An Expert Survey of Information Needs for Ohio River Sport and Commercial Fishes[1]

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Abstract. Forty-eight Ohio River fishery managers from six states were surveyed to assess the relative importance of sport and commercial fisheries data gaps on the Ohio River. Twenty-two experts responded to the complex survey, which asked respondents to judge the need for 40 data types for each of seven taxa. Among taxa, information needs were highest for white bass and hybrids (*Morone* spp.) and buffalofishes (*Ictiobus* spp.), and lowest for bass/sunfish (*Micropterus/Lepomis* spp.) and common carp (*Cyprinus carpio*). Among data types, information needs were highest for natural and fishing mortality rates, and lowest for fecundity. Among life stages, information needs were highest for larval fishes, and lowest for adults during spawning season and summer. Expert opinions on information needs can be used to direct research and monitoring studies to highest priority needs and to avoid duplicative studies.

INTRODUCTION

Information needed to manage any natural fishery is enormous. For a large river system like the Ohio River, information needs are even greater than for a small or isolated fishery (Sheehan and Rasmussen 1993). Obviously, there is neither enough time nor money to investigate or monitor all aspects of a fishery. Therefore, an explicit agenda is necessary for choosing among competing research and monitoring projects.

Agendas for collecting information can be set independently by individual managers and researchers, based on their experience and interests. Projects chosen in this way are likely to provide substantial information on relatively specialized topics and sites or substantial ability to address immediate problems. But such projects may also be redundant or uncoordinated, and they may ignore longer-term and more comprehensive management concerns.

An alternative approach to setting information-gathering priorities is to invite fishery professionals to contribute their ideas to a common agenda developed in a systematic fashion. This approach is analogous to the logic behind establishment of the National Biological Survey. Coordinated, purposeful surveys and monitoring can increase both effectiveness and efficiency of biological science and natural resource management (National Research Council 1993). The premise is that broadly based expert opinion yields the most rational ranking of research and monitoring needs by reducing the influence of particular individuals and promoting a system-wide orientation (Rohrbaugh 1979).

Consolidation of expert opinion as a source for decision making has gained widespread utility in recent years. Systems for developing habitat suitability indices (Crance 1987), assigning stream quality features (Angermeier et al. 1991, 1993; Bryan 1991), weighting survey sampling designs (Stanovick and Nielsen 1991),

and designing urban fisheries (Preston 1988) are examples of using both professional and personal opinions to form group decisions. The purpose of this study was to provide professionals involved in the intensive management of the sport and commercial fisheries of the Ohio River an opportunity to identify data gaps and set priorities for these gaps collectively. The project followed the lead of Rasmussen (1983) for the upper Mississippi River.

MATERIALS AND METHODS

Information-need priorities were developed using an intensive survey asking for judgments about the importance and scarcity of data for each of seven sport and commercial fish taxa (see appendix). Each respondent was asked to complete an eight by six matrix covering eight data types (four about population data and four about habitat data) for six life stages of a particular taxa (only 40 cells were used, as some were not appropriate, such as fishing mortality on eggs). The seven fish taxa were common carp (*Cyprinus carpio*), buffalofishes (*Ictiobus* spp.), catfishes (*Ictalurus* spp.), freshwater drum (*Aplodinotus grunniens*), walleye/sauger (*Stizostedion* spp.), bass/sunfish (*Micropterus* spp. and *Lepomis* spp.), and white bass/*Morone* hybrid (*Morone* spp.).

For each appropriate cell, the respondent was asked to judge the need for data on a scale of 1-5, based on both the perceived importance of the data and the perceived scarcity (see appendix). The scale was created to assess scarcity as the primary criterion (choices 1 and 2 reflect scarce data, 4 and 5 reflect available data) and importance as a secondary criterion (1 and 4 reflect highly important data, 2 and 5 reflect less important data). In all, each respondent was asked to make 280 separate judgments.

The survey was distributed by mail in February 1989 to 48 Ohio River fishery biologists from eight states previously identified in a three-stage census project (Scott and Nielsen 1988). The first two stages were inclusive, seeking as large a list as possible. The first stage was assembling a list of Ohio River fishery biologists based on rosters from previous Ohio River Biology Symposium meetings, authors of works on Ohio River fishes, suggestions by fishery agency leaders in the Ohio River basin, and our own list of known active professionals. In the second

stage, these individuals were asked to expand the list by adding names of others they thought should be included as experts on Ohio River fishes and fisheries. This process created a list of approximately 100 people.

The third stage was exclusive, seeking to narrow the list to interested people. Each person was sent a one-page survey requesting information about their experience with and interest in 15 Ohio River topics, including two that covered fish distribution and fishery management. Approximately two-thirds of the addressees (67) returned the survey and were listed in a published directory (Nielsen and Scott 1988). We further reduced the list by retaining only those people who indicated interest in the two fish and fisheries topics and had spent at least 5% of their effort for the two previous years working on the Ohio River. This reduced list of 48 people was considered a census of Ohio River fishery experts and became the survey population for this study. The population included people from eight states, but predominantly West Virginia (17), Ohio (11), and Pennsylvania (7) residents; 21 people worked for state agencies, 12 worked for federal agencies, eight were privately employed, and seven worked for universities. This population matched our expectations, with most members working in states with management authority for Ohio River fisheries or working for federal agencies (EPA, Corps of Engineers) with regional authority for other aspects of river management. Because we wished to gather opinions of knowledgeable, interested, and currently active professionals, we made no attempts to raise return rates through repeated mailings or reminders.

An average "information-need" score, ranging from 1.0-5.0, was computed for each of the 280 cells. These scores were aggregated in three ways to examine overall need for information: 1) values for all 40 cells were averaged within each taxon to express need for taxon-specific information, 2) mean values for each type of data were computed by averaging scores for all taxa, 3) mean values for each life stage were computed by averaging scores for all taxa. No statistical tests were performed on these data because the data were intended to be descriptive and should be interpreted only as general trends, indicating relative priorities among information needs.

RESULTS

Twenty-two persons returned the survey, for a return rate of 46%. Most respondents were from West Virginia (8) and Pennsylvania (5); most worked for state (10) or federal (7) agencies. Chi-squared analyses of the population and the respondents indicated that the two groups were not different, by either state of residence or employment status. Therefore, the results can be considered representative of the entire population of Ohio River experts. Nonetheless, because the population is composed of people who live and work mostly in West Virginia, Ohio, and Pennsylvania, these results should be considered most conservatively as applicable for the middle and upper portions of the Ohio River.

A few respondents gave the same rank within a taxon to all population data types (average = 3.8 persons/taxon) or all habitat data types (5.1 persons/taxon). Although the number of completed surveys was low (16-19,

depending on taxon), we are confident that the intensity of the survey instrument and the care in selection of the survey population assured that the responses were serious, thoroughly considered, and relevant to decision-making organizations.

Mean information-need values for all data types combined ranged from 2.1 for *Morone* spp. to 3.0 for common carp (Table 1). Thus, overall values fell within the survey categories for data that were scarce or somewhat available. The range for individual data types within a taxon overlapped for all taxa. The width of the range was nearly identical for five of the seven taxa (1.5-1.7 units wide), but was substantially narrower for buffalofishes (0.9) and freshwater drum (0.8).

Mean information-need values among eight types of data ranged from 2.0 to 3.0 for all taxa combined (Table 2). Information about survival and fishing mortality rates ranked as the highest two needs overall (2.0 and 2.1, respectively) and for five of seven taxa. Information about fecundity ranked as the lowest need overall (3.0) and for six of seven taxa. Needs for other data were intermediate overall, averaging in a narrow range from 2.4 to 2.7.

Mean information-need values among six life stages ranged from 2.2 to 2.7 for all taxa combined (Table 3). This range (0.5 units) was much narrower than when data were summed by data type (1.0-unit range; Table 2) or by taxon (0.9-unit range; Table 1). Information about larval fish was ranked as the highest need overall (2.2) and for six of seven taxa. Information about adult fish during spawning and summer seasons was ranked as the two lowest needs overall (2.6 and 2.7, respectively) and for five of seven taxa.

DISCUSSION

Data needs for buffalofishes and white bass/*Morone* hybrids ranked the highest among the seven taxa. Data needs for white bass/*Morone* hybrids were high because

TABLE 1

Mean scores for information needs about Ohio River fish taxa, based on average scores for 40 data types for each taxon, and ranges of average scores among 40 data types within each taxon.

Taxon	N[a]	Mean	Range Within Taxon
White bass/*Morone* hybrids (*Morone* spp.)	18	2.1	1.4–3.0
Buffalofishes (*Ictiobus* spp.)	16	2.1	1.7–2.6
Walleye/sauger (*Stizostedion* spp.)	18	2.4	1.4–3.1
Catfishes (*Ictalurus* spp.)	17	2.4	1.6–3.2
Freshwater drum (*Aplodinotus grunniens*)	16	2.5	2.1–2.9
Bass/sunfish (*Micropterus/Lepomis* spp.)	19	2.8	1.8–3.4
Common carp (*Cyprinus carpio*)	18	3.0	2.4–3.9

[a]N (sample size) is number of respondents. Each respondent provided 40 judgments/taxon.

TABLE 2

Average scores for information needs for various data types, based on average scores for all life stages combined.

Taxon	N[a]	Growth	Fecundity	Survival	Fishing Mortality	General Habitat	Substrate	Water Depth/ Flow Rate	Water Quality
White bass/*Morone* hybrids (*Morone* spp.)	18	2.3	3.0	1.7	1.8	2.3	2.4	2.4	1.8
Buffalofishes (*Ictiobus* spp.)	16	2.3	2.5	1.9	2.0	2.2	2.2	2.1	2.0
Walleye/sauger (*Stizostedion* spp.)	18	2.7	3.0	1.7	1.8	2.6	2.2	2.5	2.4
Catfishes (*Ictalurus* spp.)	17	2.5	3.3	1.8	1.8	2.9	2.2	2.5	2.4
Freshwater drum (*Aplodinotus grunniens*)	16	2.7	3.0	2.3	2.4	2.5	2.5	2.4	2.3
Bass/sunfish (*Micropterus/Lepomis* spp.)	19	2.7	3.1	1.8	2.2	3.1	3.2	3.1	3.0
Common carp (*Cyprinus carpio*)	18	2.9	3.4	2.6	2.5	3.3	3.2	3.0	3.2
Mean	—	2.6	3.0	2.0	2.1	2.7	2.7	2.6	2.4

[a]N (sample size) is number of respondents. Each respondent provided six judgments for each data type, except for growth (five judgments), fecundity (one judgment), and fishing mortality (four judgments).

of the interest in these fishes in the southeastern U.S. (Smith and Reeves 1986, Moring 1993) and their recent introduction into the Ohio River. The narrow range in ranks among data types for buffalofishes (0.9) indicated that experts considered data for buffalofishes as uniformly scarce and valuable. Although buffalofishes are not highly sought by anglers, they represent a large portion of the biomass and a possible commercial fishery (Sheehan and Rasmussen 1993).

Data needs for walleye/sauger, catfishes, and freshwater drum received intermediate ranks. These rankings reflected a combination of the general importance, long-term presence, and wide distribution of these species. Ohio River walleye and sauger populations have been recovering steadily for several decades and are a source of pride for state and federal agencies; data about these species, therefore, have been collected regularly. Catfishes are historically important commercial species, and substantial data are available. Freshwater drum are also common on the Ohio River, but are not broadly popular for either sport or commerce. For these three taxa, abundant studies in other systems can provide a useful comparative database (Carlander 1977). The large range in ranks for data types within each of these taxa, however, indicated the importance of making existing data more uniformly available to Ohio River fishery researchers and managers.

Bass/sunfish and common carp data received the lowest rankings. The rationale for low rankings undoubtedly differed for the two taxa. Ohio River fishery biologists realize that although bass and sunfish are highly sought by anglers, the constraints on centrarchid populations are not caused by data gaps, but by lack of suitable habitat, stunting, or overfishing. In contrast, common carp are not highly valued for sport or commerce and abundance is high; therefore, management of common carp is a secondary concern for most agencies.

High interest in survival and fishing mortality data reflects substantial interest in population regulation and the scarcity of these costly data. Mortality data require one or more population estimates along with creel surveys—difficult in all environments, and especially so in large lotic systems. In contrast, the low interest in fecundity data reflects the relative ease with which such data are collected and their relative consistency among individuals in different habitats (Crim and Glebe 1990).

Data type needs differ in an important way from Rasmussen's (1983) results for the upper Mississippi River, where interests in nest-building species and in substrate-related habitat data were high. Similar data categories for the Ohio River (bass/sunfish, substrate preference) ranked intermediate or low. Conditions in the two river systems differ markedly with regard to these concerns. Sedimentation is less pervasive in the Ohio River than in the Mississippi River. Centrarchids, which dominate the fishery on the upper Mississippi River, are less important on the Ohio River, in part because backwaters are scarce (Nielsen et al. 1986, Scott and Nielsen 1989). Conversely, major data concerns on the Ohio River reflect the importance of pelagic species (white bass/*Morone* hybrids).

Differences were less clear for life stages, indicating that life stages represent less discriminating criteria for judging data needs. Nevertheless, larval fish data were generally considered more important for most taxa. This is consistent with Rasmussen's (1983) upper Mississippi River study, in which information on larval and juvenile fish was the most sought. This need is particularly obvious in regard to river developments, which often have minimal effects on adult fishes but can affect large portions of the subadult population (e.g., power plant entrainment, tow-boat propeller entrainment, and shoreline dewatering; Odom et al. 1992).

Expert assessment of information needs for Ohio River fishes reveals in strong detail the important gaps in fisheries information. Although some of these gaps were

TABLE 3

Average scores for information needs about life stages, based on average scores for all data types combined.

Taxon	N[a]	Eggs	Larvae	Juvenile	Adult (Summer)	Adult (Winter)	Adult (Spawn)
White bass/*Morone* hybrids (*Morone* spp.)	18	2.0	1.8	1.8	2.3	2.2	2.4
Buffalofishes (*Ictiobus* spp.)	16	2.0	1.9	2.2	2.3	2.2	2.2
Walleye/sauger (*Stizostedion* spp.)	18	2.3	2.2	2.2	2.5	2.5	2.6
Catfishes (*Ictalurus* spp.)	17	2.6	2.2	2.2	2.6	2.4	2.6
Freshwater drum (*Aplodinotus grunniens*)	16	2.6	2.2	2.3	2.7	2.6	2.6
Bass/sunfish (*Micropterus/Lepomis* spp.)	19	2.8	2.6	2.8	3.0	2.6	2.9
Common carp (*Cyprinus carpio*)	18	3.0	2.8	2.9	3.3	2.9	3.2
Mean	—	2.4	2.2	2.4	2.7	2.5	2.6

[a]N (sample size) is number of respondents. Each respondent provided five judgments about eggs; six about larvae; seven about juveniles, adults in summer, adults in winter; and eight about spawning adults.

predictable, many rankings were not intuitive and, in either case, quantitative analysis of the data lends credence to the implicit assessments of individual experts. For example, this analysis suggests several shifts in priority for fisheries studies on the middle and upper Ohio River. Research and monitoring of *Morone* spp. and buffalofishes (*Ictiobus* spp.) populations should take precedence over traditional studies of catfish and centrarchids. Studies of sub-adult life stages, particularly larvae, should supplant most studies of adult fishes. Fishing mortality studies are also highly desired; therefore, routine monitoring and creel surveys should be redesigned to incorporate data useful for long-term mortality studies.

This analysis also reveals two weaknesses in expert surveys. First, the surveyed population is likely to be small and self-selected, raising the potential for non-response and sample-size bias. As long as the most active and knowledgeable professionals respond, however, bias is more of an academic than an operational problem.

Second, biologists may be unwilling or unable to make highly discriminating decisions about priorities. Respondents in this study tended to value most data as scarce and important, and several gave the same ranking to all data for a species or data type. The format of a survey greatly influences response (Dillman 1978); in this survey, all judgments about a taxon were on one page. If biologists tend to think in terms of species, this style may have encouraged uniform answers. Had we put each life stage on a single page, asking for distinctions among taxa, the answers may have been different. For this reason, archiving of detailed survey techniques and instruments is crucial.

Despite weaknesses, assessments like this are broadly needed in fisheries. Whether simple, like this exercise, intensive (e.g., Delphi methodology), or technologically sophisticated (e.g., Hilborn and Walters 1992), explicit group analyses improve the efficiency and effectiveness

of fisheries management. Efficiency increases because redundant projects can be eliminated and because regional or national projects can be designed and executed. Effectiveness increases because the most crucial data gaps can be identified and filled in a logical progression.

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APPENDIX

Example of intensive questionnaire used to identify Ohio River data gaps.

<center>Ohio River Data Gap Survey Form</center>

Instructions:

The table below lists fish life-stages down the side and types of data across the top. Each cell, therefore, represents a type of data for a life stage; there are 39 cells in all. Your task is to assign a value to each cell that represents the severity of the data gap. Choose a number from 1 to 5, based on the explanation at the right.

If you wish to comment about the number you chose, please do so in the space below the table. Simply write your comment and then draw a line from the comment up to the relevent cell or cells. General comments are also welcome.

> **FOR EACH CELL, WRITE ONE OF THE FOLLOWING NUMBERS:**
>
> 1. If data are very scarce and highly important.
>
> 2. If data are very scarce, but not highly important.
>
> 3. If data are somewhat available, regardless of importance.
>
> 4. If data are available and highly important.
>
> 5. If data are available, but not highly important.

SPECIES OR SPECIES GROUP: **FRESHWATER DRUM**

Life-stage	Growth rates	Fecundity rates	Survival rates	Fishing mort. rates	General habitat preferences	Substrate preferences	Depth and flow preferences	Water quality preferences
Eggs	—	-		—				
Larvae		-		—				
Juveniles		-						
Adults (summer)		—						
Adults (winter)		—						
Adults (spawning)								

Comments:

Please return by February 24 to: Larry Nielsen
                                   Department of Fisheries and Wildlife
                                   Virginia Tech
THANKS FOR YOUR HELP!   Blacksburg, VA 24061-0321