many years. But they’ve all been university, state, or federal, where we work off of an appropriation and need to either plan for it, defend it, or manage the expenditure of it. With the AFS we are a little different. We have mutual funds, CDs, cash, money markets, and probably should have a large jar to throw in spare change at the end of the day. So I’ve been meeting with investment advisors, accountants, and reading audits. It’s really nothing terribly complicated (although it could be) but, rather, a matter of figuring out how to distill it down into manageable pieces of information that allow us to know where we are, what we want to accomplish with the funds, and how we want to spend it wisely. The asset that we have with the AFS is that we can be creative and act quickly. We can take an idea from a member, committee, or officer and simply create the mechanism to help it come to life. All we need is the cash. Any of you have any spare change?

PEOPLE ARE EVERYTHING

It’s the same story no matter the organization—the people are what make it work or not. Most of you will never be able to spend much time with your AFS staff. But you are all invited to visit us at any time to say hello, have some coffee, and just chat. Really. We’d enjoy your company! We’re fairly small, with an organizational chart with only 17 boxes, and some of them are currently empty. Yet we have a broad suite of activities that we need to manage. Despite our small size, we still need to have human resources expertise, someone to do accounting, others to manage meetings, and we have to keep track of 9,000 members, put out six journals and around eight or so books each year, run a website and social media, and stay active with dozens of partner organizations. That spreads us thin and leaves little bench strength. As a result, many people do multiple tasks and we’re working to ensure that staff are able to fill in for others when things happen, as they inevitably do. This team is a wonderful group of people dedicated to making the AFS work well for the members. We’ll be filling in some of the boxes on the chart in the next couple of months, and we all look forward to some additional help at the home office.

REINTRODUCING WASHINGTON TO AFS

By press time this will be old news, but you still need to know this. The AFS is getting reengaged in Washington in a way that we hope will make the AFS the center of gravity when people think about fisheries issues.
Communicating Successes and Convincing Others

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Communication is an oft-undervalued component of success. In the fish world, with complexities we know too well, both words and the mode of conveyance are crucial to all we do—establishing program priorities, advising leaders on key decisions, debating colleagues on sampling strategies, writing for prestigious journals, or sharing intriguing results with a curious public. Each facet of a general communications plan must touch on those and other crucial steps of this complex field. In this column, we delve into the important role of communications, with applications across the fish habitat arena.

Every program needs a communications strategy, complete with breadth, depth, and an acute sense of timing. The fish habitat field is no different. A manuscript in the highest-rated American Fisheries Society journal offering newfound insights on how robust fish stocks depend on healthy habitat will go unrecognized if key conclusions are not shared with target audiences on a timely basis. The general public would not know of the deep-sea coral discoveries this past summer if they are unaware of the live feeds from Atlantic Ocean cruises from automated observing systems. And few people will benefit from our insights about climate change, natural cycles, shifting baselines, and management implications if we fail to take the time to engage.

As I've been known to say, we're not just worrying about habitat for sand dollars or goldfish.

Those examples seem obvious, but I’m continually amazed how often results of fine work go unappreciated, or even unknown. My government career in resource management spans nearly four decades, but just this year I can recollect several of my own rookie mistakes that undermined my intentions and compromised my office’s effectiveness. I’m thinking specifically of influential work that was not translated into best practices and did not generate the reaction needed to ensure future funding. Perhaps some of you can look back on your own missed opportunities. Such mistakes can be fatal in today’s political and economic arenas, perhaps more so in state and government circles.

Through teams of professors and graduate students, academia has its own means to nurture a long-term approach to complex ecosystem challenges and serve as primary brokers in habitat knowledge. Academic leaders are often sought by media for summary statements about complex issues and will always be valued for keynote addresses. The ivory tower perch offers distinctly different opportunities from those afforded government officials. Besides informing the public, academics can challenge governments to consider new realities, to push beyond the status quo. That seems to be happening now in multiple arenas—climate change/storms/ecosystem resilience, invasive species/Asian carp, overfishing/predator–prey relationships, the role of aquaculture in stock rebuilding or as a substitute for wild harvest, and even how renewable energy is extracted from our nation’s waters.

It is natural to envision publications and presentations as our foremost investments in the expansive communications arena. Scientific papers, talks during technical sessions at major conferences, and special events such as seminars provide high visibility outside the home office but are preceded by important steps earlier in a project life span. My experience suggests that routine, internal exchanges termed loosely as “in-reach” happen by the hour and are more important over the course of a project or a career. They are also best shared from the outset, as we embark on early planning and long before any thought of results and conclusions. “Outreach” is vital but we might not get to that point without internal support that begets external accolades and long-term program survival.

The communications arena has expanded noticeably in the past decade, with social media adding nicely to more traditional fare, especially for younger professionals. Just as online journals help us exchange results sooner than bound journals, and e-mail has replaced many letters and phone calls, we now see Twitter and Facebook as common tools for the public to track our programs and results. The era of press releases and personnel announcements is disappearing, if not gone already. In my agency, the communications specialists do not distribute press releases; they are left for a public affairs office that operates on a more deliberate schedule.

Each communications strategy focuses on the findings, results, implications, etc., of our work, whether we succeed or fail with respect to our original intent. Across the many disciplines of American Fisheries Society members, our important messages could relate to scientific knowledge, policy implications, administrative efficiency, natural resource benefits, or many other tangible improvements to habitat for harvested or protected species or their ecosystem components.

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Fish Culture Section Past-President, Western Division Vice President, American Fisheries Society

Jesse Trushenski
Fish Culture Section President, Resource Policy Committee Chair, American Fisheries Society

The American Fisheries Society (AFS), the Fish Culture Section’s Working Group on Aquaculture Drugs, Chemicals, and Biologics, and the Food and Drug Administration Center for Veterinary Medicine (CVM) are engaged in an ongoing dialogue to ensure fisheries professionals have access to the best information available regarding the use of fish drugs. CVM drafted the article below following a meeting with AFS leaders to discuss the AFS Policy Statement on the Need for an Immediate-Release Anesthetic/Sedative for Use in the Fisheries Disciplines. There is considerable confusion and misinformation among fisheries professionals regarding the legal use of fish drugs, particularly sedatives, and how these tools are applied in the field, hatchery, or lab setting. Many fisheries professionals use clove oil (85–95% eugenol) and MS-222 as immediate-release sedatives, thinking that products that are Generally Recognized as Safe or are approved fish drugs must be okay to use in the field. Clove oil is not approved for any use in fish, and fish treated with MS-222 cannot be immediately returned to the wild. In short, it is not legal to sedate fish in the field with either product. Misinformation and misuse of sedatives also extends to the many lay-people who may administer them in the field (e.g., participants in catch-and-release fishing tournaments). AQUI-S20E (10% eugenol) is a fish sedative that can be used under the U.S. Fish and Wildlife Service’s Investigational New Animal Drug exemption, but relatively few people are aware that this option exists. This is one of many complex issues related to fish drugs fish professionals may encounter. The article below lays the groundwork for a better understanding of fish drugs and their use. We commend the many individuals within CVM who prepared this article, having worked hard to address fisheries professionals’ concerns in an accessible way while maintaining legal accuracy. Working together, we are committed to reaching out to the fisheries and fish culture communities, and we hope this article provides fisheries professionals and others with valuable information regarding fish drugs.

Meet FDA’s Center for Veterinary Medicine

FDA’s Center for Veterinary Medicine (CVM) is responsible for ensuring that available drugs are safe and effective for their intended use in animals. Several offices at CVM are directly involved in reviewing and monitoring the safety and effectiveness of fish drugs:

The Office of New Animal Drug Evaluation is the lead office for reviewing information about animal drugs and determining if the information meets the approval requirements.

The Office of Minor Use and Minor Species Animal Drug Development manages programs and incentives that help the drug industry develop drugs for minor species, including fish, and make them legally available.

The Office of Surveillance and Compliance is the lead office for monitoring safety and effectiveness information about animal drugs after they are approved and on the market and also about marketed unapproved animal drugs. The office also recommends corrective or regulatory action when FDA identifies problems with an animal drug or regulatory violations.

The Office of Research develops methods and models to help FDA better ensure that food made from animals treated with an animal drug is safe for people to eat.

What’s a drug?

Federal law (the Federal Food, Drug, and Cosmetic Act) defines the term “drug” to include “articles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or other animals” and “articles (other than food) intended to affect the structure or any function of the body of man or other animals.”

Let’s take a more practical look at the definition from an aquaculture perspective. A drug (the “article”) can, for example, be something that is intended to treat a fish disease or intended to affect the structure or function of a fish’s body. A product’s intended use determines whether it’s a drug or not.

When the intended use of formalin—a solution of formaldehyde—is to fix a biopsy sample from a fish, it isn’t a drug because the intended use is to preserve the tissue for future study. But when the intended use of formalin is to kill external parasites on finfish, it’s a drug because the intended use is to treat parasitism. Because, in this case, the intended use of formalin is to treat a disease, it’s a drug under federal law.

Now, let’s look at the other part of the definition about a drug affecting the structure or function of a fish’s body. When the intended use of tricaine methanesulfonate, or MS-222, is to immobilize fish, it’s a drug because the intended use is to change how the fishes’ bodies function. When the intended
use of oxytetracycline hydrochloride is to mark the otoliths of finfish fry and fingerlings for future identification, it’s a drug because the intended use is to affect the structure of the fishes’ bodies (their otoliths, in this case).

**What’s an approved new animal drug?**

Several drugs are FDA-approved for use in fish, but what does that mean?

Approved new animal drugs have gone through the New Animal Drug Application (NADA) process, or for generic animal drugs, the Abbreviated New Animal Drug Application (ANADA) process. In a nutshell, the process involves the drug sponsor—typically a drug company—collecting safety, effectiveness, and other information on the intended use of an animal drug. The sponsor then submits this information to FDA in the NADA or ANADA application. If the application meets the approval requirements, the agency approves the new animal drug. FDA approves the drug only for the specific intended uses listed on the drug’s label.

The aquaculture industry, drug companies, and government agencies created public partnerships to support research on fish drugs with the hope that this research will lead to the availability of more legally marketed fish drugs. The public partners conduct studies on the safety and effectiveness of a fish drug. The information goes into a Public Master File (PMF) that, as the name suggests, is available to the public. Rather than conduct all its own studies, a drug company can use the information in a PMF to help satisfy FDA’s approval requirements, thereby reducing both the time and cost of completing the NADA process. This gives companies more incentive to pursue approval of a fish drug, especially when the market for that drug is small.

FDA maintains an online searchable database, called “Animal Drugs @ FDA,” that lists approved new animal drugs, including fish drugs (www.accessdata.fda.gov/scripts/animaldrugsatfda).

**What does FDA’s approval provide?**

FDA’s approval of an animal drug ensures that:

- The drug is safe and effective when used according to the label;
- The drug’s strength, quality, and purity are consistent from batch to batch; and
- The drug’s labeling is truthful and complete.

If the drug is for food-producing animals, such as fish intended for human consumption, FDA’s approval also ensures that food made from treated animals is safe for people to eat.

FDA continues to monitor an approved animal drug after it’s on the market to make sure that:

- The drug remains safe and effective. Sometimes, the agency’s post-approval monitoring uncovers safety and effectiveness issues that were unknown at the time of approval;
- The quality and consistency of the manufacturing process are maintained; and
- The labeling remains truthful and complete.

**What’s a conditionally approved new animal drug?**

Did you use AQUAFLOR-CA1 when it was “conditionally approved”? Were you unsure what that meant? It meant that AQUAFLOR-CA1 went through the Conditional New Animal Drug Application (CNADA) process. This process has the same approval requirements as the NADA process except FDA conditionally approves the drug before the effectiveness requirement is complete. FDA’s conditional approval ensures the drug is safe and that there’s a reasonable expectation of effectiveness when used according to the label.

The drug company’s conditional approval is effective for one year, and can be renewed annually for up to four additional years. During this time, the company can legally market the drug while collecting the remaining effectiveness data. When the company completes the effectiveness requirement, FDA can finish its review and, if appropriate, approve the application for full approval. Conditional approval is available only for drugs for minor species or minor uses in a major species.

AQUAFLOR-CA1 was the first ever conditional approval of a drug. FDA conditionally approved AQUAFLOR-CA1 for the control of mortality in catfish due to columnaris disease associated with Flavobacterium columnare. [The “CA1” after the name indicated that the drug was conditionally approved (CA) and that it was the first (1) conditionally approved application for this product.] In April 2012, FDA fully approved AQUAFLOR to control mortality due to columnaris disease associated with Flavobacterium columnare in all freshwater finfish, including catfish. (Note the lack of “CA1” after the drug name now that it’s fully approved for this use.)

Currently, there are no conditionally approved fish drugs.

**Is the approval/conditional approval process the only legal pathway to the marketplace for a new animal drug?**

No, some animal drugs can take a different pathway called indexing. Indexed animal drugs are technically unapproved but still legally marketed for some minor species.

You may know about, or have even used, the two indexed drugs for ornamental fish: OVAPRIM (salmon gonadotropin releasing hormone analog + domperidone) and AQUACALM (metomidate hydrochloride). Both drugs are currently on FDA’s Index of Legally Marketed Unapproved New Animal Drugs for Minor Species, referred to simply as “the index” (www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/MinorUseMinorSpecies/ucm125452.htm). A drug listed on the index can be legally marketed for a specific use in certain minor species.
Indexed is allowed for drugs for:

- Non-food-producing minor species, such as ornamental fish. These animals don’t produce food for people to eat; and
- Early life stages of a food-producing minor species, such as oyster spat (immature oysters). Because people don’t generally eat oyster spat, a drug to treat a disease in spat can be indexed, but a drug to treat a disease in adult oysters, which people commonly eat, cannot be indexed.

Indexing a drug is a three-step process that includes a review of the drug’s safety and effectiveness by a panel of qualified experts outside FDA. All members of the expert panel must agree that, when used according to the label, the drug’s benefits outweigh the risks to the treated animal. If FDA agrees with the panel, the drug is added to the Index.

CVM’s Office of Minor Use and Minor Species Animal Drug Development maintains the Index.

**How can I find out if an animal drug is legally marketed?**

To find out if an animal drug is legally marketed, look at the drug’s label for a specific number and statement. FDA assigns a unique, six-digit number to every approved, conditionally approved, and indexed animal drug. Examples include:

- Application (CNADA)
- Application (ANADA)
- Abbreviated New Animal Drug Application (NADA)
- Application (CNADA)
- MIF (Minor species Index File)

You should not confuse these numbers with a National Drug Code (NDC) number, which are also sometimes listed on a drug’s label. FDA assigns a unique, 10-digit NDC number to a drug to serve as its universal identifier. The presence of an NDC number on a drug’s label does not mean the drug is FDA-approved or legally marketed.

**What’s the difference between a finished drug product and an active ingredient?**

You may wonder why 35% PEROX-AID, an approved fish drug with hydrogen peroxide as the active ingredient, is different than another source of hydrogen peroxide.

<table>
<thead>
<tr>
<th>Type of animal drug</th>
<th>Type of number</th>
<th>Labeling statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved</td>
<td>New Animal Drug Application (NADA)</td>
<td>“NADA XXX-XXX, Approved by FDA” typically on the label</td>
</tr>
<tr>
<td>Approved Generic</td>
<td>Abbreviated New Animal Drug Application (ANADA)</td>
<td>“ANADA XXX-XXX, Approved by FDA” typically on the label</td>
</tr>
<tr>
<td>Conditionally Approved</td>
<td>Conditional New Animal Drug Application (CNADA)</td>
<td>“Conditionally approved by FDA pending a full demonstration of effectiveness under application number XXX-XXX” required on the label</td>
</tr>
<tr>
<td>Indexed</td>
<td>MIF (Minor species Index File)</td>
<td>“NOT APPROVED BY FDA—Legally marketed as an FDA Indexed Product under MIF XXX-XXX. Note—In order to be legally marketed, an animal drug product intended for a minor species must be Approved. Conditionally Approved, or Indexed by the FDA. THIS PRODUCT IS INDEXED” required on the label</td>
</tr>
</tbody>
</table>

In the context of an approval, conditional approval, or index listing, the term “drug” refers to the final drug product. The final drug product includes both active and inactive ingredients.

An active ingredient is the pharmacologically-active component responsible for achieving the drug’s intended purpose—for example, to treat a disease or to change the structure or function of the body. A drug may have one or more active ingredients. Inactive ingredients are all other components of the final drug product, such as coloring and flavoring substances, preservatives, and binding agents.

When FDA approves a drug, the agency is approving the final drug product, not the active ingredient alone.

Now let’s take another look at 35% PEROX-AID. This approved final drug product, which contains a specific concentration of hydrogen peroxide, was shown to be consistently manufactured to ensure its strength, quality, and purity. The final drug product was also shown to be safe and effective to control mortality due to certain fungal and bacterial fish diseases. Another hydrogen peroxide product, even at the same concentration, isn’t the same as 35% PEROX-AID. Unapproved hydrogen peroxide products may not be safe or effective to treat fish diseases, and the quality and consistency of the manufacturing process cannot be assured.

**What’s the difference between an approved new animal drug and a drug that has an INAD exemption?**

You’ve probably heard that the U.S. Fish and Wildlife Service’s Aquatic Animal Drug Approval Partnership (AADAP) Program is the sponsor of an INAD for the fish sedative AQUI-S® 20E (eugenol), and several other drugs, but you may be confused by what that means.

First, let’s define “INAD.” The acronym stands for Investigational New Animal Drug. An “INAD exemption” allows a drug sponsor to ship the investigational drug for research purposes.

For administrative purposes, CVM assigns an INAD file number in the beginning of the approval process. The sponsor then uses the INAD file as a way to correspond with CVM. For example, the sponsor uses the file to communicate with CVM before treating fish. Before treated fish can enter the food supply, the sponsor must ask CVM for permission and have the center grant a “food use authorization.” Before granting the food use authorization, CVM makes sure that treated fish are safe for people to eat.

When conducting studies under the INAD exemption, researchers follow a specific study protocol as well as certain procedures for reporting results, problems, and other information to the sponsor. All information is submitted to CVM as part of the INAD file. For any study done under the INAD exemption, the drug is for investigational use only—it’s not approved, or if the
drug is approved for other intended uses, it’s not yet approved for the intended use under investigation.

In the case of AQUI-S® 20E, fishery professionals can legally obtain the drug by working with AADAP under the program’s INAD exemption. Fishery professionals who cooperate with AADAP and comply with all investigational procedures, food use authorization conditions, and reporting requirements can legally use the fish sedative for research purposes.

Let’s revisit the question about the difference between a drug and an active ingredient. The active ingredient in AQUI-S® 20E is eugenol, but the food use authorization granted under AADAP’s INAD exemption has a very narrow and specific scope and doesn’t cover all eugenol-containing products. Although clove oil contains eugenol, clove oil isn’t the same as AQUI-S® 20E. Clove oil is not part of the food use authorization nor is it approved. CVM has concerns about the potential of some components of clove oil to cause cancer (see Guidance for Industry 150 for more information: www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/UCM052520.pdf).

What should I do if I experience a problem with a fish drug?

Problems with any drug, approved or not, include adverse drug events and product defects. Adverse drug events are undesired side effects associated with a drug or a lack of effect (the drug doesn’t do what it’s supposed to do). Adverse drug events also include unfavorable reactions in people who handle the drug. Product defects are problems such as defective packaging or abnormal appearance of the drug.

CVM encourages veterinarians, fish health specialists, fishery biologists, hatchery managers, researchers, and animal owners to report adverse drug events and product defects with approved animal drugs to the drug company. The Federal Food, Drug, and Cosmetic Act requires drug companies to submit all reports of problems that they receive to FDA. The required reporting of adverse drug events and product defects allows CVM’s Office of Surveillance and Compliance to more easily identify and correct problems with approved animal drugs.

For unapproved animal drugs, you can voluntarily report adverse drug events and product defects to FDA. Information for fisheries on how to report adverse drug events is available on CVM’s website (http://www.fda.gov/AnimalVeterinary/ResourcesforYou/AnimalHealthLiteracy/ucm256588.htm). What are FDA’s concerns about unapproved animal drugs? Why should I care?

The term “unapproved animal drugs” means animal drugs illegally marketed in the U.S. that haven’t been approved, conditionally approved, or indexed by FDA. The agency has serious concerns about unapproved animal drugs because they potentially put the health of animals and people at risk. These drugs are not reviewed by FDA and may not meet the agency’s strict standards for safety, effectiveness, and quality. Unapproved animal drugs also may not be labeled or advertised appropriately or truthfully.

With no FDA review of an animal drug, there’s no way for veterinarians, fishery biologists, animal owners and others to know if a drug is safe and effective or if its manufacturing process is adequate to maintain the drug’s quality and consistency from batch to batch. Also, because there are no requirements to report adverse drug events and product defects for unapproved animal drugs, CVM’s Office of Surveillance and Compliance may not be able to easily identify and correct problems with these drugs.

What about products I hear referred to as “low regulatory priority”?

CVM has identified a number of unapproved products used in aquaculture that have been called “low regulatory priority” when used in fish intended for human consumption. These products should more appropriately be considered low-risk products. These products are not approved. However, CVM has determined that exposure of fish to these products, as outlined in FDA’s Fish and Fishery Products Hazards and Controls Guidance, are unlikely to result in a risk to human health if people consume the fish.

Keep in mind that just because CVM has determined that these are low-risk products doesn’t mean they are FDA-approved or that CVM has determined that they are safe and effective for fish. Also keep in mind that in the future, CVM can take a different position on the use of any low-risk product. CVM’s primary goals are to protect public health and encourage sponsors to pursue approval of drugs that will meet the therapeutic and production needs of the aquaculture industry.

Conclusion

Hopefully, this article answers many of your questions about aquaculture and FDA. If you have more questions or would like more information, please contact CVM’s Communications Staff at 240-276-9300 or AskCVM@fda.hhs.gov.

Resources for You

You may find these additional articles on the CVM website helpful:

- From an Idea to the Marketplace: The Journey of an Animal Drug through the Approval Process: www.fda.gov/AnimalVeterinary/ResourcesforYou/AnimalHealthLiteracy/ucm219207.htm
- Aquaculture and Aquaculture Drugs Basics: www.fda.gov/AnimalVeterinary/ResourcesforYou/AnimalHealthLiteracy/ucm213944.htm
- Letter to Aquaculture Professionals: www.fda.gov/AnimalVeterinary/SafetyHealth/ProductSafetyInformation/ucm324048.htm
143rd Annual Meeting Wrap Up: Thank You Little Rock

Jeff Schaeffer
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Fisheries professionals gathered at the 143rd Annual Meeting of the American Fisheries Society in Little Rock, Arkansas, which was hosted by the American Fisheries Society (AFS) Arkansas Chapter in partnership with the Arkansas Fish and Game Commission; they managed to conjure absolute feasts at the social events that ranged from barbeque to Cajun gumbo, deep-fried catfish, and hushpuppies. We reunited with colleagues and attended scientific sessions led by some of the world’s top fisheries biologists and professionals. Despite the heat, attendees ranged freely throughout a vibrant revitalized downtown that provided many opportunities for dining, shopping, and socializing.

The meeting theme was “Preparing for the Challenges Ahead,” and that idea achieved saturation within minutes of Pamela Mace’s plenary about future needs for fisheries professionals and Kelly Millenbah’s insightful talk about generational differences in the workplace; those presentations were the focus of many hallway discussions and were referenced frequently in the 30-odd symposia, most of which had at least one presentation that was geared toward looking ahead. Our new meeting format of shorter talks and longer breaks is still being discussed, but it seems to have some merit. There was a less-rushed environment and there were good discussions between the presentations.

The symposia offered an opportunity for audiences to learn current thinking on important ideas directly from some of the world’s leading experts on those subjects. They were not just random assemblages; they were invariably organized in a way that facilitates synthesis of knowledge or ideas. Sadly, this was a year when many AFS members experienced restrictions on travel and could not attend, so we present symposium summaries as a way to showcase the efforts of our organizers, to encourage development of new symposia for the 2014 meeting in Québec City, and to inform members who could not attend Little Rock about the important themes that emerged there.

The Little Rock meeting culminated in a unique farewell social held at the William Clinton Presidential Library, where haute southern and French Canadian cuisine collided head-on to celebrate both Arkansas hospitality and our journey to Québec City in 2014. The hypnotic psycho-delta rhythmic music of Tyrannosaurus Chicken turned the normally formal and staid Presidential Grand Hall into an absolute rave with tables and chairs pushed back to make space for a dance floor that became filled to capacity.

The official motto of Québec is “Je me souviens” (I remember), but it also has meaning as we think about our gracious and generous hosts in Arkansas and plan ahead for our journey to Québec City in 2014.
Plenary Talk—Dr. Pamela Mace

Only a thought-provoking, challenging presentation encourages people to continue discussing a plenary session long after the session concludes. Dr. Pamela Mace, the principal advisor for fisheries science at the New Zealand Ministry for Primary Industries, delivered one of those stimulating pieces with her presentation of “Preparing for the Challenges Ahead: What Types of Fisheries Professionals Will Be Needed?” Dr. Mace presented a “scenarios analysis” to represent alternative worlds that help us think about what the future might look like and stimulate imagination and creativity about the long-term future of fisheries.

Two contrasting scenarios—one in which “money rules” and the other where “sustainability is paramount”—challenged the audience to reflect on personal values and to consider the effects of scientific and management decision making. Dr. Mace applied the results of the analysis to examine how fisheries would look in each of the extreme scenarios and then compared similarities and differences between developed nations (e.g., the United States and New Zealand) and developing nations.

In the “money rules” scenario, fisheries would likely become depleted and overexploited, much of the oceans would become privatized, oil and gas mining would take precedence over fisheries, national and international regulations would be relaxed or ignored, and unreported, illegal fishing would be commonplace.

In the opposite “sustainability is paramount” scenario, fisheries regulations would be strictly enforced, scientists would be highly respected, habitat restoration could be a growth industry, bottom trawling and dredging would be banned, and most fish species would be protected by national and international agreements. Dr. Mace used examples of management strategies from the United States and New Zealand that have been successful in reducing overcapacity and overfishing but suggested that there has been increased pressure on all marine resources, which has resulted in higher exploitation and lower abundance of fish stocks and degraded habitat quality. Though these worlds seem to be at odds and would require opposite management strategies, some key similarities exist. Both the money rules and the sustainability is paramount scenarios must consider the impacts of ocean acidification, climate change, and increased competition for space and utilization of marine resources. Dr. Mace posed a broad question: “What skills are required to ensure the right balance between utilization and sustainability of our ocean resources?”

Paramount in importance, according to Dr. Mace, is training in quantitative skills for fisheries scientists. She encouraged universities to offer, and students to take advantage of, courses on population dynamics, multivariate statistics, sampling theory, stock assessment, and risk analysis. She proposed double, triple, and quadruple majors in fisheries science, law, economics, and management. She suggested that the future of fisheries science will require multilingual capability, negotiation expertise, and enhanced communication skills. Although Dr. Mace’s call to arms for increased education and training seems daunting, she was confident that there is an optimistic future for global fisheries if we can strike the right balance between research, education, and communication to foster common understanding, goals, and values.

Dr. Mace posed a challenging question to the members of AFS, along with researchers, managers, and industry stakeholders around the world: How can we combine objective science with rational management in order to avoid falling into the “money rules” or “sustainability is paramount” extremes? Her presentation was discussed, dissected, or disagreed with for the remainder of the meeting, indicating that the challenge she posed is vital for the future of fisheries.

Catherine E. O’Keefe, University of Massachusetts Dartmouth. E-mail: cokeefe@umassd.edu

Plenary Talk—Dr. Kelly F. Millenbah

Though I have seen many insightful and thought-provoking plenary talks, I don’t think I’ve ever seen a plenary that permeated a whole meeting more than Dr. Kelly F. Millenbah’s at the 2013 American Fisheries Society Annual Meeting in Little Rock, Arkansas. Dr. Millenbah, the Associate Dean and Director for Academic and Student Affairs in the College of Agriculture and Natural Resources at Michigan State University, spoke on “Education in the Era of Millennials: Implications for Future Fisheries Professionals and Conservation,” which fit very well with the conference theme: “Preparing for the Challenges Ahead.”

Dr. Millenbah contended that, as a profession, we can be more prepared for the challenges that face fisheries if we take into account certain characteristics of the Millennial generation—my generation—which is just entering the workforce. The Millennials, she suggested, are optimistic and realistic, good at multitasking, tech savvy, globally and socially conscious, and team oriented. This generation wants to make a difference.

In fisheries, we will face many difficult challenges, many
of which were topics of sessions and contributed papers at the conference. As seems typical of my generation, I tend to think of these challenges as opportunities and find it reassuring to think that through collaboration and tenacity, we’ll be able to improve fisheries resources for future conservation and use. Like a puzzle, we just need to figure out how all the pieces fit together!

Dr. Millenbah’s talk was the talk of the conference. Her discussion was brought up in many sessions I attended. How does this relate to the future? How can we train the next generation to address these issues? Personally, I find it so exciting to see the forward outlook of these questions. As a profession, we are really preparing for the challenges ahead!

Abigail Lynch, Michigan State University, Department of Fisheries and Wildlife. E-mail: lynchabi@msu.edu

**A Big Tent: Building a Stronger Society and Workforce Through Professional Diversity**

The Equal Opportunities Section (EOS) hosted a half-day symposium, which was one of three events hosted by the EOS during the 2013 meeting! The symposium highlighted the work of students matriculating at minority serving institutions (MSIs) and professionals from underrepresented groups. The symposium also highlighted the work of white students and professionals—including white males—who conduct research or are involved with diversity efforts at MSIs. Student presentations covered a variety of disciplines including human dimensions and policy; fish physiology and ecology; and population dynamics and fishery management implications. Fisheries professionals presented on the work they do in direct support of outreach and recruitment efforts intended to increase student participation in STEM (science, technology, engineering and math).

The first presenter spoke about his work with the Reach-up Program, a participatory aquatic science program geared towards introducing middle school students from underrepresented populations to aquatic science through school curriculum and outdoor field experiences. Emphasis is also placed on introducing students to various career paths across the aquatic sciences. Another presentation focused on the National Cooperative Fisheries Scholars Program, an undergraduate program geared towards increasing the number of ethnic and racial minorities in environmental sciences and fisheries and wildlife management. The presenter pointed out that the program success rates are high and program participants are competitive, yet challenges to entering the fisheries profession remain. Another symposium contributor asserted that proactively initiating dialogue with underrepresented groups is essential for producing better resource management outcomes. The speaker also provided highlights on successes over the past 20 years and identified improvements that would help increase recruitment and retention of women and ethnic minorities.

There was a common theme across the presentations given by fisheries professionals: diversity initiatives to increase minority participation in STEM have been successful but we still have a long way to go and a lot more work to do! At the conclusion of the symposium, the presenters answered tough questions and offered insights on how to address persistent diversity disparities and improve upon current diversity efforts to help the fisheries profession and AFS become a true reflection of the demographic landscape in our country.

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**AFS/SEA Grant Best Student Presentation**

The 2013 AFS Annual Meeting marked the sixth year of the AFS/Sea Grant Best Student Presentation and Poster Symposia. In total, there were 16 oral and two poster presentations. Student representation extended from the Pacific to Atlantic coasts and included more than 15 different academic institutions. Topics ranged from the use of stable isotope analysis to examine trophic partitioning of crayfish to the use of Bayesian methods for the estimation of freshwater mussel growth. Finfish topics included examination of growth patterns and lipid content of Rockfish (*Sabastes* spp.) to the spatial and temporal interaction between anglers and various targeted fish species in Florida. This year I was awarded the Best Student Presentation for my presentation titled “Finding Death: The Relationship between Energy and Iteroparity in Steelhead Trout.” The Best Student Poster was awarded to Nicholas Sievert from the University of Missouri for his poster titled “A Vulnerability Assessment for Missouri Stream Fish Species: Development and Evaluation.”

The two winners will receive a plaque and $450, which will be presented at the 144th Annual American Fisheries Society Meeting in Québec City, Canada, in 2014. The AFS/Sea Grant Best Student Presentation and Poster Symposium is designed to support 20 finalists for both oral and poster presentations, neither of which was exceeded this year. Understandably many students will often opt to present in symposia that fall within the scope of their own research interests at the Annual Meetings or do not wish to deal with the additional requirement of submitting an extended abstract. For this reason, advisors are also strongly encouraged to support and urge their students to enter in the Best Student Presentation and Poster Symposium or to participate as judges.

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Scientists taking a look at young salmon and their habitat by conducting snorkel surveys. Photo credit: NOAA.
Applying Genetic Principles and Technologies to the Management and Conservation of Fishery and Aquatic Resources

The two-day symposium sponsored by the Genetics Section examined a diversity of molecular approaches as they relate to the conservation and management of fishes and other aquatic resources. Many of the 31 presentations touched upon contemporary but pervasive management issues, such as habitat connectivity, invasive species, maintenance of genetic rescue, effects of stocking or overfishing, and the clarification of taxonomic relationships. Others addressed topics more evolutionary in nature, such as gauging adaptive divergences and estimating parallel evolution. The importance of molecular data in addressing these problems and providing clear management guidance was amplified repeatedly.

The symposium highlighted a diversity of techniques, including those newly established such as sandwich hybridization assay as a means for rapidly and affordably identifying planktonic fishes and restriction site associated DNA sequencing for acquisition of genomic data from next generation sequencing pipelines as a means of addressing population-level phenomena. The audience quickly perceived that rapidly advancing technologies and ever-decreasing costs facilitate not only acquisition of genomic data but their translation into the adaptive management of our most pressing environmental issues. This was particularly well represented by J. Lamer in his presentation on hybridization among invasive Asian Carp in the Illinois River and by J. Puritz on the population structure of, and connectivity among, overfished Red Snapper in the Gulf of Mexico.

However, more established molecular genetic techniques (i.e., microsatellite DNA fragment analysis; mitochondrial/nuclear DNA sequencing) were also apparent and underscored the considerable (and ongoing) importance of these techniques in yielding solid, well-evaluated data that consistently promote realistic management decisions. For example, over a dozen talks highlighted application of microsatellites in detecting gene flow as it relates to habitat connectivity, population structure, stock assessment, supplementation programs, and the collapse of populations due to overfishing. Several others employed both mitochondrial DNA and microsatellite analyses to delimit species, promote genetic monitoring, and define evolutionary significant and management units. Single-gene nuclear DNA sequencing was employed to survey reproductive success and detect introgressive hybridization.

Symposium participants continually underscored the tremendous importance of molecular genetic approaches in conserving and adaptively managing fishes and aquatic resources. Emerging technologies are transforming the field and provide new, exciting avenues but also prepare us as well for emerging challenges, whether of an anthropogenic nature or natural responses to an ever-changing environment.

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Biology, Ecology, and Management of Muskellunge and Northern Pike: New Science to Meet Current and Future Challenges

The objectives of this symposium—focusing on the biology, ecology, and management of Muskellunge and Northern Pike—were to present current research, identify research needs, advance sustainable management in a changing environment, and stimulate collaboration among researchers. The symposium attracted presenters from seven states, Canada, and the United Kingdom.

Two keynote presentations were given, one on the variability of habitats used by spawning Muskellunge and one on current threats and challenges to Muskellunge and Northern Pike populations of the Great Lakes. Thirteen contributed presentations described research on (1) critical spawning and nursery habitats; (2) distribution and movements of adult Muskellunge and Northern Pike, including responses to habitat change and restoration; (3) selective mortality caused by angling, winterkill events, and viral hemorrhagic septicemia; (4) the effects of climate change on Northern Pike diets and the metabolism of four esocids; (5) genetic approaches for identifying spatially distinct reproductive groups of Muskellunge, guiding reintroduction programs, and determining the contribution of stocked fish to current populations; and (6) escapement of stocked Muskellunge from reservoirs. Following these presentations, a panel answered questions from the audience and provided commentary on potential future directions of esocid research and management.

Although some waters currently provide exceptional angling opportunities for Muskellunge and Northern Pike, many populations in their historical range have been extirpated or rely on stocking. Throughout the symposium, degradation and loss of spawning and rearing habitat were identified as the leading...
causes of population declines for Muskellunge and Northern Pike. Esocid populations face additional threats from biological invasions and climate change—conducting research on Muskellunge and Northern Pike in an ever-changing environment poses a substantial challenge to understanding the basic needs of these species.

Although habitat loss, biological invasions, and climate change will continue as human populations grow, rapid advances in research technologies such as telemetry, genetic markers, and videography provide exciting opportunities for enhancing the science and management of Muskellunge and Northern Pike.

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Black Bass Diversity: Multidisciplinary Science for Conservation

Black bass species support some of the most popular recreational fisheries in the United States. To date, nine species of black bass have been described, including the well-known Largemouth Bass, Smallmouth Bass, and Spotted Bass. Interestingly, six other black basses are endemic to drainages of the Southeastern United States—the Shoal Bass, Redeye Bass, Alabama Bass, Florida Bass, Suwannee Bass, and Guadalupe Bass. Because these species occupy relatively narrow native ranges and face a suite of potential threats, the Southern Division’s Black Bass Conservation Committee organized the Black Bass Diversity Symposium.

The symposium brought together professionals from across the country, contributing over 65 oral and poster presentations in four sessions that covered biology, ecology, and life history requirements; habitat restoration and management; conservation genetics; and fish populations, fisheries, and human dimensions. Presenters delivered updated accounts of several undescribed species such as Bartram’s Bass, Choctaw Bass, and Cuatro Ciénegas Bass. Audiences left with a better understanding of the challenges these fish face as well as advancements being made to manage populations, restore habitats, and conserve genetic integrity of black bass species.

Timely interest and support is growing for all black bass species, and working together is necessary to ensure the long-term conservation of these unique species for the enjoyment of future generations. The symposium was part of the larger Native Black Bass Initiative, which strives to implement watershed-scale approaches to conservation of endemic black bass and other native fishes in the Southern United States. Multiple partners are currently focusing their efforts on Guadalupe Bass, Shoal Bass, and Redeye Bass conservation.

Andrew T. Taylor, Oklahoma State University. E-mail: andrew.t.taylor@okstate.edu

Centrarchid Conservation, Ecology, and Management

The ultimate goal of the “Centrarchid Conservation, Ecology, and Management” symposium—sponsored by the Centrarchid Technical Committee of the North Central Division—was to provide a comprehensive view of recent advancements in the conservation, ecology, and management of centrarchid fishes. Time slots during the formal symposium were filled with seven presentations, and an additional six posters were presented during the Trade Show and Poster Social. The symposium provided the opportunity for undergraduate students, graduate students, and professionals to come together from various locales to discuss basic ecology and life history, applied management, and human dimension aspects of centrarchid-related research. The diversity of research presented during the symposium was reflective of the diversity of centrarchid fishes. Presenters represented
a broad spatial scale and included researchers from Louisiana, South Carolina, Oklahoma, Missouri, Iowa, Nebraska, and Wisconsin. Oral presentation and poster topics included feeding ecology, age and growth, early life history, interspecific interactions following stocking of Largemouth Bass, resource partitioning among centrarchid fishes and potential competitors, bioaccumulation of contaminants in centrarchid fishes, the influence of angler harvest on centrarchid population dynamics, and the influence of environmental variables on centrarchid population dynamics. All presentations were well attended and were followed by fruitful discussions. Based on these discussions, we believe that bringing researchers together in this format aided in identifying research commonalities and stimulated further research to provide insight on remaining uncertainties. Feedback from symposium presenters and attendees was overall very positive and the Centrarchid Technical Committee plans to continually sponsor centrarchid-related research symposia during future Annual Meetings.

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Conservation Strategies for Freshwater Mollusks

The Freshwater Mollusk Conservation Society’s symposium reinforced the freshwater mollusk–fish connection and presented a better understanding of the relationship between freshwater mollusks and fishes. Our talks advocated the conservation of freshwater mollusk resources, served as a conduit for information about freshwater mollusks, endorsed science-based management of freshwater mollusks, and promoted and facilitated education and awareness about freshwater mollusks and their function in freshwater ecosystems. The title of talks included the following:

• “Ecosystem Services Provided by Freshwater Mussels,” by Dr. Caryn Vaughn (University of Oklahoma and Past-President of the Freshwater Mollusk Conservation Society)
• “Modeling Habitat Suitability for Threatened Mussel Species in East Texas Rivers,” by Dr. Lance Williams (University of Texas at Tyler)
• “How Flood Disturbance Structures the Spatial Pattern of Mussel Beds and Salmon Spawning Redds in a Large River,” by Dr. Christine May (James Madison University)
• “Does Scale Matter? A Multi-Scale Investigation of Unionid Species Assemblage and Microhabitat Parameter Relationships within and among Great Lakes Tributaries,” by Jennifer Bergner (Central Michigan University)
• “What Is the Role of Habitat, Life History and Host Fish in Determining Distributions of Louisiana Mussels?” by Dr. Kenneth Brown (Louisiana State University)
• “Integrative Conservation Biology of European Freshwater Mussels: The Importance of Fish Hosts, Stream Substratum Properties and Population Genetics,” by Dr. Juergen Geist (Technische Universität München)
• “Freshwater Mussel Conservation and Management in Arkansas: Past, Present, and Future Considerations,” by John Harris (Arkansas State University)
• Conservation and Management of Freshwater Mussels (Bivalvia: Unionoidea) in Missouri,” by Stephen McMurray (Missouri Department of Conservation)
• “Steps Taken During the Reintroduction of Federally-Endangered Mussels,” by Jeremy Tiemann (Illinois Natural History Survey)

The symposium was well received, with about 100 folks stopping in and hearing at least one talk. Discussions of our work continued well after the symposium and into evening mixers. Several researchers/managers mentioned modeling future projects after those presented at our symposium.

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Culture, Biology, and Management of Asian Carps in North America

During the Annual Meeting in Little Rock, the Introduced Fish Section and the Fish Culture Section co-sponsored a symposium highlighting the vast array of research surrounding Asian Carps. The symposium, entitled “Culture, Biology, and Management of Asian Carps (AC) in North America” en-
compassed the multi-faceted research occurring in the U.S. and Canada. The symposium, organized by Duane Chapman (U.S. Geological Survey [USGS]), Jesse Trushenski (Southern Illinois University-Carbondale [SIUC]), and the SIUC Student Subunit was highly attended. Designed as a forum for those working on all sides of carp issues, symposium topics ranged from AC behavior and control to AC marketing potential. Attendees learned that the public perception of AC as a food fish was higher than first believed, and many people would be willing to try and purchase AC (Secchi; SIUC). In addition, John Bowzer (SIUC) shared an alternative to human consumption of carp by showing that AC fish meal was highly digestible and suitable for aquafeed production.

Multiple papers documenting the Triploid Grass Carp Certification Program opened Day 2. Robert Glennon (J.M. Malone and Son, Inc.) gave an overview of the program, while Scott Stuewe (HDR Engineering) presented the results of an independent assessment program. Tatiana Garcia (University of Illinois Urbana-Champaign [UIUC]) shared the recently developed Fluvial Egg Drift Simulator (FluEgg) and discussed examples of AC egg drift for areas where spawning may occur. In addition, a variety of methods were suggested to control these fish including commercial fishing (Glover; SIUC), altering movement with seismic water guns (Kocovsky; USGS), and use of chemical stimuli (pheromones) to attract AC to specific areas (Calfee; USGS). Results of commercial fishing in the Illinois River showed lower relative abundance, fewer large fish, and skewed sex ratios. Seismic water guns were shown to deter fish from moving into an area, whereas pheromones were used as a successful attractant.

A number of presenters highlighted AC movement and the potentially negative community-level effects of AC. The presence of AC was linked to declines of native fishes in Missouri (Phelps; Missouri Department of Conservation), competition with Gizzard Shad in South Dakota (Hayer; South Dakota State University), and competition with Bluegill in Illinois (Nelson; UIUC). Finally, spawning movements of AC was shown to correspond to elevated river flow in both the Illinois (Brey; SIUC) and Wabash Rivers (Coulter; Purdue). Overall, this symposium brought together researchers working on all aspects of AC issues and acted as an excellent environment in which to learn about the control of and potential uses for these fish.

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A Bighead Carp, front, a species of the Asian Carp. Photo credit: M. Spencer Green.

Also presented was research on Yellowtail Flounder bycatch in the U.S. sea scallop fishery, including gear modifications and the initiation of a collaborative bycatch avoidance program to help fishermen avoid bycatch “hot spots.”

Dealing With Bycatch

This symposium revealed great progress by the fisheries research and management communities to mitigate non-target catch, beginning with a presentation about the National Marine Fisheries Service’s efforts to identify bycatch levels and trends in U.S. fisheries through the production of a National Bycatch Report. This was followed by presentations on conservation engineering research in the West Coast groundfish trawl fisheries, on Dungeness crab bycatch mortality rate estimation for crab and groundfish trawl fisheries, and on NOAA’s Bycatch Reduction Engineering Program (BREP), including an announcement of projects that will be funded by this program in the 2013–2014 fiscal year. There were seven papers pertaining to conservation engineering and trawl gear: presentations on (1) efforts to exclude rockfish using a flexible sorting grid in the West Coast Pacific Hake fishery; (2) turtle excluder device (TED) bar spacing in the U.S. shrimp trawl fishery; (3) sea turtle bycatch reduction through the use of a “topless” trawl; (4) experimental trials to reduce bycatch by modifying the trawl mesh in demersal finfish fisheries in the Falkland Islands; and winter flounder bycatch reduction through the use of (5) escape “windows” along the groundgear; (6) a 12-inch drop chain sweep, and (7) a large mesh belly panel. Bycatch reduction and gear selectivity were also discussed in presentations on the role of set-depth in buoy gear selectivity; the use of “tiedowns” on sink gillnets to reduce Atlantic Sturgeon bycatch; and the possibility of using hook-size regulation to reduce bycatch of undersized reef fishes in Gulf of Mexico recreational fisheries.

Also presented was research on Yellowtail Flounder bycatch in the U.S. sea scallop fishery, including gear modifications and the initiation of a collaborative bycatch avoidance program to help fishermen avoid bycatch “hot spots.” In addition, a presentation was given on silky shark bycatch in the central Pacific.

Commercial Oregon crab fishermen (shown working on their gear) work collaboratively with scientists to quantify bycatch mortality in their fishery. Photo credit: Noëlle Yochum.
Ocean commercial purse seine fishery, with respect to stress and injuries sustained during the capture process and immediate and postrelease mortality. The symposium provided an opportunity for researchers to present bycatch reduction research in a variety of fisheries with a range of fishing gears. The papers revealed advancement and innovation in bycatch mitigation.

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Fishery Resources and Environment of the Mississippi and Yangtze (Chanjiang) River Basins: Common Challenges and Shared Perspectives

Colleagues from both the Mississippi and Yangtze (Changjiang) River Basins organized the first international joint symposium on fishery resources and environment in the two basins. Twenty-seven Chinese delegates from eight institutions and universities attended the meeting. The United States was represented by 12 institutions and universities. The symposium covered a full day and included 18 paired oral presentations and 22 poster presentations. It was the biggest international symposium on aquatic sciences and environment between the United States and China, and between North America and Asia, based on the number and diversity of attended institutions and universities from both basins. These presentations covered (1) an overall comparative analysis (e.g., geology, land use, hydrology) of the two basins; (2) fisheries (commercial, recreational, and subsistence) and shellfisheries (mollusks and crustaceans); (3) endangered and invasive species (e.g., paddlefish, sturgeon, carp); (4) climate change, land use change, hydraulic/hydrologic modification impacts on aquatic ecosystems; (5) floodplains; and (6) river and watershed restorations in upper, middle, and lower subbasins of each river, respectively. After the oral presentations, 29 delegates from both basins joined the panel discussion.

As part of the conference, colleagues in the Mississippi Basin organized two field trips for the Chinese delegates: the Mississippi River Delta agriculture conservation and stream restoration projects and habitat restoration and navigation projects on the Mississippi River main channel. Common interests and benefits generated from the symposium include (1) management of Asian Carp; (2) conservation of endangered aquatic species; (3) management of commercial and recreational fishery resources; (4) idea sharing on hydrologic and hydraulic issues, water diversions, and water scarcity; (5) management of flood plain resources; (6) minimization of gulf hypoxia; and (7) collaborations on habitat and watershed restoration plans.

The panel also made the following future plans: (1) publish a book based on selected papers from the symposium with the AFS; (2) make symposium presentations available to interested colleagues with certain limitations through the Lower Mississippi River Conservation Committee website (www.lmrcc.org); (3) plan for the second Mississippi–Yangtze River Basins Symposium scheduled for summer 2015 in China; (4) plan a future symposium series that will rotate between the two basins every 2 years with future Mississippi-based symposia to be held jointly with corresponding AFS Annual Meetings; and (5) form a Mississippi–Yangtze Symposium/Network Standing Committee to coordinate future collaborations such as joint research projects, visiting students/scholars, publications, and other scientific outreach programs.

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Guidance and Advances in the Use and Application of Bioelectrical Impedance Analysis to Fish Management and Ecology

A number of individuals working with a relatively young technique, bioelectrical impedance analysis (BIA), organized a half-day symposium. The symposium addressed the current status and methods used in this technology as a nonlethal means to assess fish health as it related to fat content and overall condition. Numerous applications were presented wherein accurate and field-expedient estimates could open new doors in research and management. The focus of the symposium, however, was to answer the questions: Does it work? How does it work? and How do you use it?

The presenters showcased models for at least six species that BIA has been demonstrated to predict fat content with $R^2$ values above 0.70, and some even above 0.80. A few of these models were made before current advances in the protocol for technology application. In further model development, many investigators struggled to understand exactly what the technology was measuring. One presentation precisely explained the physics behind how the device can estimate total body composition. By understanding how the technology works, further advances have been made in improving the technique in which BIA is applied. Other presentations provided explanations on optimal sampling size for model development, improving accuracy with

It was the biggest international symposium on aquatic sciences and environment between the United States and China, and between North America and Asia.
proper probe placement, and correcting for sources of variance that can hinder a user’s results. A particularly important take-home note regarding those who had successful models and those whose models were unsatisfactory was that in the latter sample sizes under 60 and a condition range less than 30% gave inadequate results. A second germane point affecting results was the impact of temperature. Many who attempted to apply BIA in the field without properly controlling for temperature had difficulty in getting good estimates.

Along with these important lessons addressed during the symposium came a few smaller, but exciting, results that show promise for future advancement of BIA. For instance, one presentation showed the possibility of applying models across taxonomically similar species to work as a surrogate for endangered species. Three other presentations showed the future potential of BIA with small fish commonly used in toxicological and genetic studies. New tools and technology that could improve accuracy were also showcased. Ultimately, attendees were shown the history, use, advancement, application, and current status of BIA technology in fisheries science and management.

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Hatcherries and Management of Aquatic Resources (HaMAR)

A good price for and promotion of their products [cultured fish] were of paramount concern in the early years [of AFS].

With the passage of time and growing realization that stocking and restrictive regulation were ineffective, fisheries workers began to search for new answers. [...] The focus of fisheries management broadened from the previous narrow fixation on fish culture to more appropriate, ecologically oriented programs. [...] Unfortunately ... the baby was thrown out with the bath water.

The arc of the fish culture pendulum has come full swing: from early consideration as a universal fisheries management panacea through a transitional period of questioning and disrepute, to final recognition as an indispensable tool when appropriately integrated with other equally essential fisheries management protocols.

These quotes are from Fish Culture in Fisheries Management (Stroud 1986), a proceedings book published by the Fish Culture Section and the Fisheries Management Section. They illustrate the changing role of cultured fish in aquatic resource management, as well as the Society’s changing views on fish culture, from our founding in 1870 as the American Fish Culturists’ Association to the present day. This evolution occurred as a result of decades-long introspection and analysis, punctuated by forums coordinated by the AFS to collectively discuss the issues of the day related to hatcheries and hatchery-origin fish in natural resources management. Previous forums addressed concerns such as the value of hatcheries as management tools and how to optimize the ability of hatcheries to support management objectives.

The AFS once again reengaged its membership in this context, forming the Hatcheries and Management of Aquatic Resources (HaMAR) committee that hosted an eponymous fact-finding symposium at the Annual Meeting in Little Rock. Underwritten by the Fish Culture, Introduced Fishes, and Fisheries Management Sections and organized with help from the Fish Habitat, Fish Health, Fisheries Administration, Genetics, Marine Fisheries, Physiology, and Water Quality Sections, the symposium featured topics related to each of these disciplines and others such as tribal trust responsibilities and human dimensions. Over three days, attendees enjoyed one top-notch paper after another, as well as thought-provoking question-and-answer and discussion during the breaks. “There were nothing but great presentations and healthy exchanges during the three long days of talks at this latest AFS symposium on fisheries enhancement,” said one HaMAR participant. “I, for one, plan to start attending AFS meetings again because of this, as that’s the fisheries science environment that is needed as a forum. I’m really excited by what I experienced at AFS.”

The HaMAR committee is now working to distill the Little Rock symposium and a sister symposium held earlier this year at the triennial AQUACULTURE conference into concise, contemporary guidance regarding hatcheries and hatchery-origin fish.

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North American Freshwater Fish Diversity: Conservation and Management of Mysterious and Lesser Known Species

This symposium was an effort to draw attention to the need to conserve the myriad of noncommercial and nongame fish species. The vast majority of the 3,875 freshwater and marine species listed in the AFS’s *Common and Scientific Names of Fishes from the United States, Canada, and Mexico*, seventh edition (2013), are species that are not commercially or recreationally important. Given that these species are often overlooked from a conservation perspective, this symposium provided a timely discussion of the issues surrounding the need to protect these lesser known species and the diversity that they represent.

Eighteen engaging and informative presentations were delivered in the session, highlighting the need to include these lesser known species in conservation and fisheries education. The papers presented were themselves diverse, mirroring the wide range of taxa in North America.

The symposium began with an update by Nick Mandrak on the recent work of the AFS-ASIH Names Committee to catalogue North American fish diversity. Following the introductory talk, presentations were given on a wide variety of species. The session continued with talks about the difficulties in classifying sucker species and parasitic and nonfeeding lamprey species pairs. Then a talk was given on the management role of “living fossil” species, such as gars, sturgeons, and paddlefish. A presentation was given on the evolution of male nuptial coloration in darters and the early morning session concluded with an argument for the protection of Canadian fish species at the edge of their range.

The late-morning talks included a discussion of the diversity in small, subarctic lakes, and conservation of Great Lakes migratory fishes, with an account of what Missouri has lost in no longer employing a state ichthyologist. There was also a discussion on Alligator Gar stocking density and a presentation on tracking of Arapaima in Guyana.

The afternoon discussions included one on the ecology and distribution of Silver Chub in Lake Erie and one on mortality of Stonecats and sampling juvenile Burbot. The symposium concluded with discussions of the distribution and natural history of two darter species.

This symposium successfully engaged both speakers and the audience alike in lively discussions about the role of lesser known species, an important step in recognizing the importance of these mysterious fishes.

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Piloting Big Rivers for the Challenges Ahead

The American Institute of Fisheries Research Biologists (AIFRB) convened a symposium entitled “Piloting Big Rivers for the Challenges Ahead.” Like pilots guiding vessels through dangerous or congested waters with their detailed knowledge of local waterways, the goal was to bring together experts working on big river systems in various disciplines and discuss issues unique to these ecosystems. Disciplines included hydrography, water chemistry, engineering, and biology. Together we could bridge the gaps between disciplines and prepare for the challenges ahead.

The symposium opened with two keynote speakers: Dr. Robert B. Jacobson from the U.S. Geological Survey (USGS) Columbia Environmental Research Center and Dr. William Richardson from the USGS Upper Midwest Environmental Sciences Center. Dr. Jacobson set the stage by describing the flow and form of large rivers. He spoke about the alterations that large rivers have undergone as well as current restoration projects underway. He noted that large-river restoration science in the 21st century has been greatly enhanced but that challenges remain in linking physical habitat to ecological, population, and community dynamics. Dr. Richardson moved from the physical environment of large rivers to the chemical by describing nutrient fluxes in and out of rivers, especially nitrogen and its role for fish. Whereas big river systems are major conduits for nutrients from land to the ocean, their flood plain connections provide excellent locations for N removal. So although climate change and increasing demands for corn-derived ethanol will likely increase the rate of N delivery into downstream waters leading to increased eutrophication, maintenance of flood plain connectivity may ameliorate these impacts.
Population Productivity Drivers and Spatial Scale: A Case Study with Red Drum

Symposium organizers moderated 18 presentations on factors driving Red Drum (Sciaenops ocellatus) population productivity over space and time, concluding with a comprehensive discussion framing the findings within the context of future management directives. Scientists representing nearly all states within the species’ range (Virginia to Texas) provided data and dialogue through field research, laboratory experiments, genetic advances, modeling, and stock enhancement initiatives. The federally mandated moratorium prohibiting commercial harvest in the late 1980s provided 2 decades for studies to be conducted on undisturbed adult populations. Southwest Florida studies 10 and 20 years after the closure reflect rebuilding of the spawning population through significant increases in aggregation sightings, size, age, and fecundity. Moratorium effects are also evident in the age composition of fishery-independent catches off the coast of Alabama with low mortality of fish age 6 and above. Older fish were caught in the more northern states along with sex ratios skewed more toward females in South Carolina. Connectivity across states lines (Virginia to North Carolina) was demonstrated with pop-up satellite archival tags (PSAT) and acoustic tag data in southwest Florida revealed connectivity between neighboring estuaries. In Texas, spawning aggregation adults are predominately produced from nurseries in the same region or in close proximity, suggesting natal homing to specific estuarine corridors. Regional correlations of age-0 fish within North Carolina were strongest for adjacent areas, and the North Carolina statewide index was not correlated with indices from other states, suggesting that recruitment control factors operate at a scale of 10 to hundreds of kilometers.

Habitat, diet, competition, density dependence, and winter temperature were all important considerations in productivity. Habitat use in acoustically tagged North Carolina fish was highly context dependent. In Texas, although seagrass was valuable to new recruits, in areas without it, intertidal marsh played a similar role. Diet in Red Drum from the Carolinas differed and was linked to prey habitat availability. Laboratory studies in Texas indicated that maternal and larval diet affected larval performance and presumably survivorship. Models based on North Carolina juvenile fisheries independent monitoring (FIM) data indicated potential for density-dependent negative feedback loops to affect population growth. Additional effects of intraspecies competition in Louisiana were explored through an IBM evaluating the importance of refuge habitat and reproductive timing (i.e., time and number of batches). North Carolina laboratory experiments coupled with modeling also demonstrated how reproductive timing, initial settlement habitat, and winter cold fronts could affect population productivity.

Management considerations for Red Drum include evaluating the efficacy of stock enhancement and the need for data on adult population age distributions and population size. Genetic research holds promise to improve our understanding of population abundance and the appropriate spatial scale for effective management.

Reservoir Fisheries Habitat Restoration: New Life for an Aging Resource

The societal value of reservoirs—that is, flood control, hydropower, water supply, irrigation, and recreation—makes for a strong argument that reservoirs are the preeminent feature on the aquatic landscape. Aside from the economic benefits of other uses, 84% of freshwater angling pressure (exclusive of the Great Lakes; 23 million anglers) occurs in reservoirs and lakes with an annual economic benefit of $22.8 billion. The median age of reservoirs in the United States is roughly 60 years. New reservoir construction has been nearly at a standstill for the past decade. Declining habitat quality associated with these aging reservoirs threatens this valuable recreational and economic resource. The Reservoir Fisheries Habitat Partnership (RFHP) is tasked with developing partnerships at the local, state, and regional levels to address these habitat issues. To highlight the issues, the RFHP, the Missouri Department of Conservation, and the Aquatic Habitat Section of the AFS sponsored a full-day symposium to highlight the results of a national assessment of reservoir habitat quality, discuss efforts to establish best management practices for specific impairments on a regional scale, outline partnering efforts, highlight state fisheries programs aimed at reservoir habitat restoration, and detail specific habitat restoration projects that serve as a model for future habitat restoration efforts.
The assessment contained data from over 1,300 reservoirs nationwide and detailed regional similarities and differences in reservoir habitat impairments. Data from the assessment were used to help prioritize habitat restoration efforts by the U.S. Army Corps of Engineers on reservoirs in the Southwest Division. Two presentations were given on efforts by state fisheries management agencies in Arkansas and Oklahoma to secure water releases to maintain valuable tailwater fisheries. Given the multi-jurisdictional nature of reservoir management, the RFHP and the Friends of Reservoirs Foundation are building a network of concerned reservoir users to raise funds for and provide public support for reservoir fisheries habitat restoration efforts.

The vast majority of reservoir habitat restoration efforts are funded by and conducted by state fisheries management agencies. Examples of how dedicated funding for these efforts was secured by the Iowa Department of Natural Resources and Nebraska Game Fish and Parks were presented. Projects detailing best management practices from Arkansas, Florida, Kentucky, Missouri, and New Mexico were presented. The RFHP will continue to build on the efforts presented at the symposium to facilitate more and technically sound reservoir habitat restoration efforts.

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Use of Fishery-Independent Surveys in Stock Assessment

The main objective of this symposium was to make progress in identifying optimal survey and analytical approaches for maximizing fishery-independent (FI) data utility in support of stock assessments. Two keynote speakers (former National Marine Fisheries Service Chief Scientist and current University of South Florida Professor Steve Murawski and National Marine Fisheries Service Chief Stock Assessment Scientist Rick Methot) (1) gave examples of FI surveys from multiple regions, (2) discussed the utility of FI data to stock assessments, (3) discussed the development of advanced sampling technologies to improve survey efficiency and output, and (4) identified methods of improving the utility of FI data to assessments, including developing techniques to generate true population estimates, as opposed to relative indices of abundance. Other presentations in the symposium focused on a broad range of survey techniques (e.g., trawl, longline, gill net, trap, and video), regions (Caribbean; U.S. East, Gulf, and West coasts; Great Lakes), techniques to determine gear efficiencies (catchability), optimizing survey effort, and analytical approaches (e.g., delta general linear models, occupancy models, and caveats for using the Akaike information criterion in determining year effects in models). Symposium participants gained insight into multiple approaches to improve the utility of survey data.

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Using Social Media to Improve Communication in the Fisheries Profession and Engage the Public

The use of online social media to communicate scientific information is growing, and many are interested in how these new tools can be used in fisheries science. Among the host of outstanding research presented at the recent AFS meeting in Little Rock, the Fisheries Information and Technology Section hosted a symposium dedicated to sharing ideas on how fisheries scientists can use social networking sites (e.g., blogs, Facebook, and Twitter) to better communicate with the public. In this article, I summarize some major take-home points for those who could not attend this standing-room-only symposium.

A diversity of topics was presented throughout the day. Several presenters spoke about how fisheries scientists can use blogs to increase readership of their peer-reviewed research. A few of these blogs highlighted included Beach Chair Scientist, Science Sushi, and The Fisheries Blog. One discussion showed that Twitter is not only an excellent platform for spreading fisheries news and research but that it also can be used by employers and job seekers in the fisheries profession. Another presentation was given on a recent survey on social media use within the AFS; the survey was designed to help improve communication within the AFS. Two success stories were given about how state management agencies use social media to increase public involvement and fishing license sales.

Before lunch, President Bob Hughes led a discussion on how the AFS can use social media to improve fundraising and increase membership. One emergent point was that advertisement opportunities in online media can be more flexible and better tailored to users than printed media. Most participants also agreed that social media can be used to increase student
membership in the AFS. Another topic of interest involved coupling the AFS’s technical and nontechnical communication channels. Many scientific societies run blogs about their journals. This can increase readership by disseminating the Society’s peer-reviewed research to a wider audience.

The symposium was capped off with a panel discussion on the future use of social media in the fisheries profession. Major topics of the panel discussion included promoting civil discourse among users, transparency and authenticity, and guidelines for AFS units looking to get the most out of online social networking tools.

More details on the social media symposium can be found in the September 23rd post of The Fisheries Blog (TheFisheriesBlog.com).

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Ladies Night

For the first time, the Equal Opportunities Section (EOS) and the Student Subsection of the Education Section partnered to host “Ladies’ Night.” The brainchild of EOS President Lonnie Gonsalves, Ladies’ Night was designed to honor the contribution of women to the AFS and to share these achievements with our youngest members in a relaxed and fun environment. The event was held during the Student Social at the Museum of Discovery in a format that allowed student members to learn, interact, and build lasting professional relationships with these women. The sections highlighted founding women of the AFS, including Emmeline Moore (first female AFS president), J. Frances Allen (second woman to attend an AFS meeting), Roger Arliner Young (first African American woman to receive a doctorate in zoology), and Rachel Carson (served as editor-in-chief for the U.S. Fish and Wildlife Service before writing Silent Spring). Current members, including Gwen White (U.S. Fish and Wildlife Service), Barbara Knuth (Cornell), Usha Varanasi (National Oceanic and Atmospheric Administration, retired), Phaedra Budy (Utah State), and the late Jacqueline (Jaci) Savino (U.S. Geological Survey) were also honored for their contributions to the field of fisheries.

Six women were able to attend the event and share some words of wisdom with the students. Mary Fabrizizio (Virginia Institute of Marine Science), Donna Parrish (Vermont), and Christine Moffit (Idaho) were the night’s top honorees. All three women have served the Society from the local to the national level, including a term (or upcoming term) as Society president. Their contributions have also gone beyond the Society into the larger scientific community by mentoring students, publishing dozens of peer-reviewed articles, and serving their institutions. During the event, these women spoke about the value of “seeing someone like you” and encouraged students, especially women, to continue to work hard and stay active in the Society. In addition to the honorees of the past and present, three “rising stars” were identified. Rising stars were women identified by the EOS as individuals already extremely active within the AFS and successful in their careers. These honorees included Jesse Trushenski (Southern Illinois University-Carbondale), Shannon Brewer (Oklahoma), and Jessica Mistak (Michigan Department of Natural Resources). All those in attendance deemed the event a success. This event became as much about showcasing the value of membership to attendees as it was about highlighting the achievements of our female AFS members. More about this event can be found on the EOS website and on their new Facebook page.

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Current Research on Impacts of Unconventional Oil and Gas Extraction on Freshwaters

Recovery of unconventional oil and gas (UOG) from areas such as shale plays has increased due to increasing global energy demands as well as technological advances in drilling and hydrological fracturing. Currently more than 40% of the
world’s recoverable energy comes from UOG sources, and as
demand continues to increase, so will infrastructure develop-
ment throughout the major shale basins in the United States
and the world. The development of shale basins for UOG resources
has the potential to negatively influence freshwater ecosystems
throughout the landscape. During this symposium, speakers fo-
cused on two main aspects of current research: (1) landscape-
scale impacts on ground- and surface waters and (2) the use
of biological indicators to assess various impacts of UOG develop-
ment on streams. Landscape studies addressed localized dele-
tion of surface waters due to drilling and fracturing practices,
contamination of surface waters from improper storage and
disposal of flowback waters, erosion of sediments into streams
from construction associated with infrastructure development,
noise pollution from construction practices to nearby freshwa-
ter ecosystems, and a survey of community well water quality
within the Fayetteville shale play. Biological indicators included
algal biomass and whole-stream gross primary production as
indicators of best management practices, macroinvertebrate
communities as an indicator of increased trace elements asso-
ciated with elevated road and construction activities, and fish
community assemblages as an indicator of altered habitat and
water quality associated with development of infrastructure.
Researchers from different regions came together to assess im-
acts of UOG on freshwater ecosystems as a start to understand
how environmental context could alter impacts. This session
was organized and moderated by Sally Entrekin from the Uni-
cersity of Central Arkansas in Conway, Arkansas; Steve Filipek
from the Arkansas Game and Fish Commission; and Michelle
Evans-White from the University of Arkansas in Fayetteville,
Arkansas.

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Ecosystems Connections: Watershed Health,
Anadromous Species, and Ocean Production

Using varying approaches, methodologies, and perspec-
tives, presenters explored different facets of riverine-to-ocean
linkages via anadromous fishes. Presenters identified alosines
and salmonids as primary contributors to the transport of nu-
trients between different ecosystems, with evidence supporting
region-specific and anthropogenically induced shifts in both
directions. The role of anadromous forage fishes as major play-
ners in trophic interactions with economically valuable marine
stocks and avian and terrestrial predators was also emphasized.

Large-scale data use and modeling was presented as a tool
to evaluate the economic value of forage fishes and their preda-
tors and the dramatic impacts that overfishing of the former
could have on the latter. Models depicting anthropogenic dis-
turbance effects with biotic and abiotic factors demonstrated
the value of incorporating landscape- and regional-scale data
for informing management. Predatory demand of the recovered
Atlantic Coast Striped Bass (Morone saxatilis) was evaluated
using a bioenergetics approach, uncovering exploitation of eco-
ronically important prey. Bioenergetics modeling was utilized
to evaluate delay as a factor contributing to migration failure
of iteroparous American Shad (Alosa sapidissima) in the Con-
nnecticut River, with implications for a subsequent net increase
in marine nutrients. The growing abundance of American Shad
on the West Coast of North America was presented as potential
compensation for diminished influx of marine nutrients result-
ing from declines in returning adult Pacific salmon (Oncorhyn-
chus spp.). The assignment of high marine mortality of salmon
popularly used for prediction of adult returns was challenged
by evidence for substantial in-river mortality of out-migrating
smolts. Avian predation and the loss of necessary habitat were
emphasized as primary sources of mortality. The role of disease
and potential compounding effects of stress were presented as
yet another source of migration failure or mortality at all life
stages of most fishes but often unrecognized except in cata-
strophic cases.

The importance of historic data, especially for alosines,
was demonstrated not only for ecological temporal comparisons
but also to gauge stakeholder incentives for alosine restoration
efforts and cultural importance. Key characteristics of alosines
were outlined as reasons for their value, even in regions that
may have since lost historic River Herring runs. Indeed, the
importance of River Herring on the Eastern seaboard was esti-
mated to rival that of Pacific Salmon on the West Coast. A need
for “societal reprioritization” was stressed, dependent on the
strong cultural ties of communities to these species. Successful
restoration of essential habitat by eliciting public support and
resulting in satisfied parties was identified as a priority.

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The AFS is plum full of unique characters who also happen to possess great character. These genuine, caring, and oftentimes odd fisheries professionals are the lifeblood of our Society. The personal and professional relationships spawned from AFS involvement are among the Society’s greatest benefits. Such benefits are increasing more rapidly nowadays. The continued infusion of social media into our daily lives has decreased the geographic obstacle to building stronger personal bonds. As a result, we now know much more about the personal lives of more of our colleagues than ever before.

I enjoy getting to know better the unique and like-minded fisheries professionals of our Society on a personal level. I guess I’m “new school” for fisheries in this respect—I am an extrovert. In fact, my mother always said I’ve never met a stranger. Funny thing is that both communication and relationships are two-way streets. Never meeting a stranger also means never being a stranger.

In general, I feel as though I am an open book. I don’t hide how I feel; I’m a pretty emotionally honest fellow. One thing that I haven’t talked about much that has always bothered me is my weight. I’m a big guy and probably am always going to be a big guy. However, that doesn’t mean I can’t be a healthy big guy.

I thought I was doing pretty well managing my weight, but over the past several years life hurled some additional challenges my way. My family and I focused our efforts on beating back these trials and financially surviving. We did it, but it was an all-consuming effort and, in the process, my health took a back seat.

As the additional trials began to subside I began searching, working, trying to find a way to get back to a healthy weight while balancing the other aspects of life. However, I wasn’t doing very well and was growing increasingly concerned about my health. I shared my concerns with my wife and as a result I made this Facebook post on May 14, 2013.

Not to surprise anyone but I have a weight problem, I’ve battled it most of my life, won some battles and lost some others. I’m certainly tired of it and my beautiful wife Vanessa Onyskow-Lang has suggested having a goal to work for like I did in wrestling. Something I have wanted to do for a while is participate in the “Spawning Run” 5K at the annual American Fisheries Society meeting. So that’s my goal, that on Sept. 11 in Little Rock I take a break from the meeting and go do the Spawning Run. That’s less than 4 months and I’m going for it. I’m not the only fish scientist on here that could use such a goal and is going to be at Little Rock, so who wants to join me?

The response was overwhelming and in short order this post received 73 likes and 58 comments. Good old Don Jackson wasn’t lying when he said the AFS is a “very human Society.” We greatly care about one another and this sort of support is a testament to that fact.

The encouragement was exciting and scary. I put my goal out there, and as I am a man of my word, I now had to actually do it—Oh, crap! I met with my doctor, changed some eating habits, started on the “Couch to 5K” workout plan (on my elliptical) and good things started happening.

Not all who were going to support me were going to make the meeting but nevertheless they showed their support in their own way and started their own journey to better health. Knowing that I didn’t want to let these people down was a huge motivator, and seeing that my courage of putting something very personal “out there” had inspired others to make healthier decisions was most rewarding.

Two colleagues/friends really went the extra mile. Drs. Jesse Trushenski and Steve McMullin committed to walking with me. How supportive to know that I wouldn’t be the only one in the back of the Spawning Run pack. The thought of being in the back, well behind, with people waiting on me to finish so they could close down the event, had almost prevented me from attempting the run. Having Steve and Jesse walking next to me removed that issue entirely.

So how much weight did I lose? What was our time? Well, it really doesn’t matter. I am indeed healthier, my friends are healthier, and we’re going to keep getting healthier. It wasn’t a race to us. It was a symbol of friendship and the strong personal relationships that involvement in the AFS facilitates.

In Québec we’ll be going for two Spawning Runs in a row. I know I’m not the only fisheries professional with a higher W than necessary, so consider this your personal invitation to join the back of the pack. Don’t feel nervous, it doesn’t matter if we’ve never met, because, remember, I’ve never met a stranger. You are truly welcome to join.

Tom Lang, Texas Parks and Wildlife Department—Inland Fisheries. E-mail: Tom.Lang@tpwd.texas.gov

Steve McMullin and Tom Lang crossing the finish line. Photo credit: Tom Lang.
The 2012–2013 Fenske Fellowship: Structured Decision Making in Dam Management

Lisa Peterson
Quantitative Fisheries Center, Department of Fisheries and Wildlife, Michigan State University, 153 Giltner Hall, East Lansing, MI 48824. E-mail: peter710@msu.edu

Every day we are faced with decisions. They range from simple choices to intricate, multifaceted issues. Natural resource management is a field where nearly every significant decision is complex. Structured decision making is a way to approach these decisions in a systematic and rational way. When decisions need to be made about resources, making a good decision can save money, avert disasters, and protect fragile environments. Dam management is one of the many complex decisions faced by managers. With the push to restore native species, dam removal has become the focus of many project proposals. However, managers must take into account a variety of conflicting objectives, from aquatic connectivity to preventing the spread of invasive species. It is important to determine which objectives are relevant and to look at the trade-offs and uncertainties in a transparent and organized way. This is where structured decision making can be most useful.

JAN FENSKE AND THE FENSKE EXCELLENCE IN FISHERIES MANAGEMENT FELLOWSHIP

As the recipient of the 2012–2013 Janice Lee Fenske Excellence in Fisheries Management Fellowship, I joined a group of intelligent and motivated women who are continuing to uphold the legacy of the first female fisheries biologist to work for the Fisheries Division of the Michigan Department of Natural Resources. Although I never met her, Jan Fenske is a constant inspiration. She was a dedicated and hard worker, two characteristics essential for surviving in a male-dominated field. She was committed to mentoring—having overcome the obstacles placed before her, she dedicated herself to helping others along their own paths. These qualities all resonate in this fellowship, making it a true testament to Jan’s memory.

This fellowship requires the recipient to work with a mentor from a management agency on a project that answers a management need. My mentor for this fellowship is Dr. John Dettmers, a senior fisheries biologist for the Great Lakes Fishery Commission (GLFC). My first day working at the GLFC Secretariat Office in Ann Arbor, Michigan, was a whirlwind of new faces, discoveries of the many different projects John was involved in, and stories from him and others about what it is like to work for a management agency. Talking to John and the other talented people at the GLFC made me realize how valuable this experience would be and how fortunate I was to have this opportunity as a graduate student.

In my discussions with John, I was immediately drawn to the issue of dam management. I could clearly see the multitude of concerns surrounding dam management, the foremost being the conflicting objectives of restoring aquatic connectivity for native species, while still blocking the passage of invasive species such as Sea Lamprey (Petromyzon marinus). With so many dams located around the Great Lakes, there was a clear need for transparency and consistency of the decisions being made. My advisor at Michigan State University, Dr. Mike Jones, had introduced me to the idea of decision analysis and structured decision making (SDM) to help with difficult decisions. John and I saw the opportunity to use that knowledge to fill this need for the GLFC. Under the guidance of John and Mike, I began the ambitious project of developing a framework for applying SDM to decisions about barriers.

THE DAM PROBLEM AND SDM

Although the exact count of dams in the United States is undocumented, the U.S. Army Corps of Engineers National Dam Inventory has put the number of large dams well into the tens of thousands and the number of low-head barriers into the millions. In the Great Lakes drainage basin alone, some researchers estimate there are more than a quarter-million barriers to fish movement. Every one of these barriers has its own story. Some unnamed dams were created solely for the purpose of Sea Lamprey control, blocking large river systems from this destructive species. Other dams have names and detailed histories, such as Caledonia Dam in Ontario, Canada. This dam allowed the city of Caledonia to prosper back in the 19th century by allowing shipping access along the entirety of the Grand River. Every dam also has its own characteristics, from height, function, and structural integrity to historical value, ownership, and
Involving stakeholders at each step enhances the effectiveness of SDM and engenders support for the final decision. This is especially important if the issue is contentious. Understanding and incorporating stakeholder objectives helps managers avoid controversy and litigation, while improving the comprehensiveness of the decision process. Stakeholder support can also lead to more effective and efficient management by increasing communication and building trust, both between stakeholder groups and between stakeholders and managers.

To tailor these steps specifically for decisions about barriers, I needed to understand the wide range of objectives involved with dams. At the encouragement of my mentor, John, I began reaching out to the Council of Lake Committees (CLC) to provide me with feedback and real-world barrier examples. The CLC is composed of state, tribal, and provincial agency representatives from the different jurisdictions around the Great Lakes. This body was my intended audience, because they were already developing protocols related to barrier management. We agreed that my project could develop additional guidance to support those protocols. The first time I presented my in-progress work to the CLC I knew that this was the type of experience that the Fenske Fellowship was promoting. As I stood in front of a room full of fisheries managers, who were mostly men, I felt that Jan Fenske would be proud of the opportunities afforded by her fellowship.

Through the communications with the CLC and discussions with John, I developed my framework to be specific for barrier issues. After describing SDM and some of the benefits of this process, I described each of the steps in the context of barrier decisions. I also included potential applications of these steps to real-world dams, as well as strategies to elicit productive stakeholder participation.

As I put the final touches on my framework I am already strategizing ways to distribute this document more widely. I believe that the work I have done and the resulting framework I have created could be of real use to managers and stakeholders facing these types of complex decisions.

ENDURING LESSONS OF THE FENSKER FELLOWSHIP

Having the opportunity to work with John and the rest of the GLFC on a project that is distinct from my master’s research has been a valuable experience. Delving into the world of SDM and investigating the issues involved with dam projects has expanded and challenged my thinking. I had to think not only about the science but also about the management implications and the human dimensions involved. With my mentors guiding me, I navigated the murky waters of conflicting objectives and controversial dam issues—an area where there are no clear answers—and found a way to use SDM to chart a path that others could follow. It is this insight into the complicated world of natural resource management that I gained thanks to my participation with the Fenske Fellowship, and this knowledge will help me throughout my career.

For more information on structured decision making please see the following references:

The Steven Berkeley Marine Conservation Fellowship Winners

This annual fellowship was created to honor the memory of Steven Berkeley, who passed away from cancer in June 2007. Throughout his career, Berkeley was a passionate advocate of conserving fish populations and improving fisheries management by integrating basic research results and scrutinizing fundamental assumptions about fish stocks. On the East Coast, he examined stock composition and bycatch issues in large pelagic fishes and developed management plans as a staff member of the South Atlantic Fishery Management Council. After moving to the West Coast, he served on the Science and Statistical Committee for both the North Pacific and Pacific councils. His research on maternal effects in rockfishes has been widely recognized in demonstrating the need to protect older females in long-lived species, particularly through management measures such as marine protected areas. The 2013 recipient of the Berkeley Fellowship is Christian Conroy, a graduate student at Northeastern University’s Marine Science Center. Honorable mention awards go Alexander Filous, from the University of Hawaii’s Fisheries Ecology Research Laboratory, and Alexis Jackson, from the University of California Santa Cruz.

WINNER—Christian Conroy, a graduate student at Northeastern University’s Marine Science Center, and his advisor, Dr. Jonathan Grabowski, are exploring life history diversity, an important and often overlooked aspect of natural populations, in Atlantic Cod (Gadus morhua) stocks of the Gulf of Maine. Depending on whether it’s redundant or complementary, life history diversity may provide stability and resilience and consequently may be particularly important to exploited populations. Fishermen, managers, and scientists have recognized co-occurring morphological variants of cod for at least a century, yet little is known about their role in cod population structure. Chris will be investigating how these variants differ in their distribution, behavior, ecology, and importance to cod population persistence using conventional fisheries techniques, such as acoustic telemetry and stomach content, age, and genetic analyses, coupled with population dynamics modeling. Chris hopes that the findings of this research on intrapopulation biodiversity can inform management of Atlantic Cod in the Gulf of Maine. This work builds on Chris’s master’s thesis (with Dr. Dave Secor) at the University of Maryland’s Chesapeake Biological Laboratory on Striped Bass (Morone saxatilis) life history diversity.

HONORABLE MENTION—Alexander Filous is a master’s of science student at the University of Hawaii’s Fisheries Ecology Research Laboratory studying under his advisor, Dr. Alan Friedlander. He grew up fishing on the Northern California coast and has always been very passionate about fishing and the conservation of fisheries resources. He went to the University of Idaho for his undergraduate degree in fisheries resources, where he focused his studies on salmonoids under his advisor, Dr. Brian Kennedy, and studied fisheries with Dr. Christine Moffitt and the art of fly-fishing under his instructor, Brian Mahoney. At the University of Hawaii, he is currently studying the fisheries of the tropical Pacific with a focus on the biology of bonefishes and their fisheries across the Pacific islands, as well as the movements of apex predators in the Molokini Crater Marine Life Conservation District in Maui. For these projects, he is utilizing various fisheries techniques including conventional tagging, diet analysis, and acoustic telemetry. After the completion of his graduate education, he hopes to find a job where he can produce science that can help guide the development of sustainable fisheries in the Indo-Pacific and encourage the engagement of fishermen in the scientific process.

HONORABLE MENTION—Alexis Jackson is entering her final year at the University of California Santa Cruz where she has been working in the laboratory of Dr. Giacomo Bernardi. Her dissertation work focuses on using mitochondrial DNA, microsatellites, and single nucleotide polymorphisms to assess genetic connectivity and population structure of commercial groupers. In particular, she has focused on groupers that form spawning aggregations. Due to the spatial and temporal predictability of spawning aggregations, these fishes are easily and quickly exploited by fishermen. Her two focal species are Leopard Grouper (Mycteroperca roxacea) in the Gulf of California and Nassau Grouper (Epinephelus striatus) in the Caribbean Sea. Both species have experienced significant population declines due to aggregation-targeted fishing. Results from her dissertation work will be used to implement spatially explicit fisheries management plans. In the case of Nassau Grouper, results were contributed to the petitioning process to include Nassau Grouper on the U.S. Endangered Species Act in December 2012.
The Steven Berkeley Marine Conservation Fellowship

This fellowship was created by the American Fisheries Society (AFS) in 2007 to honor the memory of Steven Berkeley, a dedicated fisheries scientist with a passionate interest in integrating the fields of marine ecology, conservation biology, and fisheries science to improve fisheries management. Berkeley was a long-time member of the AFS and a member of the first board of directors of the Fisheries Conservation Foundation. The fellowship includes a competitively based $10,000 award to a graduate student actively engaged in thesis research relevant to marine conservation. Research topics may address any aspect of conservation; a focus on fisheries issues is not required.

Requirements for application:

1. The applicant must be a student officially accepted or currently enrolled in a M.S. or Ph.D. program.

2. The student must be actively engaged in thesis research related to some aspect of marine conservation; the intent of the award is to support ongoing research costs.

3. The student must be a member of the AFS in good standing; membership can be obtained at the time of application submission.

4. Applications must be e-mailed by February 1, 2014.

Berkeley Fellowship application details are located on the AFS Marine Fisheries Section website: sfrc.ufl.edu/mfs and click on Berkeley Fellowship.

Q: How do I track multiple fast-moving fish?

A: Lotek wireless telemetry systems - near collision immunity and 2 second resolution

www.LOTEK.com
Call for Award Nominations: 2014 American Fisheries Society Awards

The American Fisheries Society (AFS) is seeking nominations and applications for several 2014 awards. Award recipients will be honored at the 144th Annual Meeting to be held in Québec City, August 17–21, 2014. Nominations typically require a candidate’s name, full contact information, biographical information, and/or history of service to the Society. Some awards require additional nomination materials. For more information on how to nominate an individual or organization and to find the criteria for selection and other important nomination information, please visit fisheries.org and click on Awards, or contact Gail Goldberg, AFS awards coordinator, at ggoldberg@fisheries.org.

AWARD OF EXCELLENCE
The Society’s highest award for scientific achievement is presented to a living AFS member for original and/or outstanding contributions to fisheries and aquatic biology.

Nomination deadline: April 1, 2014
Contact: Christine Moffitt, Committee Chair
Phone: (208) 885-7047
E-mail: cmoffitt@uidaho.edu (subject: Award of Excellence)

CARL R. SULLIVAN FISHERY CONSERVATION AWARD
Presented to an individual or organization for outstanding contributions to the conservation of fishery resources. Eligibility is not restricted to AFS members, and accomplishments can include political, legal, educational, scientific, and managerial successes.

Nomination deadline: April 1, 2014
Contact: Donna Parrish, Committee Chair
Phone: (802) 656-2693
E-mail: dparrish@uvm.edu (subject: Carl R. Sullivan Award)

DISTINGUISHED SERVICE AWARD
Recognizes outstanding contributions of time and energy for special projects or activities by AFS members. The number of recipients may vary. A single member, a group of members, and AFS staff are eligible candidates.

Nomination deadline: April 1, 2014
Contact: Donna Parrish, Committee Chair
Phone: (802) 656-2693
E-mail: dparrish@uvm.edu (subject: Distinguished Service Award)

EMERGING LEADERS MENTORSHIP AWARD
The AFS Emerging Leaders Mentorship Award Program was established to develop future leaders of the Society, and the fisheries profession as a whole, by providing selected candidates an opportunity to participate for one year in activities of the AFS Governing Board. Candidates must be full AFS members in good standing who submit complete application packages. Awardees will be paired with a mentor who is a member of the Governing Board and will be awarded up to $500 to offset costs associated with attending the Management Committee meeting, the Governing Board Retreat, and the Governing Board Meeting that are held in conjunction with the AFS Annual Meeting.

Nomination deadline: April 1, 2014
Contact: Jim Bowker, Committee Chair
Phone: (406) 599-9924
E-mail: jimmybtmt123@yahoo.com (subject: Emerging Leaders Mentorship Award)

MERITORIOUS SERVICE AWARD
Presented annually to an individual AFS member for loyalty, dedication, and meritorious service to the Society over a long period of time and for exceptional commitment to the programs, objectives, and long-term goals of the Society.

Nomination deadline: April 1, 2014
Contact: Bob Curry, Committee Chair
Phone: (919) 707-0221
E-mail: robert.curry@ncwildlife.org (subject: Meritorious Award)

OUTSTANDING CHAPTER AWARD
Recognizes outstanding professionalism, active resource protection, and enhancement programs, as well as a strong commitment to the mission of the Society. Three awards are given, one for small chapters, one for large chapters, and one for a student subunit of a chapter.

Nomination deadline: April 1, 2014
Contact: Gary Whelan, Committee Chair
Phone: (517) 373-6948
E-mail: whelang@michigan.gov (subject: Outstanding Chapter Award)
PRESIDENT’S FISHERY CONSERVATION AWARD
Presented in two categories: (1) an AFS individual or unit or (2) a non-AFS individual or entity, for singular accomplishments or long-term contributions that advance aquatic resource conservation at a regional or local level.

Nomination deadline: April 1, 2014
Contact: John Boreman, Committee Chair
Phone: (919) 998-8145
E-mail: John.Boreman@ncsu.edu (subject: President’s Fishery Conservation Award)

WILLIAM E. RICKER RESOURCE CONSERVATION AWARD
Presented to any entity (individual, group, agency, or company) for accomplishment or activity that advances aquatic resource conservation that is significant at a national or international level.

Nomination deadline: April 1, 2014
Contact: John Boreman, Committee Chair
Phone: (919) 998-8145
E-mail: John.Boreman@ncsu.edu (subject: William E. Ricker Award)

THE EMMELINE MOORE PRIZE
The AFS has established a career achievement award, named after the first female AFS president, Emmeline Moore (1927–1928), to recognize efforts of an individual member in the promotion of demographic diversity in the society. This award will be presented to an individual who demonstrates strong commitment and exemplary service to ensuring equal opportunity access to higher education in fisheries and/or professional development in the broad range of fisheries science disciplines.

Nomination Deadline: April 1, 2014
Contact: Lonnie Gonsalves, Committee Chair
Phone: (410) 226-5193
E-mail: lonnie.gonsalves@noaa.gov (subject: Emmeline Moore Prize)

EXCELLENCE IN PUBLIC OUTREACH
Presented to an AFS member who goes the “extra mile” in sharing the value of fisheries science/research with the general public through the popular media and other communication channels.

Nomination deadline: April 1, 2014
Contact: Cleve Steward, Committee Chair
Phone: (206) 719-1260
E-mail: cleve.steward@amec.com (subject: Excellence in Public Outreach)

HONORARY MEMBERSHIP
Presented to individuals who have achieved outstanding professional accomplishments or have given outstanding service to the Society. Honorary Members must be nominated by at least 100 active members and elected by a two-thirds majority of active members voting. Please include in the nomination letter the nominee’s title and full contact information (i.e., address, e-mail, phone, etc.) to complete the package.

Nomination deadline: April 1, 2014
Contact: Gail Goldberg
Phone: (301) 897-8616 X201
E-mail: ggoldberg@fisheries.org (subject: Honorary Membership)

RETIRED MEMBERS TRAVEL AWARD FOR THE AFS ANNUAL MEETING
The AFS has established this travel award to encourage and enable members of the Society to attend Annual Meetings, particularly those members who might play a more active role in the meeting. The Society recognizes that some retired members who desire to participate in the Annual Meeting might be inhibited for financial reasons. Retired members may not have funds for travel to meetings that were available to them while employed. Therefore, this award is meant for those members who truly have a need for financial assistance.

Nomination deadline: April 1, 2014
Contact: John Boreman, Committee Chair
Phone: (919) 998-8145
E-mail: John.Boreman@ncsu.edu (subject: Retired Members Travel Award)

STUDENT WRITING CONTEST
Recognizes students for excellence in the communication of fisheries research to the general public. Undergraduate and graduate students are asked to submit a 500- to 700-word article explaining their own research or a research project in their lab or school. The winning article will be published in Fisheries.

Submission deadline: April 1, 2014
Contact: Cleve Steward, Committee Chair
Phone: (206) 719-1260
E-mail: cleve.steward@amec.com (subject: Student Writing Contest)

AWARDS ADMINISTERED BY SECTIONS

Education Section

EXCELLENCE IN FISHERIES EDUCATION AWARD
The American Fisheries Society Excellence in Fisheries Education Award was established in 1988. The award is administered by the Education Section and is presented to an individual to recognize excellence in organized teaching and advising in some aspect of fisheries education.
JOHN E. SKINNER MEMORIAL FUND AWARD

The John E. Skinner Memorial Fund was established in memory of John Skinner, former California–Nevada Chapter and Western Division AFS President. The fund provides monetary travel awards (up to $800 per award) for deserving graduate students or exceptional undergraduate students to attend the AFS 2014 Annual Meeting, to be held in Québec City, August 17–21, 2014.

Completed applications (for both student and advisor) must be received no later than April 1, 2014.
Contact: Dan J. Daugherty, Committee Chair
Phone: (830) 866-3356 x 211
E-mail: Dan.Daugherty@TPWD.Texas.gov (subject: John E. Skinner Award)

Equal Opportunities Section

J FRANCES ALLEN SCHOLARSHIP AWARD

The AFS is pleased to announce that applications are being accepted until April 1, 2014, for the J Frances Allen Scholarship for a female doctoral fisheries student. The J Frances Allen Scholarship was established in 1986 to honor Allen, who pioneered women’s involvement in the AFS and in the field of fisheries. The scholarship fund was established with the intent of encouraging women to become fisheries professionals.

Electronic applications deadline: April 1, 2014.
Contact: Abigail Lynch, Committee Chair
Phone: (703) 216-0109
E-mail: ajlync@gmail.com (subject: J Frances Allen Scholarship)

Marine Fisheries Section

THE STEVEN BERKELEY MARINE CONSERVATION FELLOWSHIP

This fellowship was created by the AFS in 2007 to honor the memory of Steven Berkeley, a dedicated fisheries scientist with a passionate interest in integrating the fields of marine ecology, conservation biology, and fisheries science to improve fisheries management. Berkeley was a long-time member of the AFS and a member of the first board of directors of the Fisheries Conservation Foundation. The fellowship includes a competitively based $10,000 award to a graduate student actively engaged in thesis research relevant to marine conservation.

Application deadline: February 1, 2014
Contact: Howard Williams
E-mail: hwilliams@fisheries.org (subject: Steven Berkeley Fellowship)
American Fisheries Society Section Awards for 2013

The following American Fisheries Society (AFS) sections announced award recipients at the Annual Meeting in Little Rock, Arkansas:

BIOENGINEERING SECTION
Career Achievement Award: Charles Coutant
Ned Taft Scholarship: Elsa Goerig

CANADIAN AQUATIC RESOURCES SECTION
Peter A. Larkin Award: Ph.D. level—Jake Browncombe; Runner up: Graham Raby
M.Sc. level—Samantha Wilson; Runners up: Nicholas Burnett and Sean Naman

EDUCATION SECTION
Young Professional Achievement Award: Michelle Walsh
AFS BEST STUDENT POSTER AWARD AT THE 2012 ANNUAL MEETING IN SAINT PAUL, MINNESOTA
Winner: Geoffrey H. Smith, Jr., University of Florida
Honorable Mention: Liza R. Walleser, University of Wisconsin–La Crosse

AFS/SEA GRANT BEST STUDENT PAPER AT THE 2012 ANNUAL MEETING IN SAINT PAUL, MINNESOTA
Winner: Jason R. Neuswanger, University of Alaska Fairbanks
Honorable Mention: Ashley Stasko, Laurentian University

ESTUARIES SECTION
Student Travel Award: Ryan W. Schloesser, Shane Ramee, Shelley Edmundson, and Konstantine John Rountos

FISHERIES AND INFORMATION TECHNOLOGY SECTION
Best Student Poster Award: Brittany Schwartzkopf, Louisiana State University

FISH CULTURE SECTION
Student Travel Award: Shane Ramee and Alichia Sunflower Wilson
Best Paper in North American Journal of Aquaculture: Brian Bosworth

FISH HEALTH SECTION
Snieszko Student Travel Award: Amy Teffer, University of Victoria

FISHERIES ADMINISTRATION SECTION
2013 Outstanding Sport Fish Restoration
SPORT FISHERY DEVELOPMENT AND MANAGEMENT:
• Habitat Acquisition or Improvement Category: Nebraska Game and Parks Commission, Nebraska’s New Reservoir Construction Program

FISHERIES MANAGEMENT SECTION
Award of Excellence: Brian Murphy and Dennis Scarnecchia
Conservation Achievement Award: John G. Shedd Aquarium, Chicago, Illinois
Hall of Excellence: Dave Philipp and Bob Ditton

GENETICS SECTION
James E. Wright Graduate Award: Darren Wood and Cassidy Hahn
Transactions of the American Fisheries Society 141:1374–1388

MARINE FISHERIES SECTION
Steven Berkeley Marine Conservation Fellowship: Christian William Conroy, Northeastern University
Honorable Mention: Alexis Jackson, University of California Santa Cruz, and Alex Filous, University of Hawaii
Oscar E. Sette Award: Phillip Goodyear
Student Travel Award: Christopher Hollenbeck and Pablo Granados-Dieseldorff

SOCIOECONOMICS SECTION
A Stephen Weithman Best Student Paper Award Winner: Ed Camp, University of Florida
Honorable Mentions: Ingrid Biedron, Cornell University, and Julia Beaty, University of Maine

WATER QUALITY SECTION
Best Student Poster Award: Brandy Bossle, University of South Carolina–Aiken

• Access Category: Tennessee Wildlife Resources Agency, Morris Ferry Boat and Bank Fishing Access: Revived and Alive Again! Project
• Research and Surveys Category: North Carolina Wildlife Resources Commission, Project Using the DIDSON to Evaluate the Effectiveness of Different Fish Attractors in Turbid Reservoirs
• Aquatic Education Category: Florida Fish and Wildlife Conservation Commission, Fishing and Basic Boating Skills Camp Pilot and Expansion Project
Fisheries and Oceans Canada, the Canadian Aquatic Resource Section, the Atlantic International Chapter, and the Northeast Division of the American Fisheries Society are pleased to announce the fourth call for papers for the 144th Annual Meeting of the American Fisheries Society in Québec City, Canada! The meeting’s theme—“From Fisheries Research to Management: Think and Act Locally and Globally”—should foster presentations and discussions that consider topics such as:

• Growing evidence for meaningful local adaptation despite the lack of neutral genetic differentiation;
• Incorporating metapopulation concepts into regional assessment and management actions;
• Research on and management of transboundary stocks;
• Shifting source-sink dynamics in metapopulations under climate change, and their implications for conservation;
• Research on the precautionary approach, including science, management, and socioeconomic aspects;
• Eel and salmon biology, ecology, and management; and
• Any other topic relevant to the theme.

AFS 2014 will be held on 17-21 August 2014 at the Québec City Convention Centre, next to the historic Old City. This fortified city on the banks of the Saint-Lawrence River is a UNESCO World Heritage Site treasure. Come explore its multitude of cafés, boutiques, and varied night life!

**GENERAL INFORMATION**

The scientific program consists of three types of sessions: Symposia (oral presentations organized by individuals or groups with a common interest), Contributed Oral Presentations (grouped into sessions by topic), and Contributed Poster
Presentations (organized to coincide with either symposia or contributed oral presentation topics). Fisheries professionals are invited to submit symposia proposals and abstracts for oral or poster presentations that address the meeting’s theme or that are relevant to fisheries. We encourage participation of fisheries professionals from academia (professors and especially students), from all levels of government, from First Nations, and from the private sector. We strongly encourage topics related to marine systems and invertebrate resources.

Please note that deadlines for submission of symposia and contributed papers, and for registration, will be firm. **Deadlines will not be extended and registration will not be reopened!**

**SYMPOSIA**

The Program Committee invites proposals for symposia. Symposia related to the meeting theme will receive priority, and those not addressing the meeting theme should be of general interest to AFS members. The Program Committee also strongly encourages integrative symposia that span freshwater and marine systems (e.g., freshwater and marine phases of eel and salmon, stock assessment methods, etc.).

Already, the large and international Early Life History Section of AFS has confirmed that it will hold its annual Larval Fish Conference as a symposium of this meeting.

Symposium organizers are responsible for recruiting presenters, soliciting their abstracts, and directing them to submit their abstracts and presentations through AFS online submission forms. The Program Committee will work with symposium organizers to incorporate appropriate presentations that were submitted as contributed papers. A symposium should include a minimum of 10 presentations. Time slots for oral presentations are limited to 20 minutes, but multiple time slots (i.e., 40 or 60 minutes) may be offered to keynote symposium speakers.

Symposium proposals must be submitted by **10 January 2014**. All symposium proposal submissions must be made using the AFS online symposium proposal submission form available on the AFS website (www.fisheries.org). The Program Committee will review all symposium proposals and notify organizers of acceptance or refusal by **31 January 2014**. Please note that once the core speakers of a symposium are confirmed, organizers will use the AFS listserv to contact additional potential speakers, especially students and young professionals with whom they may not be familiar, to broaden participation by the membership. If accepted, symposium organizers must submit a complete list of all confirmed presentations and titles by **7 March 2014**. Symposium abstracts (in the same format as contributed oral and poster abstracts; see below) are due by **14 March 2014**.

**FORMAT FOR SYMPOSIUM PROPOSALS**

(Submit using AFS online symposium submission form)

When submitting your abstract, include the following:

1) **Symposium title**: Brief but descriptive.

2) **Organizer(s)**: Provide name, affiliation, telephone number, and e-mail address of each organizer. The first name entered will be the main contact person.

3) **Chairs**: Supply name(s) of individual(s) who will chair the symposium.

4) **Description**: In 300 words or less, describe the topic addressed by the proposed symposium, the objective of the symposium, and the value of the symposium to AFS members and participants.

5) **Format**: Indicate whether the symposium format is for oral presentations only or a mix of oral and poster presentations.

6) **Presentation requirements**: Speakers should use PowerPoint for presentations.

7) **Audiovisual requirements**: LCD projectors and laptops will be available in every room. Other audiovisual equipment needed for the symposium will be considered, but computer projection is strongly encouraged. Please list special audiovisual requirements.

8) **Special seating requests**: Standard rooms will be arranged theater-style. Please indicate special seating requests (for example, “After the break, a panel discussion with seating for 10 panel members will be needed”).

9) **List of presentations**: Please supply information on potential presenters, tentative titles, and oral or poster designations.

10) **Sponsors**: If applicable, indicate sponsorship. Please note that a sponsor is not required.

**CONTRIBUTED ORAL AND POSTER PRESENTATIONS**

The Program Committee invites abstracts for sessions of contributed oral and poster presentations. Authors must indicate their preferred presentation format:

1. Contributed oral presentation only;
2. Contributed poster presentation only;
3. Contributed oral presentation preferred, but poster presentation acceptable.

Only one contributed oral presentation will be accepted for each senior author. Contributed oral presentations will be organized by 20-minute time slots (14 minutes for presentation, 3 minutes for questions, and 3 minutes for room change or further questions). All oral presenters are expected to deliver PowerPoint presentations.

We encourage poster submissions because of the limited time available for oral presentations. The program will include a dedicated poster session to encourage discussion between poster authors and attendees. Presenters need to bring hard copies of their poster.

**STUDENT PRESENTERS**

Student presenters must indicate whether they wish their contribution to be considered for competition for a best presentation (paper or poster, but not both) award. If the response is “no,” the presentation will be considered for inclusion in the Annual Meeting by the Program Committee but will not receive further consideration by the Student Judging Committee. If the response is “yes,” the student will be required to submit an application to the Student Judging Committee. Components of the application will include an extended abstract and a check-off from the student’s mentor indicating that the study is at a stage appropriate for consideration for an award.
ABSTRACT SUBMISSION

Abstracts for contributed papers and poster papers must be received by 14 February 2014. All submissions must be made using the AFS online abstract submission form, available at www.fisheries.org. When submitting your abstract:

- Provide a brief but descriptive title, avoiding acronyms or scientific names in the title unless the common name is not widely known;
- List all authors, their affiliations, addresses, telephone numbers, and e-mail addresses;
- Provide a summary of your findings and restrict your abstract to 200 words;
- Provide two prioritized keywords.

Late submissions will not be accepted. AFS does not waive registration fees for presenters at symposia, workshops, or contributed oral or poster presentation sessions. All presenters and meeting attendees must pay registration fees. Registration forms will be available on the AFS website (www.fisheries.org) beginning May 2014. Register early for cost savings!

PROGRAM COMMITTEE CONTACTS

Program Co-Chairs:
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FORMAT FOR ABSTRACTS

Title: An Example Abstract for the AFS 2014 Annual Meeting

Format: Oral

Authors: Castonguay, Martin. Fisheries and Oceans Canada, Maurice Lamontagne Institute, 850 route de la Mer, C.P. 1000 Mont-Joli, QC G5H 3Z4; 418-775-0634; martin.castonguay@dfo-mpo.gc.ca

Sainte-Marie, Bernard. Pêches et Océans Canada, Institut Maurice-Lamontagne, 850 route de la Mer, C.P. 1000 Mont-Joli, QC G5H 3Z4; 418-775-0617; bernard.sainte-marie@dfo-mpo.gc.ca

Presenter: Martin Castonguay

Abstract: Abstracts are used by the Program Committee to evaluate and select papers for inclusion in the scientific and technical sessions of the 2014 AFS Annual Meeting. An informative abstract contains a statement of the problem and its significance, study objectives, principal findings, and applications. The abstract conforms to the prescribed format and must be no more than 200 words in length.

Student presenter: No.


AFS Seeks Comment on Mining and Oil and Gas Extraction Policy

Jesse Trushenski

Resource Policy Committee Chair, American Fisheries Society. E-Mail: saluski@siu.edu.

BACKGROUND

The AFS Resource Policy Committee (RPC) develops Society policy statements via a process outlined in its Procedures Manual (fisheries.org/docs/about_procedure.pdf, page 92). R. M. Hughes, F. Amezcue, W. M. Daniel, J. S. Franks, W. Franzin, D. MacDonald, E. Merriam, P. Pompeu, L. Reynolds, L. Roulson, and C. A. Woody have developed a position paper and draft policy statement. The proposed draft is intended to replace the 1995 policy statement entitled, “Effects of Surface Mining on Aquatic Resources in North America.” The RPC reviewed the position paper and draft policy statement and presented them to the AFS Governing Board. On September 7, 2013, the Governing Board unanimously approved both documents for consideration by the membership and the general public.

With this article, the draft policy statement and position paper (see link below) are available for the requisite 60-day comment period before the RPC and Society present the policy statement to the AFS membership for a vote. The RPC encourages AFS members to review the draft policy statement and position paper and provide constructive recommendations to improve both documents and ensure the Society’s position on these issues is relevant, appropriate, and based on science. To access the draft policy statement and position paper and to submit your comments, visit fisheries.org/afsseekscomment.

EXECUTIVE SUMMARY AND PROPOSED POLICY

Mining and oil and gas extraction have the potential to cause substantial negative impacts on water quality, hydromorphology (physical habitat structure), aquatic biota, and fisheries, including destruction and contamination of receiving waters; significantly altered algal, macroinvertebrate, and fish assemblages; and impairments of aquatic-dependent wildlife. For example, at low concentrations, mining-associated contaminants, such as copper, can impair salmonid olfactory function, making salmon more susceptible to predation, altering salmon migratory behavior, increasing disease susceptibility, and reducing productivity. Despite predicted compliance in permit conditions, most operating metal mines have violated water quality criteria multiple times. In the United States, federal law transfers metal wealth from the U.S. public to mining companies, and shifts clean-up liability from those companies to U.S. taxpayers. The half million abandoned hard-rock mines in the U.S. have an estimated $72-240 billion of cleanup costs, with the majority of those costs falling on taxpayers. Surface mining temporarily eliminates surface vegetation and can permanently change the topography, as with mountain-top-removal-valley-fill (MTRVF) coal mines. The reclaimed surface mine site creates a leach bed for ions producing high water conductivity and the altered hydrology produces flashy peak flows similar to urban areas. Shaft and longwall coal mines produce acid mine drainage that can eliminate most aquatic life across extensive regions or alkaline mine drainage that alters the ionic balance of freshwater ecosystems. Oil and gas wells and transportation of their products have resulted in devastating spills in freshwater and marine ecosystems. Hydraulic fracturing undertaken to extract residual oil and gas can contaminate groundwater and alter surface water ecosystems. Instream and gravel bar aggregate mining alter channel morphology and increase bed and bank erosion, which also can reduce riparian vegetation and impair downstream aquatic habitats. Catastrophic failures of mine tailings dams have killed thousands of fish and hundreds of people, and contaminated tens to thousands of river kilometers. Oil and gas wells are exempted from regulation by several USA environmental protection laws despite growing evidence of their detrimental effects on surface and ground water. Mines and wells should only be developed where, after weighing multiple costs, benefits, beneficiaries and liabilities, they are considered the most appropriate use of land and water by the affected publics, can be developed in an environmentally responsible manner, benefit workers and the affected communities, and are appropriately regulated.

Because of the substantial and widespread effects of mining and wells on hydromorphology, water quality, fisheries, and regional socioeconomics; the effects of fossil fuel combustion on global climate change; and the enormous unfunded costs of abandoned extraction site reclamation; the American Fisheries Society recommends immediate and substantive changes in the ways in which North American governments conduct environmental assessments and permit, monitor, and regulate those metal, aggregate, and fossil fuel mines and wells that are considered appropriate for development. In particular, AFS recommends that:

1) The affected public should be involved in deciding whether a mine or well is the most appropriate use of land and water, particularly the need to preserve ecologically and culturally significant areas.

2) Mine or well development should be environmentally responsible with regulation, treatment, monitoring, and bonds sufficient for protecting the environment in perpetuity.

3) Baseline ecological and environmental research and monitoring should be conducted in areas slated for mining and oil and gas drilling before, during, and after development so that the effects of those industries can be assessed in an ecologically and statistically rigorous manner.

COMMENTS

Please submit your comments on the draft policy and position paper by February 15, 2014.

ACKNOWLEDGMENTS

The RPC members express their sincere gratitude to the aforementioned authors of the position paper and draft policy statement for their insights and generous contributions of time.


Salmonella in Fish Feces Analyzed by In Situ Hybridization and Quantitative Polymerase Chain Reaction. Qiong Sha, Michael R. J. Forstner, Timothy H. Bonner, and Dittmar Hahn. 25:184–190.


A Strain of Siniperca chuatsi Rhabdovirus Causes High Mortality among Cultured Largemouth Bass in South China. Dongmei Ma, Guocheng Deng, Junjie Bai, Shengjie Li, Lingyuan Yu, Yingchun Quan, Xiaojing Tang, Xiaoyan Jiang, Zemin Zhu, and Xing Ye. 25:197–204.

## CALENDAR

### Fisheries Events

To submit upcoming events for inclusion on the AFS web site calendar, send event name, dates, city, state/province, web address, and contact information to sgilbertfox@fisheries.org.

(If space is available, events will also be printed in *Fisheries* magazine.)

More events listed at www.fisheries.org

<table>
<thead>
<tr>
<th>DATE</th>
<th>EVENT</th>
<th>LOCATION</th>
<th>WEBSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 22, 2014</td>
<td>Southern New England Chapter’s Winter Meeting</td>
<td>Hadley, MA</td>
<td>snec-fisheries.org</td>
</tr>
<tr>
<td>January 22–26, 2014</td>
<td>Southern Division Spring Meeting</td>
<td>Charleston, SC</td>
<td>sdafs.org/meeting2014</td>
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<tr>
<td>January 26–29, 2014</td>
<td>K-State Student Subunit of AFS/Midwest Fish and Wildlife Conference</td>
<td>Kansas City, MO</td>
<td>k-state.edu/ksuafs/events.shtml</td>
</tr>
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<td>January 29–31, 2014</td>
<td>Texas Aquaculture Association 44th Annual Conference and Trade Show</td>
<td>Fredericksburg, TX</td>
<td>texasaquaculture.org</td>
</tr>
<tr>
<td>February 9–12, 2014</td>
<td>Aquaculture America 2014</td>
<td>Seattle, WA</td>
<td>kosfas.or.kr</td>
</tr>
<tr>
<td>February 11–13, 2014</td>
<td>Georgia Chapter AFS Annual Meeting</td>
<td>Athens, GA</td>
<td>gaafs.org</td>
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<tr>
<td>February 18–20, 2014</td>
<td>Florida Chapter Meeting</td>
<td>Ocala, FL</td>
<td>sdafs.org/fiafs</td>
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<td>February 25–27, 2014</td>
<td>Wisconsin Chapter Meeting</td>
<td>Green Bay, WI</td>
<td>wi-afs.org</td>
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<td>March 27–31, 2014</td>
<td>Japanese Society of Fisheries Science</td>
<td>Hakodate, Hokkaido, Japan</td>
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<tr>
<td>April 7–12, 2014</td>
<td>The Western Division Meeting’s 2nd International Mangroves as Fish Habitat Symposium</td>
<td>Mazatlán, Mexico</td>
<td>fishconserve.org/email_messages/Mangrove_Symposium.html</td>
</tr>
<tr>
<td>May 19–23, 2014</td>
<td>AFS Piscicide Class</td>
<td>Logan, UT</td>
<td>fisheriesociety.org/rotenone/PiscicideClasses.htm or <a href="mailto:sjohnston@fisheries.org">sjohnston@fisheries.org</a></td>
</tr>
<tr>
<td>June 7–11, 2014</td>
<td>World Aquaculture Adelaide 2014</td>
<td>Adelaide, South Australia</td>
<td>kosfas.or.kr</td>
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<tr>
<td>July 30–August 3, 2014</td>
<td>American Society of Ichthyologists and Herpetologists Annual Conference</td>
<td>Chattanooga, TN</td>
<td>asih.org/meetings</td>
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<td>August 3–7, 2014</td>
<td>International Congress on the Biology of Fish</td>
<td>Edinburgh, United Kingdom</td>
<td>icbf2014.sis.hw.ac.uk</td>
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<td>August 17–21, 2014</td>
<td>AFS Annual Meeting 2014</td>
<td>Québec City, Canada</td>
<td>afs2014.org</td>
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<tr>
<td>August 17–21, 2014</td>
<td>38th Annual Larval Fish Conference (AFS Early Life History Section)</td>
<td>Québec City, Canada</td>
<td>larvaflfishcon.org</td>
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<td>August 31–September 4, 2014</td>
<td>AFS Fish Health Section – International Symposium on Aquatic Animal Health (ISAH)</td>
<td>Portland, OR</td>
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<td>Aquaculture America 2015</td>
<td>New Orleans, LA</td>
<td>kosfas.or.kr</td>
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<td>World Aquaculture 2015</td>
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<td>February 22–26, 2016</td>
<td>Aquaculture 2016</td>
<td>Las Vegas, NV</td>
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<td>February 19–22, 2017</td>
<td>Aquaculture America 2017</td>
<td>San Antonio, Texas</td>
<td>kosfas.or.kr</td>
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political positions. In hopes of developing greater clarity, the Society Governing Board will focus its January mid-year retreat on advocacy and the Officers and Executive Director will discuss these issues with federal and nongovernmental organization representatives. Feel free to let us know your thoughts.

REFERENCES


Continued from page 547

the events will be our first Fisheries Leadership Dialogue. This event is being cohosted by the National Wildlife Federation and our Potomac Chapter and will bring together 30 key fisheries leaders for lunch and a discussion of how the AFS can best be positioned to be an effective partner and a dynamic leader on fisheries issues. This will be the first of many events that the AFS will sponsor to support the greatly enhanced role of AFS in ensuring that science and fisheries is a regular part of the D.C. dialogue.

Continued from page 548

It’s important to think of success, and communications, from those different perspectives. We need to package our successes for the audience, sharing multiple messages with different audiences throughout each project in each program. As I’ve been known to say, we’re not just worrying about habitat for sand dollars or goldfish. Our work is crucial for species at the heart of multibillion dollar industries or on the verge of extinction. Habitat work must be connected with other priorities within our institutions and then shared as coherent stories with those outside. An ecosystem context, as discussed in an earlier column in this series, also helps to generate support from all angles.

Many of us may wonder where we can hone our skills in the wild world of in-reach and outreach. The Internet offers thousands of courses, including some dedicated to natural resource professionals. For general training on communication campaigns, I’ve heard the most about courses at the U.S. Fish and Wildlife Service’s National Conservation Training Center in Shepherdstown, West Virginia. Colleagues revel in the many software options available to convert boring text into dynamic formats that do wonders for our messages. And social media platforms offer another creative means to reach our audiences.

This column wouldn’t be complete (and would be an example of poor communications) without attention directed at the central component of a communications strategy—our habitat messages. From my vantage point (in the national office of an agency with dozens of mandates related to fish habitat), we still need to convince our leaders at all levels to dedicate resources toward habitat as a basic building block for all we do. Such habitat–population connections seem like Ecology 101, yet it continues to amaze me how often research protocols and natural resource management plans fail to include environmental variables or a habitat professional on their research team. It is equally surprising to realize how sparse habitat expertise is across states and federal agencies, academic institutions, and private sector entities covering industries or the environment. Communications is a logical step toward bridging that divide.

One size, or plan, does not fit all in the fish habitat world. Not every species is as habitat dependent as the next, but we often do not investigate the connection. We must know which species and life stages need wetlands for food or shelter, which populations need quiet waters as they migrate through noisy ports and past blockages, and how water chemistry confuses signals for natal waters. Sometimes the habitat factor is glaringly absent. For some important recreational or commercial species, our models still emphasize fishing mortality and ignore environmental mortality. With that attitude for habitat-dependent stocks, no catch limit will help a stock rebuild from overfishing or some catastrophic event. Similar mistakes are made with the social sciences, which are often ignored but could well be of huge assistance as we struggle to convince others that habitat deserves our full attention. In an important, parallel arena, we need to dedicate more effort toward public communications. We need stronger support from those who think of rain gardens as habitat and who need to know that those neighborhood efforts are essential to protecting habitat quality and quantity. It’s not all about pristine streams and lakes.

Our communications strategies must stretch from the personal to the professional, from home to office. Let’s commit to a stronger effort to be more inclusive, to connect with all of our constituents, and to capture the attention our field deserves.
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