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WHITE STURGEON-RESEARCH NEEDS: WORKSHOP RESULTS

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WHITE STURGEON -RESEARCH NEEDS: WORKSHOP RESULTS

Seattle, Washington
November 3-4, 1983

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February 1984

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FOREWORD

This report describes the results of a workshop conducted by Pacific Northwest Laboratory (PNL) under an interagency agreement with Bonneville Power Administration (BPA) to facilitate further efforts by BPA's Division of Fish and Wildlife to develop a research program for Columbia River Basin white sturgeon. The white sturgeon research would be conducted under the resident fish section (Section 800) of the Northwest Power Planning Council's Fish and Wildlife Program.[1] The workshop was held in Seattle on November 3 and 4, 1983. Invited participants developed a list of white sturgeon research needs and rationale for ranking the relative importance of the research needs.

The results of the workshop, as presented herein, represent the advice of the workshop participants to BPA. It is BPA's intent to use these results as one source of information to assist in planning further research on white sturgeon in the Columbia River Basin.

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1 Copies of the Fish and Wildlife Program, which was adopted on November 15, 1982, are available from the Northwest Power Planning Council, 700 SW Taylor, Portland, OR 96205.

EXECUTIVE SUMMARY

The highest ranked research needs listed by the workshop participants for Columbia River Basin white sturgeon were:

Define physical habitat requirements (substrate, flow, water quality) for early life history stages.

Identify genetic stocks.

Assess population status (e.g., distribution, densities, age-structure, year-class strength, age-specific mortality, disease, parasitism).

Assess reproductive status (e.g., spawning success, recruitment, age/size-dependent fecundity).

Develop new sampling techniques and gear for collecting early life history stages.

Assess gametogenesis (timing of maturation, frequency of spawning), including effects of environmental factors on gonadal development.

Define physical habitat requirements (substrate, flow, water quality) for spawning.

The ranking is the result of a workshop sponsored by the Division of Fish and Wildlife of BPA's Office of Power and Resources Management. Workshop participants were selected on the basis of their experience with sturgeon research and management. The 16 participants included state and federal agency staff, a representative of the Regional Power Council staff, a representative of the Columbia River Inter-Tribal Fish Commission, and university researchers. Most of the individuals have experience with white sturgeon in the Columbia River system, although some non-Pacific Northwest participants were also invited to provide a broad perspective on the current status of sturgeon research in other areas.

Computer software was used to facilitate ranking the research needs. The use of the software helped ensure that the workshop was structured to meet its objectives, that rationale were identified for ranking the

relative importance of the research needs, and that results were available in a timely manner. It provided each participant with an equal voice in ranking the research needs. The workshop structure ensured that participants had the opportunity to discuss and understand the research needs and ranking criteria fully.

The workshop provided an opportunity for BPA to solicit expert opinion, on the types of sturgeon research needed and facilitated communication among the participants. As a result of the workshop, there is an increased awareness of research and management activities among the participating scientists and the agencies they represent. BPA and the Regional Council staff had an opportunity to learn the state-of-the-art of ongoing research and to identify the needs of management agencies.

At the close of the workshop, participants were given copies of a preliminary report that described the workshop method and listed the research needs in priority order. Comments about the research needs were solicited and have been included in this report. Participants were also asked to critique the workshop procedures and the results at the end of the workshop. Responses to the critique were positive, and participants indicated that their input had been adequately presented to BPA

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WHTIE STURGEOM RESEARCH NEEDS: WORKSHOP RESULTS

INTRODUCTION

The Pacific Northwest Power Planning and Conservation Act (1980) established the Northwest Power Planning Council (Regional Council), which consists of two appointees each from the states of Washington, Oregon, Idaho, and Montana. In addition to planning regional electric power activities, the Regional Council is required to develop a Fish and Wildlife Program to protect, mitigate, and enhance fish and wildlife populations in the United States portion of the Columbia River Basin. The Act further requires that the Bonneville Power Administration (BPA) take a lead role in implementing provisions of the Fish and Wildlife Program.

As plans were being made to implement the resident fish measures of the program, it became clear that more information was needed on the basic biology, habitat requirements, and status of white sturgeon to develop or evaluate specific mitigation or enhancement activities. The Resident Fish Technical Committee of the Columbia Basin Fish and Wildlife Council recommended a workshop be conducted to establish a regional review of the needs for white sturgeon research. BPA asked Pacific Northwest Laboratory (PNL) to assist in planning and conducting a workshop to solicit expert advice on white sturgeon research needs.

The main objective of the workshop was to identify and rank research needs for white sturgeon in the Columbia River Basin. The focus was on research that would help identify impacts of hydroelectric development and provide background needed to develop and evaluate mitigative activities. Participants were asked in considering the research needs of white sturgeon take a basin-wide approach. Other objectives were to provide a forum for BPA and Regional Council staff to learn the current status of sturgeon research, and to facilitate communication among participants.

The two-day workshop was highly structured to provide all participants an equal opportunity to voice their opinion and to ensure that research needs for white sturgeon were listed and ranked in order of importance. The listing and ranking of research needs was facilitated using micro-computer software developed by PNL. In addition to listing research needs, participants were asked to develop and weight criteria for ranking the relative importance of the research needs. The criteria provide a clear set of rationale for the ranking process.

The ranked list of research needs and the rationale that support the ranking provide BPA with guidance to support development of a research program. The results of the workshop are expected to be one source of information used to develop the final white sturgeon research program and to allocate effectively the limited resources available white sturgeon research.

METHODS

A selected group of experts on white sturgeon participated in a workshopto develop a list of research needs related to white sturgeon in the Columbia River Basin. During the informal but clearly structured two-day workshop, participants ranked research needs. The ranking was facilitated with microcomputer-based software developed by PNL. The software has been successfully applied to a number of previous workshops with different objectives (Neitzel and Fickeisen 1983; States 1983).

PARTICIPANTS

Prior to the workshop, BPA and PNL staff identified potential participants on the basis of each participant's experience with sturgeon. Candidates were selected from an initial list of biologists who had experience with Columbia River white sturgeon. The list had been developed from al list supplied by the Resident Fish Technical Committee of the Columbia Basin Fish and Wildlife Council, and from attendees at a previous workshop on white sturgeon organized by Alex Heindl of the Columbia River Inter-Tribal Fishery Commission. Additional participants were selected from contacts made by PNL staff at the American Fisheries Society Annual Meeting in August 1983, which included a symposium on sturgeon, and from other contacts of both BPA and PNL. Phone calls to the initial list of people confirmed continued interest in sturgeon, current research activities, and willingness to participate in the workshop. Additional participants were nominated by some of the people we contacted.

A formal letter of invitation was sent by BPA to each invitee several weeks before the workshop. A subsequent letter mailed from PNL a month before the workshop described the workshop objective and suggested topical areas to be discussed at the meeting.

The workshop was attended by 16 of the 19 people who were invited (see Appendix A). In addition, Dale Johnson, of BPA's Division of Fish and Wildlife, attended as an observer in order to hear firsthand the concerns

of the participants. Two graduate students also attended as observers. The observers were encouraged to participate in the discussions and completed the evaluation forms, although their scores were not included in the final ranking of research needs.

The three invitees who were unable to attend were subsequently asked to complete a one-page questionnaire listing what they considered to be the most important research needs for white sturgeon. Two did so and their responses are included in this report. However, it was not possible for the non-attendees to formally rank the needs since they had not participated in the discussions.

Three of the workshop participants were from state fishery agencies responsible for management of sturgeon; four were from federal agencies; six were university faculty members; one was from the Columbia River Inter-Tribal Fish Commission; and one was a member of the Regional Council. The sixteenth participant, now retired from the U.S. Army Corps of Engineers, has had a long fishery career that included substantial work with white sturgeon. Three of the participants were from outside the Pacific Northwest. The non-Pacific Northwest participants all have experience with white sturgeon research in other river basins, and one has experience with research on other species of sturgeon.

In their responses to a questionnaire regarding their experience, 12 participants indicated that they had published at least one journal article or technical report or had presented at least one paper on white sturgeon. All but two had conducted research on white sturgeon, either in the field or in the laboratory. The majority had at least four years experience with sturgeon (Figure 1), and the majority held a graduate degree in fisheries or a related area (Figure 2).

PLANNING SESSION

One week before the workshop, the three PNL facilitators met with several BPA staff members and conducted a preliminary "dry-run" workshop. The purposes of the preliminary workshop were: to develop a list of

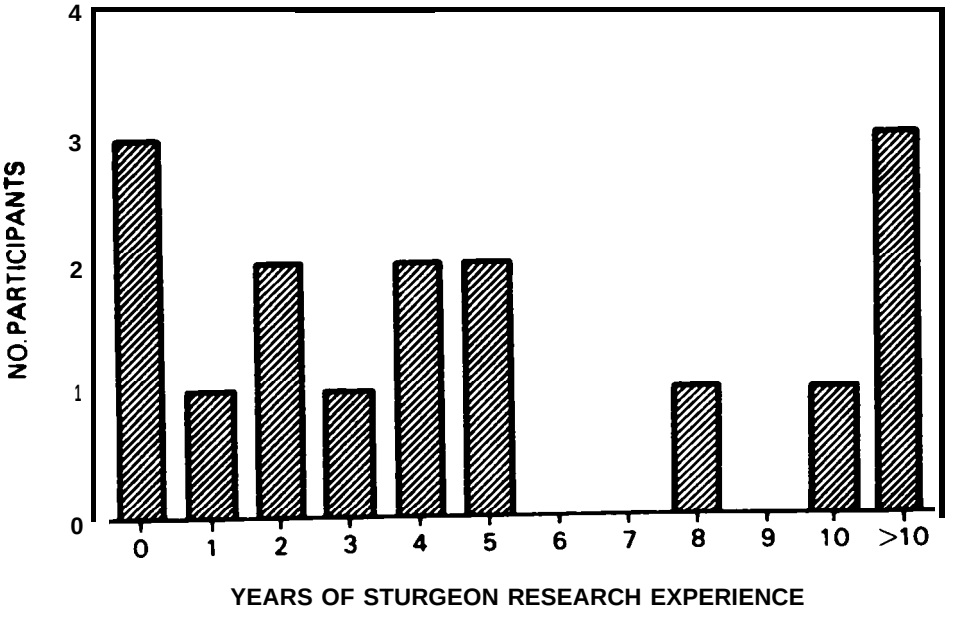

FIGURE 1. Experience of Workshop Participants in Sturgeon Research (Field or Laboratory)

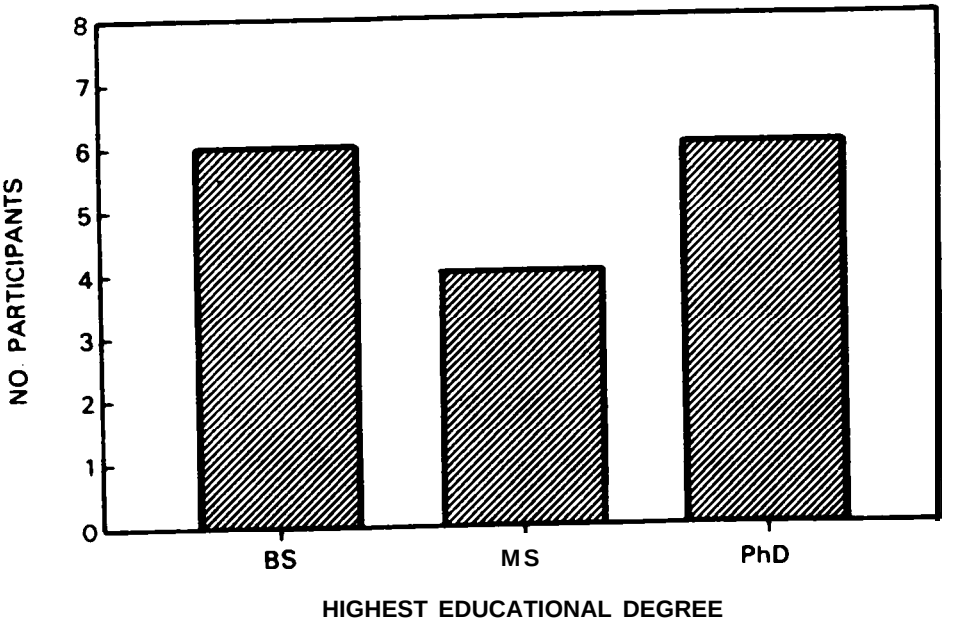

FIGURE 2. Education of Workshop Participants

specific research needs and evaluation criteria that could be used to stimulate discussion during the meeting; to focus our thoughts on the issues to be discussed in order to better facilitate the meeting; and to familiarize BPA staff with the actual workshop methodology. During the workshop, participants independently identified research needs and evaluation criteria that were similar to most of those developed in the preliminary workshop. The remaining research needs and criteria identified in the preliminary workshop were presented to the participants for possible inclusion or to provide suggested alternative wording. In several cases, these items were used in the actual workshop.

WORKSHOP STRUCTURE

The workshop approach involved six steps. In step 1, the workshop objective and methods were explained to the participants. In step 2, the participants developed a list of research needs related to 1) identifying effects of hydroelectric development on white sturgeon in the Columbia River Basin, 2) mitigating adverse effects, and 3) enhance in white sturgeon stocks. The group discussed each research need in order to develop a common understanding of the need and the basis for its inclusion on the list.

In step 3, the participants developed a list of criteria for ranking the importance of the research needs they had identified under Step 2. Each of the criteria included a rating scale (0 to 9) with an indication of the endpoints of the scale (e.g. a 9 would indicate the research need would rank high). Like the research needs, each criterion was discussed by the group to develop a common understanding of its meaning and the scale for evaluating research needs against that criterion.

In Step 4, paired comparisons of the criteria were made by each participant to determine the relative importance of the criteria to ranking the identified sturgeon research needs. Each possible pair of the criteria was evaluated. The paired comparisons provided the basis for assigning weighting factors to the criteria.

In Step 5, each of the research needs was scored against each criterion, using the subjective measurement scale for each of the criteria. These scores, weighted by the factors developed in Step 4, provided the data for ranking the research needs.

Finally, in Step 6, a preliminary report was distributed to participants before adjournment. The preliminary report included the criteria weights and ranked list of research needs. Comments on the final list and the priorities were solicited from participants.

SOFTWARE

The PNL-developed software used to rank research needs produces evaluation forms, computes criteria weighting factors, computes scores used in ranking the research needs, and produces reports. The lists of research needs and criteria for ranking them were typed into the computer after the lists were developed.

The software produced two evaluation forms. The first, used to poll participants on the importance of their criteria, was a random list of all possible pairs of the criteria. Participants were asked to indicate which member of each pair was more important for ranking their white sturgeon research needs. The software algorithms distributed a total of 100 points among the criteria based on the responses to the paired comparisons. These distributed points are the criteria weights.

The second evaluation form, used to score the research needs against the criteria, consisted of one page for each research need with all of the criteria listed. Each participant scored (on a scale of 0 to 9) each of the research needs against each criterion. These raw scores were averaged across all of the participants. The mean raw scores were multiplied by the criteria weights and summed across all of the criteria for each of the research needs to obtain a total score, which could range from 0 to 900.

Participants were given the option of not responding to a particular criterion for one or more research needs. The mean raw score is based only on the data from those who responded to a particular criterion, so by not

responding, the participant deferred judgement to the rest of the group. 'he option of not responding was infrequently used.

The software sorted the research needs by their total scores to produce a ranked list. The criteria weights and ranked list of research needs were then printed. The software permits analysis of subsets of the participants. For each subset, the criteria weights and the ranking scores are recomputed.

The data entered from both the criteria weighting process and the research need evaluation forms were later verified to ensure that keyboard errors had been corrected. The final ranking reports were then produced and analyzed. Subgroups of participants were identified and the results analyzed for each of them in order to compare various subsets of the participants.

RESULTS AND DISCUSSION

Workshop participants developed a final list of 31 research needs related to white sturgeon in the Columbia River Basin. They ranked the importance of the research needs on the basis of a set of six criteria. The criteria were weighted and are presented in Table 1 in order of their weights. The 31 research needs, ranked in order of their total scores, are listed in Table 2. Scores ranged from 516 to 745 points, with standard deviations of about 80 points. Differences of less than a few points in total scores should be ignored in interpreting the results. Thus, while the top two scores are probably significantly different from the third highest score, they are not different from each other.

Participants placed strong emphasis on researching the basic biology of white sturgeon, which is a reflection of the relative lack of life history data on the species. For example, research that would yield data on the physical habitat requirements for different life stages was ranked high:

> Define physical habitat requirements (substrate, flow, water quality) for early life history stages. (Ranked 1)
>
> Define physical habitat requirements (substrate, flow, water quality) for spawning. (Ranked 7)
>
> Define physical habitat requirements (substrate, flow, water quality) for adults. (Ranked 14)

Research needs related to the assessment of existing conditions (stock, habitat inventory, and recruitment) were also important and comprised six of the top ten needs:

> Identify genetic stocks. (Ranked 2)
>
> Assess population status (e.g., distribution, densities, age-structure, year-class strength, age-specific mortality, disease, parasitism). (Ranked 3)
>
> Assess reproductive status (e.g. spawning success, recruitment, age/size-dependent fecundity). (Ranked 4)

TABLE 1. Criteria for Ranking White Sturgeon Research Keeds. Presented in order of weighting factors as developed by all participants.

Weight	Criterion
27	Does it fill an information gap relative to basic biology of sturgeon? (0 = currently available information meets needs; 9 = critical information is not available)
20	Does it fill an information gap relative to management of sturgeon? (0 = currently available information meets needs; 9 = critical information is not available)
18	How soon do we need the results? (0 = not for a long time; 9 = immediately)
15	Is the project do-able? (0 = low probability of success; 9 = high probability of success)
14	Is other needed research contingent on the results? (0 = not at all; 9 = critically)
5	Does it relate to mitigation or enhancement? (0 = no; 9 = very important)

TABLE 2. Research needs for Columbia River Basin white sturgeon, as ranked by workshop participants. Small differences in scores are not significant.

Rank	Score	Research Need
1	745	Define physical habitat requirements (substrate, flow, water quality) for early life history stages.
2	744	Identify genetic stocks.
3	719	Assess population status (e.g., distribution, densities, age-structure, year-class strength, age-specific mortality, disease, parasitism).
4	716	Assess reproductive status (e.g., spawning success, recruitment, age/size-dependent fecundity).
5	711	Develop new sampling techniques and gear for collecting early life history stages.
6	709	Assess gametogenesis (timing of maturation, frequency of spawning) including effects of environmental factors on gonadal development.
7	708	Define physical habitat requirements (substrate, flow, water quality) for spawning.
8	695	Assess existing levels of upstream and downstream migration and degree of reproductive isolation of populations.
9	651	Quantify existing habitat for spawning.
10	647	Assess effects of water quality (i.e., introduced contaminants) on growth, reproduction, and survival.
11	646	Quantify existing habitat for juvenile rearing.
12	635	Evaluate and predict impacts of hydro development and operation on habitat (includes altered flow regimes, water-level fluctuations, sedimentation).
13	628	Determine the effect of present harvest rates and regulations on population dynamics and evaluate alternative management strategies.
14	628	Define physical habitat requirements (substrate, flow, water quality) for adults.

TABLE 2. Contd.

Rank	Score	Research Need
15	618	Develop methods to assess impacts of artificial enhancement (includes marking).
16	617	Develop technologies for artificial propagation.
17	617	Evaluate and predict impacts of hydro development and operation on populations (includes dam passage, turbine mortalities).
18	613	Define strategies and rationale for use of artificially propagated fish.
19	613	Establish a clearinghouse for information exchange (automated retrieval system).
20	592	Determine feasibility of using wild broodstocks for artificial propagation.
21	591	Quantify existing and potential carrying capacity (spawning and rearing areas, feeding).
22	585	Assess effects of environmental variables (temperature, light, changes in hydrograph) on migration.
23	585	Describe feeding habits (food availability and preference).
24	578	Assess competition and predation.
25	578	Evaluate effects of hydroelectric projects on migration and movement.
26	566	Evaluate available mitigative and enhancement techniques (strategies).
27	543	Develop methods to assess cumulative effects of hydroelectric development.
28	539	Identify nutritional requirements.
29	532	Ouantify existing habitat for adults.
30	525	Define means to enhance natural spawning and rearing habitats.
31	516	Identify disease pathogens and parasites and examine their etiology.

Develop new sampling techniques and gear for collecting early life history stages. (Ranked 5)

Assess existing levels of upstream and downstream migration and degree of reproductive isolation of populations. (Ranked 8)

Quantify existing habitat for spawning. (Ranked 9)

Quantify existing habitat for juvenile rearing. (Ranked 11)

Quantify existing and potential carrying capacity (spawning and rearing areas, feeding). (Ranked 21)

Quantify existing habitat for adults. (Ranked 29)

Research related to assessing reproductive potential was also deemed important:

Assess gametogenesis (timing of maturation, frequency of spawning) including effects of environmental factors on gonadal development. (Ranked 6)

Research needs related to water quality environmental variables, feeding, and disease were considered of lesser importance:

Assess effects of water quality (i.e., introduced contaminants? on growth, reproduction, and survival. (Ranked 10)

Assess effects of environmental variables (temperature, light, changes in hydrograph) on migration. (Ranked 22)

Describe feeding habits (food availability and preference). (Ranked 23)

Assess competition and predation. (Ranked 24)

Identify nutritional requirements. (Ranked 28)

Identify disease pathogens and parasites and examine their etiology. (Ranked 31)

Effects of hydroelectric development were ranked lower than the research needs relating to life history:

Evaluate and predict impacts of hydro development and operation on habitat (includes altered flow regimes, water-level fluctuations, sedimentation). (Ranked 12)

Evaluate and predict impacts of hydro development and operation on populations (includes dam passage, turbine mortalities). (Ranked 17)

Evaluate effects of hydroelectric projects of migration and movement. (Ranked 25)

Develop methods to assess cumulative effects of hydroelectric development. (Ranked 27)

As a group, the research needs relating to artificial propagation and enhancement, while considered important, ranked lower:

Develop methods to assess impacts of artificial enhancement (includes marking). (Ranked 15)

Develop technologies for artificial propagation. (Ranked 16)

Define strategies and rationale for use of artificially propagated fish. (Ranked 18)

Determine feasibility of using wild broodstocks for artificial propagation. (Ranked 20)

Evaluate available mitigative and enhancement techniques (strategies). (Ranked 26)

Define means to enhance natural spawning and rearing habitats. (Ranked 30)

Finally two research needs did not fit into any other category:

Determine the effect of present harvest rates and regulations on population dynamics and evaluate alternative management strategies. (Ranked 13)

Establish a clearinghouse for information exchange (automated retrieval system). (Ranked 19)

The data were also analyzed by subgroups including: 1) only the Pacific Northwest participants, 2) only the non-Pacific Northwest participants, 3) university faculty, 4) federal and state agency staff, and 5) state agency staff. The composition (by participant) of each of the subgroups is shown in Table 3. Table 4 indicates the criteria weights for each of the subgroups. Non-Pacific Northwest and university faculty weighted the ability to do a project much higher than did other

TABLE 3. Composition of subgroups. Individual participants were included in subgroups as indicated.

	Participant Subsets				
Participant	Northwest Only	Non-Northwest Only	University Staff	Federal and State Agency Staff	State Agency Staff
Fred Binkowski		*	*		
Ted Bjornn	*		*		
Tom Bonde	*			*	
Cliff Bosley	*			*	
Ernie Brannon	*		*		
Curt Burley	*			*	
Tim Cochnauer	*			*	
Ivan Donaldson	•				
Serg Doroshov		*	*		
James Galbreath	*				
Graham Gall		*	*		
Alex Heindl	*				
Gayle Kreitman	*				
Bob McConnell	*				
Mark Schneider	*				
Bob White	*		*		
Total Number	13	3	6	7	3

TABLE 4 Criteria Weights for Subgroups of Participants

Criterion	Weight					
	All Participants	Northwest only	Non-Northwest Only	University Staff	Federal and State Agency Staff	State Agency Staff
Does it fill an information gap relative to basic biology of sturgeon? (0 = currently available information meets needs; 9 = critical information is not available)	27	26	[illegible]	30	26	22
Does it fill an information gap relative to management of sturgeon? (0 = currently available information meets needs; 9 = critical information is not available)	20	22	6	8	27	27
How soon do we need the results? (0 = not for a long time; 9 = immediately)	18	18	16	16	16	22
Is the project do-able? (0 = low probability of success; 9 = high probability of success)	15	14	20	19	10	4
Is other needed research contingent on the results? (0 = not at all; 9 = critically)	14	15	11	11	6	18
Does it relate to mitigation or enhancement? (0 = no; 9 = very important)	5	5	7	7	5	7

TABLE 5. Comparison of Ranking of Research Needs by Subgroups. Numbers indicate ranked-order of each issue (e.g., the research need ranked highest by all participants was ranked 7 by non-Northwest participants).

Research Need	NW Only	Non-NW Only	University Staff	Fed and State Agency Staff	State Agency Staff
1	1	7	2	2	6
2	6		1	5	2
3	2	1:	5	3	7
4	4	8	6	1	
5	3	14	8	8	1:
6	7	2	3	10	5
7	5	13	7	11	11
8	8	4	4	9	4
9	10	21	24	4	8
10	9	22	22	6	9
11	13	15	17	7	3
12	11	24	27		20
13	16	11	12	18	25
14	12	25	20	15	
15	21	5	10	22	1815
16	23	3	9		19
17	15	18	19	28	26
18	20	10	13	20	16
19	14	20	26	13	13
20	24	9	15	29	29
				14	
21	17	27	23	21	28
22	22	23	18		
23	18	26	16	23	23
24	25	16	11	25	24
25	19	30	28	19	27
26	27	17	21	27	14
27	26	29	31	17	22
28	30	6	14	31	30
29	28	31	30	26	21
30	29	28	29	24	17
31	31	19	25	30	31

participants. Perhaps this is a reflection of their research experience. Both the combined federal and state agency staff and the state agency staff alone weighted information related to management higher than information on the basic biology of the sturgeon, in contrast to all of the other groups analyzed. They also rated the feasibility ("do-ability") of a project as relatively less important than the other criteria.

The ranked order of the research needs for each of the subgroups are listed in Table 5. There are few differences in the needs included in the top 8 to 10 for any of the groups. The state agency staff ranked identification of physical habitat needs lower and assessment of reproductive status higher than did the overall group. One of the state agency people later commented that they were concerned with "the ratio of managers to academicians" and feared that the results might have been swayed by the composition of the workshop. Availability of the subgroup analysis should help alleviate that concern.

Northwest participants ranked assessment of genetic stocks lower and university faculty ranked it higher than the overall group. In comparing the Northwest and non-Northwest subgroups, the top 6 research needs of both groups were exclusive sets with no overlap.

One individual suggested in a post-workshop comment that the most important research needs from a management point of view were assessment of population and reproductive status, and effects of harvest rates and regulations on the resource. In addition, the respondent pointed out that the results indicate a different ranking for habitat requirements of spawners and of early life history stages, although the requirements and therefore the research might overlap significantly. However, both those needs were ranked in the top 7 overall and, while the state agency staff alone ranked them lower, they were close to each other. It was also mentioned that the results do not indicate dependencies between needs (i.e., gear development for early life history stages must precede surveys of recruit-tent and early life history stock status). We agree with the later comment, which points out the need to carefully consider the workshop

results as only one of many information sources required in developing a research program. It is easy to view the ranked list as a final program; however, this should not be done.

Two of the three invitees who did not attend commented after the workshop on their views of the important research needs for white sturgeon. The needs they listed overlapped those included in the list developed during the workshop. They related to habitat requirements, habitat inventory, genetic stock identification, and enhancement and to reach-by-reach assessment of stocks, habitat identification, reproductive status, downstream migration and artificial propagation.

WORKSHQP CRITIQUE

Participants were asked to comment on the results and the workshop process. They filled out a formal critique sheet and were invited to comment in writing or by phone in the two weeks following the workshop. The critique asked whether or not their white sturgeon research needs were adequately presented to BPA, what they liked or did not like about the workshop, and how the workshop could have been improved.

The 13 participants who responded to the first question all indicated that their research needs were adequately presented to BPA. All participants indicated that the workshop met its objectives. A few indicated that the needs identified were general and will require "fine tuning." One person commented that "at least [the workshop] got something started for Columbia River white sturgeon." Another wrote that "someone still has to take the results and convert them into a set of projects."

The participants frequently mentioned that they liked the organization and structure of the workshop. They appreciated having preliminary results available in a report form before the close of the meeting. They liked the aiversity of interests represented at the workshop, although one said "the group seemed slanted toward management." One participant later commented by letter that "the ratio of managers to academicians...leaned more heavily to academia." A close examination of the list of participants shows that the ratio of managers to academicians was nearly equal: there were six university faculty and seven federal and state agency staff. Three additional federal and state agency staff members were invited but did not attend.

The most common comments concerning how the workshop could be improved or what participants did not like about it were centered on development and application of the list of criteria to rank research needs. Some felt that insufficient time was spent on the criteria; while others wanted more time to discuss the research needs. Two commented that the criteria did not apply equally well to all of the research needs, and one of them later

wrote that it would be useful to have an option in the scoring process to indicate that a particular criterion "does not apply" to a particular research need. As facilitators with experience in several similar workshops, we felt that the list of criteria developed here was comparatively a very good one.

Finally, participants noted that the facilities and accomodations were outstanding and thanked the facilitators for "an excellent job in organizing and hosting this workshop" and for "keeping proceedings from bogging down without seeming to be orchestrating things."

NEED FOR FUTURE WORK

The next logical steps in developing a research program are to further identify what is known about each of the highly ranked needs, to develop the needs into research projects and scope the research, and to examine relationships among the projects in order to schedule their implementation. The relationship of specific research projects to the Fish and Wildlife Program and to BPA's mission need further consideration as well.

REFERENCES

Neitzel, D. A. and D. H. Fickeisen. 1983. Technical Information Needs of State Superfund Coordinators Related To Managing Hazardous Waste Sites and Spills: A Response Report. Pacific Northwest Laboratory. Richland, Washington.

States, J. B. 1983. Assessment of Cold-Climate Environmental Research Priorities. PNL-4581, Pacific Northwest Laboratory. Richland, Washington.

APPENDIX A

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APPENDIX B

HISTORY AND MANAGEMENT OF COLUMBIA RIVER BASIN WHITE STURGEON

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HISTORY AND MANAGEMENT OF COLUMBIA RIVER BASIN WHITE STURGEON

James L. Galbreath
Fish Division, Oregon Department of Fish and Wildlife

History of Commerical Fishery

Sturgeon were a dominant species when the first salmon gill-net fisheries began in the 1860s. At that time, sturgeon were routinely killed and discarded in an attempt to eradicate them. In 1874, an item in The Daily Astorian carried a news item that a sturgeon weighing 1,250 lb was landed and sold for $0.25/lb. By 1880, the sturgeon fishery had started in a small way. Some sturgeon flesh was used fresh locally and pickled in brine and salted. Smoke fish also began to be important in the East and in San Francisco and in 1888, 94 tons of sturgeon were salted and pickled. The same year saw the beginning of an important industry on the Columbia, when the first railroad car 0f frozen sturgeon was shipped to the East.

With sturgeon becoming a marketable species, several types of gear were used including fish wheels, traps, gill nets, baited setlines, and Chinese gang lines (unbaited).

By 1892, the fourth year of intensive fishing, a peak production of 5.5 million lb was reached and this catch was valued at $66,000. Fishermen did not even keep fish under 50 lb. The average weight was about 150 lb, but slipped to 50-60 lb by 1895. The fishery collapsed in the late 1890s due to overfishing, especially on the large brood stock. Despite heavy fishing in the next 7 years, only 73,000 lb were landed in 1899. Wherever sturgeon have been commercially exploited there has been a history of depletion. Because of their economic importance and man's ignorance of sturgeon biology, irrational utilization was seen worldwide. Dam construction and pollution further depressed stocks until emergency measures were needed.

Regulations

The first regulations to protect sturgeon were enacted in 1897 by Washington when the season was closed between March 1 and November 1. Also, sturgeon under 4 ft were to be released. In 1899, Oregon passed the same season regulation, made 4 ft the minimum length and prohibited Chines? gang lines. Fish traps, fish wheels, and seines were subsequently outlawed.

Sturgeon catches from the 1900s through the 1960s were small and incidental to salmon gill-net fishing. As a result of extensive research by Oregon Fish Commission biologists under the direction of Alex Bajkov, the most important protective regulation was enacted in 1950--a maximum size limit of 6 ft to protect brood stock. Also in 1950, a minimum size limit of 30 in. for sport-caught fish with a limit of five fish per day was adopted. In 1951, this was reduced to three fish per day. In 1958, the minimum length was increased to 3 ft. The sport fishery downstream of Bonneville has burgeoned to a point where in 1977 and 1978, the sport fishery caught sturgeon at a rate of 2:1 and 3:l over the commerical fishery. The possession limit upstream of Bonneville, however, was changed to two fish per day last year.

With minimum and maximum size limits, reduced salmon gill-net seasons, increased smelt and shad runs and pollution abatement, the sturgeon population below Bonneville has flourished. Commercial sturgeon landings almost doubled in the early 1970s, nearly doubled again in the late 1970s and have remained at a somewhat reduced level in the early 1980s. In terms of number of fish, the modern peak catch of 1979 was greater than the historical peak catch of 1892. However, the average weight now is 30-35 lb for commercial and about 17 lb for sport. In 1983, the estimated take downstream of Bonneville will be about 35,000 sport and 15,000 commercial

Management Plan for Sturgeon

GOAL

To maintain optimum use of the sturgeon resource.

OJBECTIVES

1. Provide for opportunity for 110,000 angler days and a harvest of about 30,000 sturgeon annually.
2. Provide opportunity for an average commercial harvest of about 20,000 sturgeon annually.

GUIDELINE

Sturgeon brood stock over 6 ft in length will continue to be protected from harvest.

Problem 1 and Strategies

The information base on optimum harvest, population sizes, early life history, migration patterns, and optimum harvest rates should all be increased for better management of the resource. To this end, ODFW will: (1) support efforts by federal and state agencies to obtain better harvest information from below and above Bonneville commercial and sport fisheries; (2) seek to increase the biological information base in both areas, particularly in regard to spawning areas and early life history of sturgeon; (3) explore the feasibility of supplementing population by planting fingerlings or juveniles in specific areas, particularly above Bonneville Dam and the Willamette Falls; (4) make population estimates.

Problem 2 and Strategies

Snake River sturgeon populations are severely depressed.

The ODFW would: (1) continue regulations which prohibit keeping sturgeon caught in the Snake River, (2) explore feasibility of supplementing populations in the Snake River, and (3) seek

compensation for losses to sturgeon as a result of power project construction.

Problem 3 and Strategies

Poaching reduces the sturgeon populations.

The ODFW has: (1) supported efforts of OSP to reduce illegal activities, and (2) made it illegal to remove eggs from any sturgeon without retaining fish carcass while in the field or in transit.

Problem 4 and Strategies

Careless handling may be causing important losses of undersized and oversized sturgeon in both sport and commercial fisheries.

The ODFW would: (1) maintain regulations requiring immediate release of undersized and oversized fish, and (2) determine extent of loss caused by handling in both sport and commercial fisheries. This is being done on monitoring of set-line fisheries and experimentation with a large mesh gill-net season.

At the January 1983 Compact Hearing in Portland, Oregon, the joint staffs of ODW and WDF reiterated our 1983 Recommended Management Objectives:

1. Provide for an efficient commercial harvest of sturgeon at relative historic proportions to the recreational fishery. No intentional change of the relative commercial and recreational fishery catches is recommended.
2. Address as many of the sturgeon set-line fishery problems as possible.
3. Thoroughly evaluate commercial seasons for sturgeon.

APPENDIX C

SUMMARY OF IDAHO'S WHITE STURGEON MANAGEMENT OBJECTIVES

APPENDIX C

SUMMARY OF IDAHO'S WHITE STURGEON MANAGEMENT OBJECTIVES

Tim Cochnauer
Idaho Department of Fish and Game

In Idaho, the white sturgeon is found in the Snake River from near Lewiston upstream to Shoshone Falls, which is a natural barrier to further upstream movement. It is also found in the entire portion of the Kootenai River in northern Idaho.

The Snake River has been under catch and release fishing regulations for white sturgeon since 1970. Prior to 1970, harvest was restricted to two fish per year and between 90 and 180 cm in length. A consumptive fishery still exists in 1983 on Kootenai River white sturgeon and anglers may keep one sturgeon annually between 90 and 180 cm. Catch and release regulations have been recommended for white sturgeon in the Kootenai for 1984.

In 1979, the Idaho Department of Fish and Game initiated a 5-year program to evaluate the status of our white sturgeon populations; 1983 will be the last year of those studies. Our objectives were to determine the status of all populations, add to the relatively small amount of life history information, and to develop a population simulation model for use in determining harvest regimes on populations that were abundant enough to allow a consumptive fishery. White sturgeon populations between C. J. Strike and Bliss Dams and below Hells Canyon Dam are the two most healthy populations and may be of sufficient numbers to allow limited harvest. All other populations in both the Snake and Kootenai rivers appear to be depressed and may not be self-sustaining.

Our overall management goals for white sturgeon in Idaho are (1) to maintain existing self sustaining populations by preserving habitat and restricting angler harvest, and (2) to rebuild depressed populations by

restricting harvest, transplanting sturgeon from healthy populations, and through enhancement by hatchery means.

At the end of this year's study we will begin putting together a state-wide white sturgeon management plan and evaluate our research needs on the basis of that plan. We do have tentative plans to fund a limited research project on the Kootenai River in 1985 to look at viability of sex cells and to evaluate the applicability of hatchery techniques for boosting that populations.

APPENDIX D

STATUS AND MANAGEMENT OF WHITE STURGEON IN MONTANA

APPENDIX D

STATUS AND MANAGEMENT OF WHITE STURGEON IN MONTANA

Patrick J. Graham
Montana Department of Fish, Wildlife and Parks

and

Robert G. White
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In Montana, distribution of the white sturgeon (Acipenser transmontanus) is limited to the Kootenai River downstream from Kootenai Falls (Figure D.l). Taking of white sturgeon has been prohibited since 1979 although they are classified as a game fish. Indications of their diminishing numbers prompted this closure.

Historical Abundance

From a historical perspective it is known that white sturgeon were utilized by Kootenai Indians at least several hundred years ago. Early explorers noted that canoes used by Kootenai Indians had a nose shaped like the head of a sturgeon.

Mroe recently a fishery is known to have existed in the Kootenai River downstream from Kootenai Falls in Montana. In the Montana portion of the Kootenai River, fishermen frequently reported catching sturgeon in the 1940s and 1950s on set-lines and while fishing for ling. The ling population rapidly declined in the late 1950s and early 1960s. This coincided with increased algal growth in the late 1950s and a subsequent decrease by the mid-1960s. The catch of sturgeon during this period reportedly declined. Whether this was a result of a decrease in fishing pressure due to the small ling population or to an actual decrease in the number of sturgeon is not known.

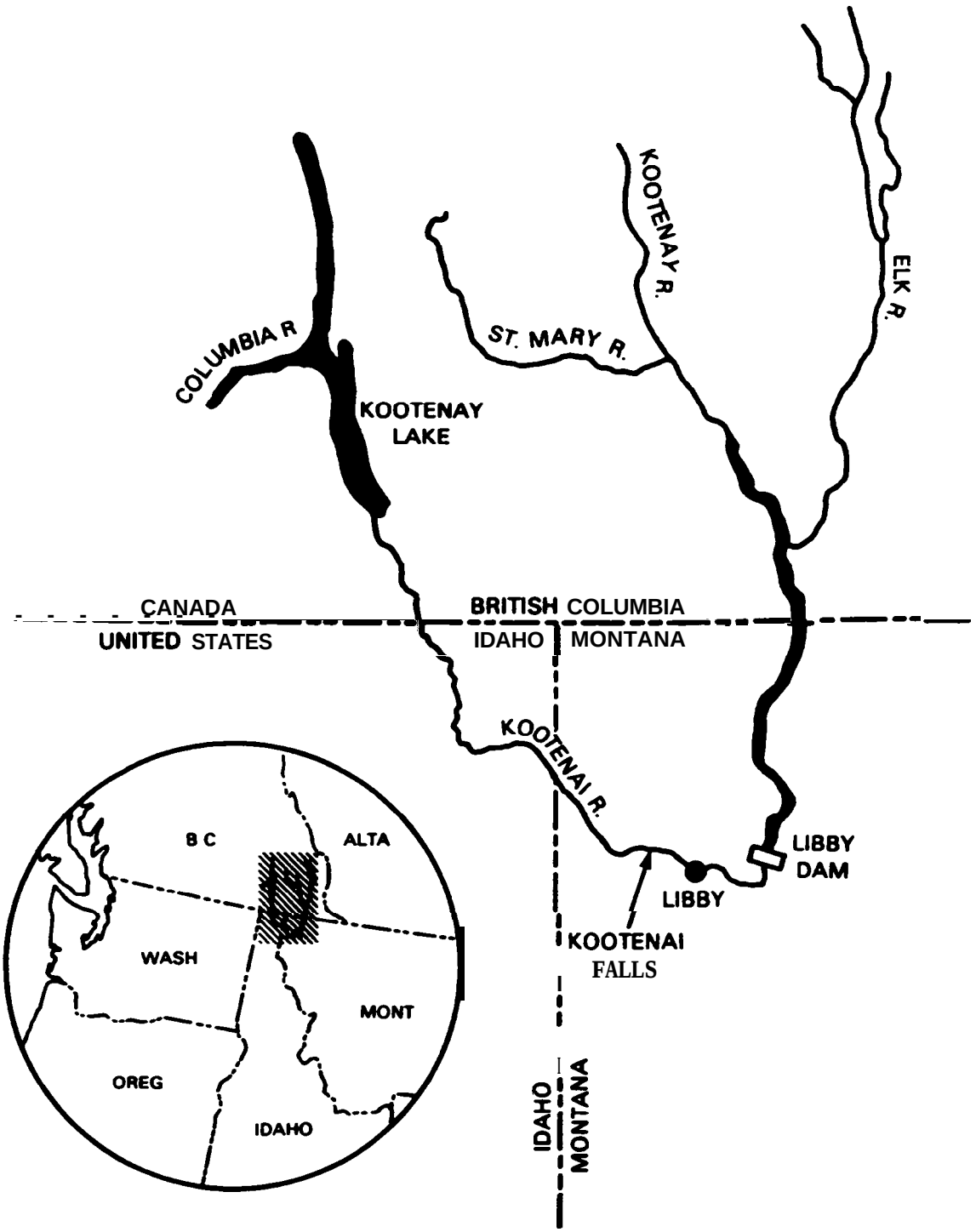

FIGURE D.1. Kootenai River Drainage Basin

Present Status

Estimates of the present abundance of white sturgeon have been obtained from a combination of sources, including volunteer information by fishermen, recapture of marked sturgeon, angler interviews and sturgeon tags. No intensive studies have been conducted on white sturgeon in the Kootenai River.

Tagging of white sturgeon in British Columbia began in 1977, but population abundance and life history data are limited. A study initiated *in* the Idaho portion of the Kootenai River in 1979 was proceeded by two years of periodic tagging of sturgeon. The present Idaho study is directed at (1) assessing movement patterns; (2) identifying major use areas; and (3) determining the status of white sturgeon in the Idaho portion of the Kootenai River.

Studies in Montana have been limited to gill netting in 1975 and 1976, SCUBA diving from 1978 to 1980, and fisherman logs of partial angler catch from 3968 through 1972 in the most popular fishing area in the Montana portion of the Kootenai River.

The present population size in Montana is estimated to be from one to five sturgeon. The apparent stability of the sturgeon population in the British Columbia and Idaho portions of the Kootenai River suggest that few, if any, sturgeon migrate upstream into Montana and do not reside in Montana waters for extended periods of time.

Between June 1968 and May 1972 one group of fishermen reported catching 43 sturgeon, of which nine *were* killed. This included the state record of 96 pounds. Some of the sturgeon were probably caught more than once. These catches are thought to be low compared to reports of sturgeon fishermen that catches were common in the 1940s and 1950s. In 1975, biologists from the Montana Department of Fish, Wildlife and Parks captured and tagged only six sturgeon. Two more sturgeon were captured the following year. Five of these sturgeon were taken upstream and placed in Libby Reservoir in an effort to establish a population. The introduction

of sturgeon into Libby Reservoir was probably not successful. Three of the sturgeon are known to have been captured upstream from the reservoir in flowing-water habitat. It is also not known what their sex or state of maturity was.

In 1978, numerous net sets, set-line fishing and rod and reel fishing produced only three sturgeon, all of which were captured at least twice (one of these sturgeon was tagged in 1976).. Two of the sturgeon were captured downstream in Idaho by the same fisherman in the spring of 1980. Biologists searched about two miles of the canyon below Kootenai Falls in the summer of 1979 and 1980 by using SCUBA gear and observed only one sturgeon each summer.

The limited information on white sturgeon in Montana would indicate they are very near extinction. Lack of adequate information on the life history and population changes in years past make it difficult to accurately identify the direct cause of their decline. A number of factors including pollution, changes in water quality and shifts in fish populations, and hydroelectric dam construction and operation may have contributed. Without further study, the feasibility and subsequent implementation of a recovery program would have questionable value.

Recovery Plan

Project Identification (Phase I)

1. Initiate a more complete assessment of the spatial and temporal distribution of white sturgeon in the Kootenai River in cooperation with Idaho and British Columbia to determine the present upstream limit of their spawning migration.
2. Conduct an assessment of the other fish and invertebrate populations downstream from Kootenai Falls to determine the available food source.
3. Model stream flow-temperature changes at Kootenai Falls and below the major tributaries downstream to further evaluate moderating influence of major tributaries on the regulated flows resulting from Libby Dan.

4. Conduct tissue analysis of white sturgeon in the Kootenai River to determine if heavy metal contamination may be influencing reproduction or egg survival.

Develop and Assess Recovery Alternatives (Phase II)

These alternatives cannot be addressed specifically until the problem-identification phase is completed. If regulated flows were the problem, the assessment would include: (1) determine potential for altering the existing flow regime; (2) assess impacts of flow alterations on other aquatic populations; and (3) determine impact of flow alterations on power production.

If a workable solution is identified it might be necessary to secure a source of mature white sturgeon or eggs to begin a new run. One possibility is to continue with the introduction of sturgeon into Libby Reservoir. This would have questionable value for Montana at this time, and this alternative would be workable when and if Libby Reservoir developed a food base for sturgeon.

APPENDIX E

PRESENT FISHERY AND MANAGEMENT OF COLUMBIA RIVER STURGEON

APPENDIX E

PRESENT FISHERY AND MANAGEMENT OF COLUMBIA RIVER STURGEON

Gayle Kreitman
Washington Department of Fisheries

Present Commercial Fishery

Sturgeon are presently harvested by setlines and gill-nets downstream of Bonneville Dam, and by setlines and set nets in the treaty Indian fishery upstream of the dam. At this time the sturgeon catch upstream of Bonneville is considered to be minimal.

Setline Fishery

Following a two month experimental fishery early in 1975, a one-month setline season was set in April of that year. This was expanded to three months in 1976 and 1977 so that the fishery was open from February through April. In 1977, area closures also occurred in an attempt to minimize sport-commercial conflicts. Monthly extensions of the season continued so that by 1982 only May, June and July were closed to setlineing. These months were closed to protect spawning sturgeon. In 1982, a 9/0 minimum hook size was also established to decrease the catch of sublegal-sized fish 9<4 feet total length) and use of treble hooks was prohibited. Comprehensive evaluation of the fishery since 1975 resulted in a reduction in the season. In 1983, August and September were re-closed and hook size was again increased to a 12/0 minimum.

Both biological and non-biological problems developed with the setline fishery. The landing of sublegal sturgeon was extensive (80 percent of those caught on legal gear). Of those sublegals, three percent were immediate mortalities. The delayed mortality due to stress and hook damage is unknown.

A. Goa1

1. Maintain sturgeon stock levels to provide a maximum harvest by recreational and commercial fisheries on a sustainable basis.

B. Objectives

1. Determine resource status both above and below Bonneville Dam.

2. Establish and maintain data base including, but not limited to:

a. population estimates

b. migration patterns of adult and juveniles

C. feeding habits of adult and juveniles

d. spawning characteristics

1. spawning ground locations

2. timing

3. extent of natural production

e. age and growth

f. survival and fecundity.

C. Application of management techniques to achieve goal

1. Change regulations to maintain optimum stock levels.

2. Enhance stock, if necessary, through:

a. maximum and minimum size limits

b. artificial means

D. Honitor stock status to ensure goal is being met.