

White Sturgeon Bibliography

**Final Report
1985**



DOE/BP-22209-2



March 1986

This Document should be cited as follows:

Fickeisen, Duane, "White Sturgeon Bibliography", Project No. 1985-06400, 50 electronic pages, (BPA Report DOE/BP-22209-2)

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

White Sturgeon Bibliography

FINAL REPORT

BY

Duane H. Fickeisen

Prepared For

Fred W. Helm, Project Manager

U.S. Department of Energy

Bonneville Power Administration

Division of Fish and Wildlife

Contract No. DE-AI-84BP22209

Project No. 85-64

March 1986

PREFACE

This bibliography was compiled from a number of sources with the objective of providing access to the majority of published materials on white sturgeon (**Acipenser transmontanus**) I checked citations with original sources whenever they were available **however**, because I wanted to provide as complete a bibliography as possible, I included many citations to materials that were not available to me. In some cases, only partial references could be obtained. I also included several unpublished works.

While my focus was on white sturgeon, many references to papers describing other sturgeon species came to my attention. These were included, however, no attempt was made to provide a comprehensive survey of literature on species other than **A. transmontanus**.

Many of the citations include notations describing the content of the publication. I intended thereby to help researchers select materials for more detailed review, not to provide a complete summary of the contents of each paper.

The Bonneville Power Administration sponsored development of the bibliography as a tool to assist in planning and implementing research on white sturgeon in the Columbia River system as a basis for planning actions to mitigate for effects of hydroelectric development, enhance the fishery, and protect the species.

Communications from users of this bibliography are welcome, particularly with regard to corrections or additions to the white sturgeon literature.

I want to acknowledge E. Dave Lane and Steven Vigg who each made drafts of their bibliographies available to me. Members of the BPA White Sturgeon Steering Committee provided helpful comments on an early draft and helped locate agency reports. Don Klopfer assisted in compiling original reference materials.

DHF
Portland, Oregon

Afonich, R. V. 1970. The feeding habits of starred sturgeon larvae at the early stages of development at hatcheries. Vses. Nauchno-Issled. Inst. Morsk. Rybn. Khozy. Okeanograf., Tr., **74:58-81** [in Russian].

Aitken, D. 1981. Interim report on white sturgeon (**Acipenser transmontanus**) studies in the Nechako River. British Columbia Fish and Wildlife Branch (Omineca Peace Region), Prince George, British Columbia. [Manuscript report]

Andrusak, H. Undated. Kootenay River white sturgeon. Brit. Columbia Fish and Wildl. Branch. Mimeo rept.

Andrusak, H. 1980. Kootenay River white sturgeon. B. C. Fish and Wildlife Branch. [mimeo rept]

In the 32 km reach of the Kootnay River in BC, 40-76 sturgeon sport fishing permits were issued in 1974-1 980, with annual catches of 5-1 8. Population is estimated at 3000-5000 Very few fish under 100 cm were observed.

Anon. Undated. White sturgeon intensive rearing husbandry table. Univ. Calif. Davis, 3p. [mimeo report]

Anon. 1940. Sturgeon. **Calif. Conservationist 5(5):20.**

History of fishery and depletion, effect of Chinese set line operations, carp and striped bass introduction. Migration, spawning, predation.

Anon. 1940. Sturgeon on the increase. **Outdoor California 1(8):1.** [Press Release]

Reported observation of sturgeon in Klamath River.

Anon. 1954. Getting the facts on the sturgeon. **Outdoor California 15(11):9.**

Announcing tagging program in Sacramento-San Joaquin Delta. Food said to include shrimp and small clams.

Anon. 1954. New season on the biggest fish of them all tempts California anglers. **Outdoor California 15(4):1,6.**

Sport fishing for sturgeon reopening in California after 35 year closure due to stock depletion from overfishing. Commercial catch peaked in 1880's at 700,000 lbs.

Anon. 1955. Idaho Sturgeon. **Idaho Wildl. Rev.** Jan-Feb. p. 15.

Letter to editor and response outlining sturgeon sport fishing regulations.

Anon. 1955. Tagged sturgeon recovered. **Comm. Fish Rev. 17(10):48.**

Report of recapture near Astoria of sturgeon tagged in San Pablo Bay.

Anon. 1977. Dams bring change for white sturgeon. **Focus 4(1):4.**

Anon. 1979. The development of technology for a prototype sturgeon hatchery. Univ. Calif. Davis [Manuscript] 36pp.

Anon. 1979. U. S. workers induce spawning in sturgeon. Fish Farming International **6(3):3**.

Spawning induced in Atlantic sturgeon.

Applegate, V. 1971. The white sturgeon-a case for regulation. Mont. Fish and Game Field Stn., Libby, MT, [mimeo], 8pp.

Aquaculture Digest Reviews of white sturgeon work. [Most issues from 1980 to present.]

Avedikova, T. M. 1980. Some growth patterns among sturgeons (Acipenseiridae family) of the Sea of Azov.

Ayres, W. 1854. Description of new fishes from California. Proc. Cal. Acad. Sci. 1854-57 (1857) 1:3-22.

Includes descriptions of Acipenser acutirostris Ayres, s.n.; A. medirostris Ayres s.n.; A. brachyrhynchus Ayres s.n. on pp. 14-16.

Badenko, L. V., G. G. Komiyenko, V. P. Chikhacheva, and L. A. Altukhova 1981. Methods for evaluating the quality of sturgeon spawners (as exemplified in the sevryuga, Acipenser stellatus) from the Kuban River. J. of Ichthyology 31 (1):96-103.

Use of blood parameters to estimate maturity and plan induction of ovulation with pituitary.

Bailey, E. D. 1954. Sacramento-San Joaquin salmon and steelhead study. California Dept. of Fish and Game, Quarterly Progress Report, Sacramento, California 8pp.

Bajkov, A. D. 1949. A preliminary report on the Columbia River sturgeon. Fish. Comm. Oreg. Res. Briefs **2(2):3-10**.

Review of available information, describes tagging and tag loss, lays out proposed research program, proposes management approach that includes protection of spawners, establishing reserve areas, and artificial propagation.

Bajkov, A. D. 1951. Columbia River sturgeon fingerlings. Fisheries Commission of Oregon, Portland, Oregon. [Memorandum]

Bajkov, A. D. 1951. Migration of white sturgeon (Acipenser transmontanus) in the Columbia River. Fish. Comm. Oreg. Res. Briefs **3(2):8-21**.

Extensive Peterson disk tagging program. Disk most effective in upper lobe of caudal fin. Recaptures indicate upstream migration of immature fish in fall, downstream in winter and spring. Movement likely in response to food. Bonneville Dam apparently blocks movement, both up- and down-stream. Sturgeon concentrate in deep holes in winter and move to shallow water in spring.

Bajkov, A. D. 1951. Summary of sturgeon investigations. Fisheries Commission of Oregon, Portland, Oregon. [Memorandum]

Bajkov, A. D. 1951. The Columbia River sturgeon fingerlings. Oreg. Fish Comm, Dept of Res. [mimeo rept].

Spawning area assumed to be from Bonneville Dam to 2mi below Beacon Rock. Reports ripe females and males both taken at Beacon Rock and juveniles caught at Bonneville Dam and near Beacon Rock. Seining and fyke nets failed to catch juveniles in the area. Additional trials suggested with a small 1/4-mesh beam-trawl.

Bajkov, A. D. 1955. White sturgeon with seven rows of scutes. Calif. Fish. and Game 41(4):347-348.

Report of about 25 sturgeon (0.3% of sample) with seven instead of the usual five rows of scutes.

Barannikova, I. A. 1949. Concentration of gonadotropic hormone in the pituitary of male and female sturgeons at different stages of the sex cycle. Dokl. AN SSSR 68(6):147-150.

Barannikova, I. A. 1957. Biological differentiation of the Volga-Caspian sturgeon population in relation to the commercial sturgeon culture in the Volga Delta. Uch. zap. Leningr. gos. un-ta. 228(44):57-72.

Barannikova, I. A. 1975. Functional Basis of Fish Migration [in Russian]. Nauka Press, Leningrad, p. 210.

Barannikova, I. A. 1975. Pituitary-ovarial relationship in sturgeon during normal and disturbed sex cycles. Tr. Vsesoyuz. n.-i. in-ta morsk. rybn. khozva i okeanogr. 111:86-97.

Barannikova, I. A. 1978. Hormonal regulation of reproduction in sturgeon. Tr. Vsesoyuz. n.-i. in-ta morsk. rybn. khozva i okeanogr. 130:6-17.

Barannikova, I. A. 1979. Present status and future problems of sturgeon farming. In: Biological Basis of Developing Sturgeon Farming in the Waterbodies of the USSR [in Russian]. (Nauka Press, Moscow) pp. 49-59.

Barannikova, I. A., O. S. Bukovskaya, and N. A. Efimova. 1984. Gonadotropin dynamics and conditions of the pituitary gonadotropocytes of sturgeon, Acipenser gueldenstaedti, with different conditions of the sex glands during the riverine period of life. J. of Ichthyology 24(6):59-66. [Originally published in Voprosy Ikhtologii 5(1984):822-828].

Differences found in pituitary gonadotropocytes and gonadotropic hormones in pituitary gland and blood serum during different periods.

Barannikova, I. A., and N. A. Efimova. 1981. Study of the pituitary gonadotropocytes of female sturgeons at different stages of the sex cycle. In: Rational Basis of Sturgeon Farming [in Russian]. (Volgograd) pp. 23-24.

Barrett, S. A., and E. W. Gifford. 1933. Miwok Material Culture. Bull. Public Mus. Milwaukee **2:117-403**.

Sturgeon fishery by plains miwok natives. p. 189.

Bartley, D. M., and G. A. E. Gall. 1983. The genetic structure of white sturgeon populations in the Pacific Northwest. Abstr. AFS 113th Ann. Meeting, Milwaukee, Wisc., Aug. 16-20, 1983. p.101.

Development of electrophoretic technique for study of isozymes with objective of determining degree of genetic differentiation.

Becker, C. D. 1970. Marine trematode Tubulovesicula lindbergi (Digena: Hemiuridae) from resident white sturgeon in the Columbia River. J. Fish. Res. Bd. Can. **27(7):1313-1316**.

New host record. Postulates that the trematode was transported upstream in an anadromous teleost which was subsequently eaten by the sturgeon.

Becker, C. D. 1971. Cestrahelminis rivularis sp. n. (Digenea: **Deropristiidae**) from white sturgeon, Proc. nser transmontanus, in the Columbia River, Washington. Helm. Soc. Wash. **38(1):23-26**.

Description of species infecting mid-Columbia sturgeon.

Becker, C. D. 1980. Hematozoa from resident and anadromous fishes of the central Columbia River: A survey. Can. J. Zool. **58(3):356-362**.

10-yr survey of haematozoa in fish of central Columbia River. First record of Trypanoplasma salmositica in white sturgeon.

Beer, K. E. 1981. Embryonic and Larval Development of the White Sturgeon (Acipenser transmontanus). M. S. Thesis, UC Davis. 93pp.

Embryonic stages described, many photographs, post-hatch larval behavior is described.

Beer, K. 1982. [Report on 1982 sturgeon rearing activities.] Correspondance, Ken Beer to Aquaculture Digest, December 6, 1982.

Hatched 650,000 larvae. Found dry trout diets were readily accepted. Tank (raceway) culture more effective than pond culture.

Beer, K. E. 1983. Commercial feasibility of white sturgeon culture. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug **16-20, 1983**, p. 103.

Description of pilot scale commercial hatcheries and state regulations.

Beer, K. E., and **S. I.** Doroshov. 1984. Embryonic and larval development of white sturgeon, Acipenser transmontanus. Ms. U. C. Davis.

Bell, M. C. 1973. Fisheries handbook of engineering requirements and biological criteria. Fish. Eng. Res. Prog. Corps of Engineers, N. Pac. Div., Portland, OR

Benfield, P. A., B. G. Forcina, I. Gibbons, and R. N. Perham. 1979. Extended amino-acid sequences around the active site lysine residue of class-I fructose 1,6-bisphosphate aldolases from rabbit muscle, sturgeon muscle, trout muscle, and ox liver. Biochem. J. **183(2):429-444.**

Amino acid sequences described indicate strong homology.

Bennett, D. E. 1980. Lower Willamette River steelhead, white sturgeon and shad fisheries. Progress Report, Feb-June 1980, Oregon Dept. of Fish and Wildlife, Corvallis, Oregon, 9pp.

Berg, L. S. 1948. Freshwater fishes in the U.S.S.R. and adjacent countries. Vol. I, 4th ed. Transl. Israel Programs for Scientific Translations, Jerusalem, 1962. U.S. Dept. of Comm., Off. Tech. Serv., OTS 61-31218, pp. 52-105. [Akademiya Nauk SSSR Zoologicheskii Institut]

Keys, distribution, descriptions, and life history reviews for Eurasian sturgeons.

Bohn, B. R., and D. O. Mclsaac. 1983. Columbia River fish runs and fisheries **1960-1981**. Oregon Dept. Fish Wild. and Wash. Dept. Fish., 83pp.

Bohn, B. R., and D. O. Mclsaac. 1984. Columbia River fish runs and fisheries. 1960-1983. Ore. Dept. Fish. Wild. and Wash. Dept. Fish.

Borisov, V. N. 1969. Contamination with **clostridium-botulinum** type **E** of low-grade fish and the meat of white sturgeon. Giaienia i Sanitarria **34(12):87-89.** [Russian]

Bosley, C. E. 1979. Intensive monitoring--Columbia River. U. S. Fish and **Wildlife** Service, Fisheries Assistance Office, **Marrowstone** Field Station, Nordland, Washington.

Bosley, C. E., and G. F. **Gately.** 1981. **Polychlorinated** biphenyls and chlorinated pesticides in Columbia River white **sturgeon (Acipenser transmontanus)**. U. S. Fish and Wildlife Serv., **Marrowstone** Field Station, Fish. Assistance **Office**, Nordland, Washington. Nov. 1981. **30pp.**

PCB's and DDE found in most filet samples taken from Astoria to **Lk. Wallula**. The FDA action level for **PCB's** (5 ppm) was exceeded in one filet (5.3 ppm). Levels showed positive **correllation** with lipid content and with age. Levels of **PCB's** in one egg sample (1.45 ppm) were possibly high enough to cause some mortality if toxic level is similar to that for salmon eggs.

Botsford, L. W. and R. C. Hobbs. 1984. Optimal fishery policy with artificial enhancement through stocking: **California's** white sturgeon as an example. Ecol. Modeling **23(4):293-312**.

Economic model developed to help set stocking and fishery policy. Different cases of recruitment/stocking **are** considered. Model is sensitive to poorly known parameters.

Boyko, Ye. G., and V. I. Naumova. 1960. Breeding conditions of sturgeons in the Don after flow regulation. Tr. Azov Fisheries Research Institute **1(1):259-287**.

Brannon, E. L. 1980. Proposal to establish a prototype sturgeon hatchery on the Columbia River. University of Washington, College of Fisheries, Seattle, Washington, **12pp. [Manuscript report]**

Brannon, E. L., C. L. Melby, and S. D. Brewer. 1984. Columbia River white sturgeon (Acipenser transmontanus) **enhancement**. University of Washington, Final Report to Bonneville Power **Administration**, Proj. No. 83-316. **43pp.**

Sturgeon were successfully spawned and incubated, studies were undertaken to examine distribution behavior of larvae and fry, **tolerance** of young sturgeon to saltwater, and feeding behavior of larvae and fry.

Brennan, J. S. 1984. Techniques for ageing sturgeon: a comparative analysis. Am. Zool. **24(3):26** (Abstract) Presented at Annual Meeting, American Society of Zoologists, December **27-30**, 1984, Denver, Colorado.

Comparison of methods of counting **annuli** in bony structures including **otoliths**, **scutes**, **opercles**, **cleithra**, and fin ray sections.

Brice, J. J. 1898. A manual of fish culture based on the methods of the United States Commission of Fish and Fisheries. **Rept. U. S. Comm. Fish.** 1897 (1898) Part 23, Append. **C:1-340**.

Brown, C. J. D. 1971. Fishes of Montana. Big Sky Books, **Bozeman**, Montana, 207 pp.

Brunson, R. B., and D. G. Block. 1957. The first report of the white sturgeon from Flathead Lake, Montana. Proc. Montana Acad. Sci. **17:61-62**.

A ripe male sturgeon, 27 **yrs** old, 2.3 **m** TL, and 181 **lbs** is described.

Buddington, R. K. 1983. Digestion and feeding of the white sturgeon, Acipenser transmontanus. Univ. **Calif.** Davis, Ph. D. Dissertation, 151 pp. Diss Abs. **44(10-B):2981**.

Embryology and enzymology of digestive canal is described. Manufactured diets found sufficient for rearing in hatchery, with good survival and growth. Feeding **attractants** and alternative or additional binders added to commercial salmonid diets did not influence survival or growth rates.

Buddington, R. K. 1983. Digestive physiology of the white sturgeon, **Acipenser transmontanus** Abstr. AFS 113th Annual Meeting, Milwaukee, **Wisc.**, Aug. 16-20, 1983, p. 100.

Digestive enzymology described for juvenile sturgeon (up to 80 days posthatch).

Buddington, R. K. 1985. Digestive secretions of lake sturgeon, **Acipenser fulvescens**, during early development. **J. Fish Biol.** **26:715-723**.

Description of enzymology during development. Changes in digestive enzymes were age-related, perhaps due to different feeding **habits** and nutritional requirements, and were not induced by diet.

Buddington, R. K., and S. I. Doroshov. 1982. Early growth of white sturgeon (**Acipenser transmontanus**) fed manufactured foods. Presented at World **Mariculture** Society Annual Meeting, Charleston, South Carolina.

Sturgeon fed semi-moist artificial diet from initiation of feeding throughout the **growout** period showed slower initial growth, but reached larger size than fish fed live feed or live feed initially followed by semi-moist feed. Dry **commercial** diets were not accepted. Recommended feeding regime is to start with semi-moist diet 10 days post hatch (at 20 °C), with particle size of 1.0 to 1.5 mm. **12-15%** body weight per day, in **12-15** feedings. **Yielded** specific growth rate of 8.2% per day and a conversion ratio of 2.7 **g** food per **g** fish produced during first 14 days of feeding.

Buddington, R. K., and S. I. Doroshov. 1984. Feeding trials with hatchery produced white sturgeon juveniles (**Acipenser transmontanus**). **Aquaculture** **36(3):237-243**.

Semi-moist commercial feed produced lower growth, but similar survival to live feed for first 40 days, and avoided mortality associated with later change from commercial diet to live food. **Dry** diets were not well accepted, resulting in lower rates of growth and survival.

Bukovskaya, O. S. 1981. **Radioimmunological** estimation of gonadotropin and sex **hormone** content in the **blood** serum of **sevruga** at some stages of cell cycle. **In:** Rational Basis of Sturgeon Farming [in Russian]. (Volgograd) pp. **31-32**.

Burggren, W. W. 1978. Gill ventilation in the sturgeon, **Acipenser transmontanus**: unusual adaptations for bottom dwelling. **Respiration Physiology** **34(2):153-170**.

Details of physiology of gill ventilation. Found to draw water in through opercular slits when mouth is blocked as in bottom feeding.

Burggren, W. W., J. Dunn, and K. Barnard. 1979. **Branchial** circulation and gill **morphometrics** in the sturgeon **Acipenser transmontanus**, an ancient Chondrosteian fish. **Can. J. Zool.** **57(11):2160-2170**.

Gill area is low compared to other fishes, reflecting low activity rate. Details on gill area and function.

Burggren, W. W., and D. J. Randall. 1978. Oxygen uptake and transport during hypoxic exposure in the sturgeon Acipenser transmontanus. Resp. Physiol. 34(2):171-183.

Shown to be an oxygen conformer, with reduction in metabolic rate under hypoxia.

Bychowsky and Dubinina. 1954. Zool. Zhur. 33:788-793.

Caballero. 1952. Rev. Med. Vet. Parasit. 11: 1-231.

Cable, R. M. 1950. An Acanthocolpid trematode from the sturgeon of the Wabash River. Presented at 25th Annual Meeting, American Society of Parasitologists, Cleveland, Ohio, December 27-29, 1950. [Abstr. published in J. Parasitology 36(6):27.]

Description of a new genus and species, found in numbers in spiral valve of sturgeon.

Cable, R. M. 1952. On the systematic position of the genus Deropristis, of Dihemistephanus sturionis Little, 1930, and of a new digenetic trematode from a sturgeon. Parasitology 42:85-91.

Description of Pristotrema manteri n. g., n. sp. from shovelnose sturgeon (Scaphirhynchus platorhynchus (Raf.).

Cable, R. M. 1955. Taxonomy of some digenetic trematodes from sturgeons. J. Parasit. 41(4):441.

Discussion of taxonomy of trematodes commonly found in sturgeon representing at least 3 genera. Several references.

Cable, R. M., and A. V. Hunninen. 1942. Studies on Deropristis inflata (Molin), its life history and affinities to trematodes of the family Acanthocolpidae. Biol. Bull. 82: 292-312.

Calif. Fish and Game Commission. 1982. [Renewal of permits for sturgeon culture for 1983] Minutes, Calif. Fish and Game Commission, Item 14, p. 57, November 1982.

Five permittees reported on 1982 results and plans for 1983. All five permits were renewed. The Fishery (Ken Beer, The Fishery, Star Rt B, Cascade Locks, OR 97014), White Water Sturgeon (Ron Lipton, White Water Sturgeon, Inc., 1438 51st St., Sacramento, CA 95819), Arrowhead Fisheries, Inc. (Keith Brown), Calaveras Trout Farm (Ed Murrison), and California Sunshine, Inc. (Mats Engstrom. Calif. Sunshine, Inc., 1217 C Street, Sacramento, CA 95814)

Callman, J. L. 1983. Studies on the gastrointestinal microflora of hatchery reared white sturgeon, Acipenser transmontanus. MS Thesis. Univ. of Calif., Davis.

Callman, J. L., and J. M. Macy. 1984. The predominant **anaerobe** from the spiral intestine of hatchery-raised sturgeon (**Acipenser transmontanus**), a new **Bacteroides** species. Arch. Microbiol. **140(1):57-65.**

This new sp appears to **be** important to sturgeon nutrition and physiology. **It** forms succinate, proprionate, acetate, and hydrogen, and is able to synthesize vitamin K. Swim bladder gas was shown to be hydrogen, and this organism may be the **source.**

Campbell, K. P., S. R. Johnson, K. U. Wolniakowski. 1982. A pilot study of potential phenolic contamination of fishes in the Columbia River and tributaries in the vicinity of Mount St. Helens. **Rept.** to Office of Water Research and Technology, Beak Consultants, Portland, OR. **W83-01354 OWRT-C-10072-V(1462)1. 32pp.**

A single white sturgeon, FL **86cm**, collected in the Columbia River near **Mayger**, OR on **9/16/81**, had phenol concentration in flesh of **56 ng/g**. This was the highest concentration reported among several species of fish. Pentachlorophenol was not detected in this sample. 9 other white sturgeon collected between **Sept** 1981 and Mar 1982 from the Columbia River had non-detectable levels of phenol. Source of phenol was assumed to be industrial (including an industrial fire involving phenol at Kalama, or natural, including decaying logs in Spirit Lake following eruption of Mt. St. Helens.

Carl, G. C., W. A. Clemens, and C. C. Lindsey. 1967. The freshwater fishes of British Columbia. British Columbia Prov. **Mus.**, Handbook No. 5, 192 pp.

Carlander, K. D. 1969. Handbook of Freshwater Fishery Biology, Vol 1. Iowa State Univ. Press, Ames 752 pp.

Carter, E. N. **1904**. Notes on sturgeon culture in Vermont. Trans. Am. Fish. Soc. **33:60-75.**

Notes on spawning of lake sturgeon and on artificial propagation.

Cech, J. J., Jr. 1981. Comparative growth and respiration of juvenile white sturgeon and striped bass. Estuaries **4(3):254** [Abstract] See **Cech**, et al, 1984.

Cech, J. J., Jr., S. J. Mitchell, and T. E. Wragg. 1984. Comparative growth of juvenile white sturgeon and striped bass: effects of temperature and hypoxia. Estuaries **7(1):12-18.**

Sturgeon growth greater at 20 than 15 but not greater at 25 °C. Activity increased with temperature regardless of hypoxia except that activity at 20 and 25 °C was not different under hypoxia. Hypoxia reduced growth rate at each temperature.

Chacko, A. J., and T. C. **Coley**. 1984. **Histopathology** of Cystoopsis **acipenserii** (Nematoda: Cystoospiidae): Infection in white sturgeon **Acipenser transmontanus**. Program and Abstracts, 59th Annual Meeting, American Society of **Parasitologists**, Snowbird, Utah, August 1984. **p. 45.**

Chadwick, H. K. 1959. California sturgeon tagging studies. Calif. Fish Game 45(4):297-301.

Tagging study to estimate fishing mortality. Used Peterson and spaghetti tags (single and double-tagged). Tag losses shown to be similar and low. Insufficient returns to estimate mortality. One fish reported in Columbia River, 660 mi from release point in San Pablo Bay.

Chadwick, H. K. 1959. Studies of sturgeon and striped bass. California Dept of Fish and Game, Quarterly Progress Report, Sacramento, California.

Cherfas, B. I. 1956. Fish culture in natural waters. M. Jonanovic, transl. Moscow.

Cherr, G. N. 1984. Gamete morphology, physiology, and interaction in the white sturgeon, Acipenser transmontanus. Ph. D. Dissertation, Univ. Calif. Davis. 101pp. Diss. Abs. Int. B Sci. Eng. 45(4):1129.

Describes fine structure of white sturgeon egg envelope; physiological mechanisms of jelly release, and chemical composition of jelly; sperm morphology before and after the acrosome reaction; and characterization of the factor in the egg envelope that induces the acrosome reaction.

Cherr, G. N., and W. H. Clark, Jr. 1980. Sperm passage through the micropyles and egg activation in white sturgeon, Acipenser transmontanus. Am. Zool. 20(4): 876 (Abstract) Presented at Annual Meeting of American Society of Zoologists, December 27-30, 1980, Seattle Center, Seattle, Washington.

Spermatozoa congregate at micropyles, which are numerous (ave 10) and taper to size of sperm diameter. Numerous spermatozoa remain in canals at least 2 min postfertilization.

Cherr, G. N., and W. H. Clark, Jr. 1982. Fine structure of the envelope and micropyles in the eggs of the white sturgeon, Acipenser transmontanus Richardson. Develop., Growth and Different. 24(4):341-352.

Description of structure of egg envelope layers and micropyles, as prerequisite to functional studies of gamete activation. Structure differs from that of other sturgeon eggs. Micropyle structure relatively complex. Micropyles are numerous (contrast with singular micropyle in teleosts), hence potential for polyspermy. Envelope thicker than typical teleost eggs.

Cherr, G. N., and W. H. Clark, Jr. 1983. Artificial and natural activation of sperm from two acipenserid fish--a demonstration of species specificity. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug 16-20, 1983. p.98.

Acrosome reaction and inducers described.

Cherr, G. N., and W. H. Clark, Jr. 1983. Characterization of the natural inducers of the acrosome reaction in sturgeon sperm. J. Cell. Biol. 97(5, pt. 2):180 (Abstracts, 23rd Annual Meeting) See Cherr, 1984 (dissertation)

Cherr, G. N., and W. H. Clark, Jr. 1984. An acrosome reaction in sperm from white sturgeon, Acipenser transmontanus. J. Exper. Zool. 232(1):129-139.

Morphology of sperm, description of acrosome reaction and inducers.

Cherr, G. N., and W. H. Clark, Jr. 1984. Jelly release in the eggs of the white sturgeon, Acipenser transmontanus: An enzymatically mediated event. J. Exp. Zool. 230(1):145-150.

Biochemical description of jelly and physiology of release in freshwater.

Chitwood, M. B., and A. McIntosh. 1950. An American host record for the Russian sturgeon nematode, Cystoopsis acipenseris Wagner 1868 [Taken from Columbia River at Bonneville Dam]. Journ. Parasit. 36(6), Sect. 2, Suppl.: 29. [Program for 25th Annual Meeting, American Society of Parasitologists, Cleveland, Ohio, December 27-29, 1950. Title only].

Christofferson, J. P. 1983. Preliminary investigations of the chemical control of feeding behavior in juvenile Acipenser transmontanus. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug. 16-20, 1983. p. 100.

Sturgeon imprinted on live tubifex responded to treated homogenates, indicating a low-MW, non-volatile, nitrogenous, amphoteric stimulant was present. The stimulant was either absent from Biodiet or was masked by other chemicals in Biodiet.

Chugunov, N. I., and N. I. Chugunova. 1964. Comparative study on the fishery and biology of Acipenserids in the Azov Sea. Proc. All-Union Research Institute of Marine Fisheries and Oceanography 52:87-182. [in Russian]

Classen, T. E. 1944. Age and rate of growth of the sturgeon. Instit. Espanol de Oceanogr. Madrid 19:54-70.

Cleaver, F. C. 1951. Fisheries statistics of Oregon--sturgeon. Oregon Fish. Comm. Contribution. 16. 176pp.

Catch of white sturgeon in Columbia River, 1889-1949.

Clemens, W. A., and G. A. Wilby. 1961. Fishes of the Pacific coast of Canada. Fish. Res. Bd. Can. Bull. 68 (2nd ed) 443pp.

Cochnauer, T. C. 1980. River and Stream Investigations. Snake River Fisheries Investigations. Part A: Survey of fish populations in the Snake River, Lower Salmon Falls Dam to Bliss Dam; Part B: Survey status of white sturgeon population in Snake River, Bliss Dam to CJ Strike Dam. Job Performance Report, Project F-73-R-2, Idaho Dept. of Fish and Game, 24pp.

431 sturgeon caught, 79% <3ft; 3% >6ft.

Cochnauer, T. C. 1981. River and Stream Investigations. Snake River Fisheries Investigations. Part A: Survey Status of White Sturgeon Populations in the Snake River, Bliss Dam to C. J. Strike Dam. Part B: Survey of Fish Populations in Snake River, Lower Salmon Falls Dam to Bliss Dam. Job Performance Report, Project F-73-R-3, Idaho Dept. of Fish and Game, 24pp.

678 caught during study. 74% < 3 ft; 2.6% > 6 ft. SCA of 10 indicated chironomids and crayfish as principle diet items.

Cochnauer, T. C. 1983. Abundance, distribution, growth and management of white sturgeon (Acipenser transmontanus) in the middle Snake River, Idaho. Ph.D. Dissertation, Univ. of Idaho, Moscow, Idaho, 52 pp. Diss. Abs. 45(05-B):1335.

Mark-recapture population estimate of 2191 sturgeon in reach between Bliss and CJ Strike Dams. Model estimated annual allowable harvest of 6 fish to maintain present population size estimates. A catch and release fishery above Bliss and below CJ Strioke is recommended.

Cochnauer, T. 1983. Status and management of white sturgeon in Idaho. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug. 16-20, 1983, p. 105.

Review of research in Idaho, fishery regulations.

Cochnauer, T. C. 1984. Summary of Idaho's white sturgeon management objectives. Appendix C, In Fickeisen, D. H., et al, White Sturgeon Research Needs: Workshop Results, Battelle Pacific Northwest Laboratories, Richland, Washington.

Cochnauer, T. C., and J. Lukens. 1984. Where have all the sturgeon gone? Acipenser transmontanus throne is shakey. Idaho Wildlife (May-Jun 1984) pp. 4-6.

Of the 7 populations (defined by dams blocking migration) in the Snake River, only 2 appear to be self sustaining. Others are limited by lack of critical habitat and overharvest.

Cochnauer, T. C., and R. White. 1975. Stream resouce maintenance flow studies. Idaho Dept. of Water Res., Idaho Dept. of Fish and Game, and Idaho Cooperative Fishery Research Unit

Columbia Basin Interagency Committee, Fishery Steering Committee. 1957. Columbia River basin fisheries program, Part II, inventory of streams and proposed improvements for development of the fishery resource. 7pp.

Conte, F. S. 1980. U.C. Davis Sturgeon Program. Calif. Aquaculture 80(2):2-3.

Coon, J. C. 1978. Movement, Distribution, Abundance and Growth of White Sturgeon in the Mid-Snake River. Ph. D. Dissertation. Univ. of Idaho. **73pp.**, Diss. Abs. 39(06-8):2588.

Between 1972 -75,889 white sturgeon were tagged between Lower Granite and Hells Canyon Dams and movements assessed. Small fish (**0.5-1.0 m**) moved downstream **7 km/yr**. Larger fish remained near site of capture. Population in the study area was estimated at 8,000 to 12,000 sturgeon **>0.5 m**. Growth was **back-calculated** and was variable with age. Successful reproduction was demonstrated. Adults found in deep (**>30 ft**) pools between rapids. Telemetry indicated that during filling of the Lower Granite pool sturgeon moved upstream into areas with active current.

Coon, J. C. 1979. Dark water and ancient fish. **Idaho Wildl.:**17-20.

Popular review of sturgeon in Idaho, fishing regulations, and growth and recruitment. Growth rates reported to be much slower than in the past, and recruitment to stocks over 30 inches is poor.

Coon, J. C., **R. R. Ringe**, and T. C. Bjorn. 1977. Abundance, growth, distribution and movements of white sturgeon in the mid-Snake River. Final Report to Office of Water Research and Technology, prepared by Forest, Wildlife and Range Exp. Stn., Univ. of Idaho, Cont. 97. **63pp.** [Available from Water Resources Research Inst., Office Water **Res.** and Tech., Wash., DC, **73pp.** NTIS **W78-00552; OWRT-B-026-IDA(1)**]

Tag recapture study in Lower Granite to Hells Canyon Dam reach. Population estimates, size distribution, growth, and movement information.

Craig, J. A. and **R. L. Hacker**. 1940. The history and development of the fisheries of the Columbia River. U.S. Rur. Fish. Bull. **49(32):133-216**

Review of the early commercial fishery, including methods and catch data.

Crass, D. W., and **R. H. Gray**. 1982. Snout dimorphism in white sturgeon, **Acipenser transmontanus**, from the Columbia River at Hanford, Washington. Fish. Bull. **(NOAA) 80(1):158-160.**

Report of dimorphism in snouts of similar sized white sturgeon.

Cuerrier, J.-P. 1949. Observations sur l'**esturgeon de lac (Acipenser fulvescens Raf.)** dans la region du **lac Saint-Pierre** au **cours** de la **période** du frai. These. **Université de Montreal, Qué.**

Cuerrier, J.-P. 1951. The use of pectoral fin rays for determining age of sturgeon and other species of fish. Canada Fish. Cult. **11:10-18**

Literature review on techniques of aging sturgeon. Presents details of fin ray method, including photographs.

Cuerrier, J.-P. 1966. L'esturgeon de lac Acipenser fulvescens Raf. de la région du Lac St-Pierre au cours de la période du frai. Le Naturaliste Canadian 93(4):279-334 [French, English Abs]

Reproductive data including size and age at maturity and interval between spawnings.

Cuerrier, J.-P., and G. Roussow. 1951. Age and growth of lake sturgeon from Lake St. Francis, St. Lawrence River. Report on material collected in 1947. Can. Fish. Cult. 10:17-29.

Length and weight distribution of commercial catch.

Cuplin, P. 1955. The white sturgeon. Idaho Wildl. Rev. 7(5):4.

General review.

Dean, J. M. 1976. Temperature of tissues in freshwater fishes. Trans. Am. Fish. Soc. 105(6):709-711.

Several species, including white sturgeon, shown to have increased muscle temperature (0.1-1.1 C) over ambient.

Dees, L. T. 1961. Sturgeons. Bur. Comm. Fish., Fish. Leaflet 526, 8pp.

Breif review of life history and use.

Deparade, M. P., K. Glöggler, and W. E. Trommer. 1981. Isolation and properties of glyceraldehyde-3-phosphate dehydrogenase [ec 1.2.1.12] from a sturgeon [Huso huso] from the Caspian Sea and its interaction with spin labeled NAD+ derivatives. Biochem. Biophys. Acta. 659(2):422-433.

Enzyme properties were similar to those reported for A. transmontanus. Study of coenzyme binding.

Deschamps, G. 1967. Coastal Investigations, Washington, USA. Salmon and Sturgeon Fishery. Wash. Dept. Fish. Ann. Rept. 77:52-54.

Grays Harbor catch in 1967 was 50,000 lbs white sturgeon (second best in 15 yrs). Best was 81,000 in 1962. Green sturgeon catch of 34,000 lbs was below 15 yr ave of 42,000 and 1966 harvest of 40,000 lbs. Willapa Bay catch of green sturgeon was 83,000 lbs (nearly 3x ave and 10,000 lbs more than in 1966). Incidental catch of white sturgeon was 4,900 lbs, slightly above the ave and 2X the 1966 catch.

Deschamps, G. 1968. Summary of Proposed 1968 Coastal Commercial Food Fish Regulations. Wash. Dept. Fish., Research Division.

Deschamps, G., and D. Phinney. 1969. Summary of Proposed 1969 Coastal Commercial Food Fish Regulations. Wash. Dept. Fish., Research Division.

Deschamps, G., and D. Phinney. 1971. Summary of Proposed 1971 Coastal Commercial Food Fish Regulations. Wash. Dept. Fish., Research Division.

Deschamps, G., and S. Wright. 1965. A Report on the Status of Coastal Gill-Net Fisheries and Regulations for 1965. Wash. Dept. Fish., Research Division. March 1965.

Deschamps, G., and S. Wright. 1966. A Report on the Status of Coastal Gill-Net Fisheries and Regulations for 1966. Wash. Dept. Fish., Research Division.

Deschamps, G., and S. Wright. 1967. A Report on the Status of Coastal Gill-Net Fisheries and Management Proposals for 1967. Wash. Dept. Fish., Research Division.

Detlaf, T. A., and A. S. Ginzburg. 1954. Embryonic development of sturgeon in connection with artificial propagation. Inst. Anim. Morphol. Acad. Sci. USSR Trudy. 47:204.

Donaldson, I. 1958. Information bulletin, fish passage **facilities**, Bonneville Dam. U. S. Army Corps of Engineers, Portland District, Report 66-1 : **68pp.** [Continued to present. No subsequent authors given.]

Dorofeeva, T. A., and A. I. Nikolaev. 1983. Comparative characteristics of bester of the first generation, **back-crossed** hybrids with great sturgeon and great sturgeon under different raising conditions. Proc. All-Union Meet. Genetics. Selection. Breeding. Hybridization Fish. 2:98-102.

Doroshov, S. I. 1979. **Morpho-physiological** study of fertilization and early development of white (*Acipenser transmontanus*) and green (A. *medirostris*) sturgeon. Ms. Univ. Calif. Davis, **17pp.**

Doroshov, S. I. 1979. The development of technology for a prototype sturgeon hatchery. Research Proposal to Fish and Wildlife Service, Univ. of Calif., Davis, March 23, **1979, 38 pp.** (mimeo).

Includes literature review on artificial propagation.

Doroshov, S. I. 1980. **Artificial** propagation of white sturgeon, *Acipenser transmontanus*, Richardson. Ms. Univ. Calif. Davis, **13pp.**

Doroshov, S. I. 1983. Sturgeon culture. Abstr. AFS 113th Annual Meeting, Milwaukee, **Wisc.**, Aug. **16-20**, 1983. p. 101.

Review of Soviet **culture**, need for intensive culture of sturgeons.

Doroshov, S. I., and W. Clark. 1979. The development of **technology** for a prototype sturgeon hatchery. Univ. Calif. Davis, **36pp.** [Research Proposal]

Doroshov, S. I., W. H. Clark, Jr., P. B. Lutes, R. L. Swallow, K. E. Beer, A. B. McGuire, and M. D. Cochran. 1983. Artificial propagation of the white sturgeon, Acipenser transmontanus Richardson. Aquaculture 32(1-2):93-104.

First successful reproduction of white sturgeon in captivity in 1980. Sturgeon and carp pituitary used to induce ovulation and spermiation. Description of procedures.

Doroshov, S. I., and P. B. Lutes. 1984. Preliminary data on the induction of ovulation in white sturgeon (Acipenser transmontanus Richardson). Aquaculture 38(3):221-227.

Induction was studied with different hormonal preparations (sturgeon and carp pituitary, and analogue) at three doses.

Doynikov, K. G. 1936. Materials on the biology and evaluation of sturgeon stocks in the Sea of Azov. Tr. Don-Kuban' REsearch Fishery papers 4:228 pp.

Dryagin, P. A. 1949. The biology of the Siberian sturgeon, its stocks and rational exploitation. Izv. Vses. n.-i. inst. ozern. i rechn. rybn. khoz., 29.

Duméril, A. H. A. 1867. Prodrôme d'une monographie des esturgeons et description des espèces de l'Arménie du nord qui appartiennent au sous-genre Antaceus. Nouv. Arch. Mus. Hist. Nat. Paris, 1869, 3:131-188.

Edson, M. 1956. The sturgeon story. Idaho Wildlife Review 9(2):4-9.

Review of sport fishery for sturgeon in Idaho.

Efimova, N. A. 1982. Comparative study of the gonadotropic elements of the pituitary of female sturgeons before and after spawning. Abstr. V All-Union Conference on Ecology, Physiology and Biochemistry of Fishes. Pt. 2 [in Russian] (Nauk. Dumka Press, Kiev) pp. 24-25.

Eschmeyer, W. N., E. S. Herald, and H. Hammann. 1983. A Field Guide to the Pacific Coast Fishes of North America. Peterson Field Series. Houghton Mifflin Co., Boston, 336pp.

Brief description for identification.

Fickeisen, D. H., D. A. Neitzel, and D. D. Dauble. 1984. White sturgeon research needs: workshop results. Pacific Northwest Laboratory, Richland Washington, PNL-4950

Fisk, L. O. 1959. Experiments with a vertical baffle fishway. Calif. Fish and Game 45(2):111-122.

Various species were tested with an experimental fish passage facility. 20% of the white sturgeon tested successfully passed through the test fishway.

Fisk, L. O. 1963. The Shasta Lake sturgeon fishery. Calif. Fish. and Game, Inland Fish. Admin. Rept. 63-12. 4pp. (mimeo).

Creel census of sturgeon caught incidentally during night catfish fishery.
Concluded that incidental catch had no adverse effects on sturgeon population.

Fleck, J. L., and H. Andrusak. 1977. Length and ages of Kootenay River white sturgeon. B. C. Fish and Wildl. Br. Unpub. Misc. Rept. 5pp.

Age and length data. Use of Floy anchor tags.

Fry, D. H. 1973. Anadromous fishes of California. Calif. Dept. Fish and Game. 111pp. (Rev. 1979, pp. 32-39).

Brief review of fishery and species.

Galbreath, J. 1979. Columbia River colossus--the white sturgeon. Oregon Wildl. 34(3):3-8.

Review of life history, fishery, and research.

Galbreath, J. L. 1983. Status, management and life history of Columbia River white sturgeon, Acipenser transmontanus. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug. 16-20, 1983. pp. 103-104.

Review of fishery, catch, and management.

Galbreath, J. L. 1984. History and management of Columbia River white sturgeon. Appendix B In Fickeisen, D. H., et al, White Sturgeon Research Needs: Workshop Results. Battelle Pacific Northwest Laboratories, Richland, Washington.

Galbreath, J. L. Various dates. [Several memoranda on sturgeon] Ore. Dept. Fish and Wildl.

Ganssle, D. 1966. Fishes and decapods of San Pablo and Suisun Bays. pp. 64-94 in D. W. Kelley, ed. Ecological Studies of the Sacramento-San Joaquin Estuary, Pt. 1. Calif. Fish and Game Fish. Bull. No. 133.

Experimental fishery catch information, stomach contents included mysids, Corophium, clams, and annelids.

Gardiner, B. G. 1967. Further notes on Palaeoniscoid fishes with a classification of the chondrostei. Bull. Brit. Museum (Natural History) Geol. 14(5):143-206.

Taxonomy and phylogeny of paleoniscoid fishes.

Geibel, G. E. 1966. Propagation of sturgeon in Russia. Calif. Dept. Fish and Game, Unpublished, 6p. typewritten.

Notes extracted from various sources on Russian sturgeon culture.

Gerbil'skii, N. L. 1951. Intraspecific biological groups of acipenserine fishes and their reproduction in the lower regions of rivers with regulated flow. Rybnoe Khoziaistvo 27(4):24-27. [Trans. in *Systematic Zool* 4(2):86-92].

Discussion of the possible existence of different races of Soviet sturgeons and implications for hatchery operations.

Gerbil'skiy, N. L. 1962. The theory of the biological progress of sturgeons and its use in the practice of sturgeon management. *Uch. zap. LGU*, No. 311.

Gibbons, I., R. N. Perham and P. J. Anderson. 1972. Amino-acid sequence homology in the muscle aldolases from sturgeons of different species. Nat. New Biol. 238(84):173-175.

Significant differences in amino acid sequence of this enzyme among sturgeons are indicative of early isolation of the different species as the sequence in other animals is highly conserved.

Gibson, H. 1975. Survey of fish populations in the Snake River from Grandview, Idaho, to C. J. Strike Dam. Idaho Dept of Fish and Game, Job Performance Report, Project F-63-R-3, Job III-6, Part 1). Boise, Idaho. 18pp.

Ginzburg, A. S. 1968. In: Israel Program for Scientific Translations, Ltd. (1972) (T. A. Detlaf, ed.)

Golovanenko, L. F. 1964. The physiological condition of the young sturgeon reared on different feeds. Izv. Gos. Nauchno-Issled. Inst. Ozern. Rechn. Ryb. Khoz. 57:235-241. (in Russian)

Goodnight, W. H., and B. Bowler. 1973. Survey of fish populations in the Snake River above Brownlee Reservoir. Idaho Dept of Fish and Game, Job Performance Report, Project F-63-R-2, Job III-b). Boise, Idaho. pp 31-64.

Gordon, M. S., H. Chin, and L. Attardo. 1982. Energetics and hydrodynamics of swimming in the white sturgeon, Acipenser transmontanus. Am. Zool. 22(4):979 (Abstract) Presented at Annual Meeting of the American Society of Zoologists, December 27-30, 1982, Galt House, Louisville, Kentucky.

Oxygen consumption and hydrodynamics of low-speed (1-2 body lengths/sec) were investigated in 20-30 cm white sturgeon using a Brett-type chamber.

Gorodnichiy, A. Ye. 1955. Some features of the biology of young sturgeon fishes in the River Don under flow regulation conditions. Zoological Journal 34(6):1326-1333.

Gorodnichiy, A. Ye. 1957. The state of the sturgeon industry of the Sea of Azov and their natural breeding route. Fisheries 7:56-60.

Graham, P. 1979. Aquatic environmental analysis of Kootenai Falls. Montana Dept. of Fish, Wildlife, and Parks. Prepared for Northern Lights, Inc. and Dept. of Natural Resources and Conservation.

Graham, P. J. 1979. Kootenai Falls aquatic environment study. Impact Study, Mont. Dept. Fish, Wildl., and Parks. Prepared for Northern tights Inc. and Dept. of Natural Resources and Conservation.

Graham, P. 1981. Status of white sturgeon in the Kootenai River. Montana Dept. of Fish, Wildlife, and Parks. Kalispell, Montana. Jan. 1981, Mimeo, **26p.**

Fishing banned in 1979 on Kootenai River because of declining stocks. Range of sturgeon in Montana is restricted to area below Kootenai Falls. Request for listing under Montana Endangered Sps Act. Possible factors contributing to decline are Libby Dam and poor water quality from mining.

Graham, P. J. 1984. Status and management of white sturgeon in Montana Appendix D In Fickeisen, D. H., et al, White Sturgeon Research Needs: Workshop Results, Battelle Pacific Northwest Laboratories, Richland, Washington.

Grant, J. J. 1977. Evaluation of striped bass party boat log reporting for the Sacramento-San Joaquin Estuary from 1969 to 1974. Calif. Dept. Fish and Game. Anad. Fish. Br. Admin. Rept. 77-8:1-21 (Mimeo)

Gray, R. H., and D. D. Dauble. 1976 Synecology of the fish community near Hanford Generating Project and assessment of plant operational impacts. p. 5-19 + Tables In: Final Report on Aquatic Ecological Studies Conducted at the Hanford Generating Project, 1973-1 974. WPPSS Columbia River Ecology Studies, Vol. 1. Prepared by Battelle, Pacific Northwest Laboratories for Washington Public Power Supply System under contract no 2311210335 with United Engineers and Constructors, Inc., Richland, Washington. 206 pp.

Review of sturgeon biology, reports of catches in Hanford Reach.

Gray, R. H., and D. D. Dauble. 1977. Checklist and relative abundance of fish species from the Hanford reach of the Columbia River. Northwest Sci. 51(3):208-215.

Gray, R. H., and D. D. Dauble. 1977. Fish community studies near WNP 1,2, and 4, October 1975 through February 1976. WPPSS Columbia River Ecology Studies, Vol. 3. Battelle, Pacific Northwest Laboratories, Richland, Washington.

Gray, R. H., and D. D. Dauble. 1977. Synecology of the fish community near WNP 1,2, and 4, and assessment of suitability of plant area for salmonid spawning. In: Aquatic Ecological Studies Conducted Near WNP 1, 2, and 4, September 1974 through September 1975. WPPSS Columbia River Ecology Studies, Vol. 2, Battelle, Pacific Northwest Laboratories, Richland, Washington.

Gray, R. H., and D. D. Dauble. 1978. Fish studies near WNP 1,2, and 4, March through December 1976. WPPSS Columbia River Ecology Studies, Vol. 4. Battelle, Pacific Northwest Laboratories, Richland, Washington.

Gray, R. H., and D. D. Dauble. 1978. Fish studies near WNP 1,2, and 4, January through December 1977. WPPSS Columbia River Ecology Studies, Vol. 5. Battelle, Pacific Northwest Laboratories, Richland, Washington.

Gray, R. H., T. L. Page, and E. G. Wolf. 1976. Aquatic ecological studies near WNP 1,2, and 4, September 1974 through September 1975. WPPSS Columbia River Ecology Studies, Vol. 2, Battelle, Pacific Northwest Laboratories, Richland, Washington. 115 pp.

Length-weight relationship for white sturgeon, stomach content analysis.

Gray, R. H., T. L. Page, E. G. Wolf, and M. J. Schneider. 1975. A study of screen impingement and fish passage at Hanford Generating Project--a progress report. Battelle, Pacific Northwest Laboratories, Richland, Washington. 47pp.

Gudger, E. W. 1942. Giant fishes of North America. Nat. Hist. **49:115-121**.

Description of records of extremely large sturgeons.

Guidastri, R., A. Bararo, A. Francescon, and F. Ghio. 1984. First rearing of white sturgeon **Acipenser transmontanus** in fresh water lagoon pond near Venice, Italy. Cent. Ittiol. Valli Vente. Ca'Venier. Rovigo, Italy. Soc. Ven. Sci. Nat. Lav. **9(pt 2):213-218**.

Gunsolus, R. T., and H. Wendler. 1971. Status Report. Columbia River fish runs and commercial fisheries, 1938-1970. Ore. Dept. Fish. Wild. and Wash. Dept. Fish.

Gunsolus, R. T., and H. Wendler. 1972 Status Report. Columbia River fish runs and commercial fisheries, 1938-1970. 1971 Addendum. Ore. Dept. Fish. Wild. and Wash. Dept. Fish.

Gunsolus, R. T., and H. Wendler. 1974. Status Report. Columbia River fish runs and commercial fisheries, 1938-1970. 1973 Addendum. Ore. Dept. Fish. Wild. and Wash. Dept. Fish., Joint Investigational Report. I(4)

Gunther, A. 1870. Catalogue of the fishes in the British Museum. Vol. 8. **337pp**.

Taxonomy and description.

Harkness, W. J. K. 1923. The rate of growth and food of the lake sturgeon (**Acipenser rubicundus** Le Sueur). Univ. Toronto Studies, Biol. Ser., Pul. Ont. Fish. Res. **Lab.** No. 18, pp. 15-42.

Harkness, W. J. K., and J. R. Dymond. 1961. The lake sturgeon. Fish and Wildl. Branch, Ontario Dept. Lands and Forests.

Developmental stages.

Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Bd. Can. Bull. 180. **740pp**.

Key, description, catch data for Fraser River, 1880-1970.

Haw, F. 1971. Angling for salmon, shad and sturgeon in freshwaters of Washington State. Wash. State Dept. Fish. Olympia. 35pp. (Revised, 2nd ed.)

Booklet for the novice sportfisherman.

Haynes, J. M. 1978. Movements and habitat studies of chinook salmon and white sturgeon. Ph. D. Thesis, Univ. Minnesota, Minneapolis. 166 pp., Diss. Abs. 39(02-B):532.

Radiotelemetry indicated movements began in June after water temperatures reached 13°C and ceased when temps fell below 13°C in autumn. Both seasonal and diel movements were noted.

Haynes, J. M. 1978. Movement and Habitat Studies of Chinook Salmon and White Sturgeon. Pacific Northwest Laboratory, Richland, WA. PNL-2471, 87 pp.

Reprint of PhD dissertation, see above.

Haynes, J. M., and R. H. Gray. 1981. Diel and seasonal movements of white sturgeon, Acipenser transmontanus, in the mid-Columbia River. Fish. Bull., U.S. 79(2):367-370.

Temperature appeared to be major influence on seasonal movement, but light cycle and feeding probably influence diel movements.

Haynes, J. M., R. H. Gray, and J. C. Montgomery. 1978. Seasonal movements of white sturgeon (Acipenser transmontanus) in the mid-Columbia River. Trans. Am. Fish. Soc. 107(2):275-280.

Radiotelemetry indicated movement was related to temperature and size of fish. Inactive in winter, with most movement in summer and early fall.

Hechel, J. J., and L. J. Fitzinger. 1936. Monographische darstellung der gattung Acipenser. Ann. Wien. Mus. Natur. 1:261-326.

Hess, S. S. 1984. Age and growth of white sturgeon in the lower Columbia River, 1980-1983. Oregon Dept Fish and Wildl. Aug 1984, 15pp.

Growth rate (length) estimated from age data (pectoral fin rays). Somewhat faster growth previously reported for 1947-53 may have been due to methodological differences and sample size.

Hjort, R. C., B. C. Mundy, P. L. Hulett, H. W. Li, C. B. Schreck, R. A. Tubb, H. W. Horton, L. D. LaBolle, A. G. Maule, and C. E. Stainbrook. 1981. Habitat requirements for resident fishes in the reservoirs of the lower Columbia River. Report to the United States Army Corps of Engineers. Dept. of Fish and Wildlife, Oregon State University, Corvallis

Hoffman, G. L. 1967. Parasites of North American freshwater fishes. Univ. Calif. Press, Los Angeles, California. 486pp.

Checklist of parasites by fish species.

Hubbs, C. L., and K. F. Lagler. 1956. Fishes of the Great Lakes region. Rev. Ed. Cranbrook Inst. Sci. Bull. 26, 213pp.

Includes brief description of the lake sturgeon.

Irving, R. B., and P. Cuplin. 1956. The effect of hydroelectric development on the fishery resources of the Snake River. Idaho Dept of Fish and Game, Final Report, Project F-8-R. Boise, Idaho. 169pp.

Ivanov and Murygin. 1937. Skrjabin Jubilee Vol. 253-268.

Jefferies, E. R. 1952. Preliminary experiments on effect of CaO and Ca(OH)₂ on live sturgeon at Bonneville hatchery. Fish Comm Ore, Dept Res.

Jordan, D. S., and B. W. Evermann. 1896. The fishes of North and Middle America. Pt. 1. Bull. U. S. Nat. Mus. 47:104-105.

Taxonomy and brief description.

Jordan, D. S., and B. W. Evermann. 1904. American Food and Game Fishes Doubleday, Page and Co., Garden City, NY, 572 pp. (Reprinted **by Dover** Publications, Inc., 1969)

Brief description.

Jordan, D. S., B. W. Evermann, and H. W. Clark. 1930. Checklist of the fishes and fishlike vertebrates of north and middle America north of the northern boundary of Venezuela and Columbia. Rep. U. S. Comm. Fish. 1928 (1930), App. X. 670pp.

A taxonomy.

Jordan, D. S., and C. H. Gilbert. 1882. Synopsis of the fishes of North America. Bull. U. S. Nat. Mus. 16. 1018 pp.

Jordan, D. S., and J. O. Snyder. 1906. A synopsis of the sturgeons (Acipenseridae) of Japan. Proc. U. S. National Museum XXX:397-398.

Description of two species, **A. kikuchii** Jordan and Snyder and **A. mikadoi** Hilgendorf, from Japan.

Kabata, A. 1973. The species of Lepeophtheirus (Copepoda: Caligidae) from the fishes of British Columbia. J. Fish. Res. Bd. Can. 30: 729-759.

Kalashnikov, G. N., and S. N. Skadovskii. 1948. Ecological and physiological study of sturgeon during the period of reproduction under natural and experimental conditions. Zool. Zh. 27:513-524.

Karasov, W. H., and J. M. Diamond. 1983. A simple method for measuring intestinal solute uptake in vitro. J. Comp. Physiol. B. 152(1):105-116.

Everted sleeve of intestine mounted on grooved rod to measure uptake. Method demonstrated with variety of animals, including white sturgeon.

Khoroshko, P. N. 1972. The amount of water in the Volga Basin and its effect on the reproduction of sturgeons (Acipenseridae) under condition of normal and regulated discharge. J. of Ichthyology 12:608-615.

Natural spawning is an important component of total production, and has stabilized with development of upstream hydroelectric dams. Suggests that spawning could be increased by operating dams at some undefined optimal level.

King, S. D. 1979. The 1978 Lower Columbia River Recreational Fisheries, Bonneville to Astoria. Ore. Dept Fish and Wildl. 45pp.

Effort and catch data for sport fishery. Estimated 80,628 sturgeon trips and 29,687 legal sturgeon caught in 1978. This continues a trend of increasing catches since 1971. Catch broken down for bank and boat, Washington and Oregon, and by area. Length distribution data from 1974-1 978 are given.

King, S. D. 1980. The 1979 Lower Columbia River Recreational Fisheries, Bonneville to Astoria. Ore. Dept Fish and Wildl. 49pp.

Effort was 98,700 trips and catch of 30,700 sturgeon. Broken out by area and length data given.

King, S. D. 1981. The 1980 Lower Columbia River Recreational Fisheries. Bonneville to Astoria. Oregon Dept. of Fish and Wildl. 47pp.

101,200 trips yielded 25,800 sturgeon. Speculates that mudflows from Mt. St. Helens limited migration and recruitment.

King, S. D. 1982. The June and July 1981 Middle Columbia River Recreational Fishery. Bonneville to McNary Dams. Oregon Dept. Fish and Wildl. 1 lpp.

Catch and effort data, length frequency for the two months.

King, S. D. 1982. The 1981 Lower Columbia River Recreational Fisheries, Bonneville to Astoria. Ore. Dept Fish and Wildl. 54pp.

110,300 trips produced 25,700 sturgeon. Tagging results indicate increased movement to other river systems following eruption of Mt. St. Helens compared with pre-eruption data.

King, S. D. 1983. The 1982 Lower Columbia River Recreational Fisheries. Bonneville to Astoria. Oregon Dept. of Fish and Wildl. 42pp.

Sport catch and effort data for 1982. Includes length data. By sections, with tabulation of 1969-1 982 data.

King, S. D. 1983. White Sturgeon in the 1983 Woody Island Spring Chinook Test Fishery. Oregon Dept of Fish and Wildlife, Information Report 83-2. 8pp.

Summary of white sturgeon catch in spring test fishery at Woody Island (RM28) and Corbett (RM 124-127) 1959-1983. Includes length frequency and tag-recovery data.

King, S. D. 1984. The 1983 Lower Columbia River Recreational Fisheries, Bonneville to Astoria. Ore. Dept Fish and Wildl. 45pp.

136,300 trips produced 33,700 legal sized sturgeon. Estimates of total catch (census program covers only Feb-Nov) and of under- and over-legal handling by anglers. Green sturgeon entered sport fishery for first time in significant numbers (141).

King, S. D. 1985. The 1984 Lower Columbia River Recreational Fisheries, Bonneville to Astoria. Ore. Dept. Fish and Wildl. 48pp.

134,600 trips produced 39,700 legal sturgeon. Speculation that decreasing catches in the area near Bonneville Dam are due to changes in food availability and consequent movement into the estuary. Larger fish near Bonneville believed to be more permanently resident there. Charter boats entered the lower river fishery.

King, S. D. 1985. The 1983 Middle Columbia White Sturgeon Recreational Fisheries. Ore. Dept. Fish and Wildl. Information Rept. 85-5. 10pp.

King, S. D. and G. Kreitman. 1983. Evaluation of the experimental, large-mesh, gill-net sturgeon fishery on the lower Columbia River, Jan. 1983. Ms., Oregon Dept of Fish and Wildlife and Wash Dept of Fisheries April 1983. 15pp.

Experimental fishery demonstrated method superior to setlines in terms of targeting legal sized sturgeon and reducing stress on sublegal fish.

Kirsch, P. H., and M. W. Fordice. 1889. A review of the American species of sturgeons (Acipenseridae). Proc. Acad. Natur. Sci. Philad. **41**:245-257.

Key for identification and list of synonymy.

Kohlhorst, D. W. 1976. Sturgeon spawning in the Sacramento River in 1973, as determined by the distribution of larvae. Calif. Fish. Game. **62(1):32-40.**

Cone shaped net fished from anchored boat. 246 larvae and 9 eggs taken, larvae were 5.2-19.5 mm. Estimated spawning from mid-Feb to late May when temperature was 8-18C.

Kohlhorst, D. W. 1979. Effect of first pectoral fin ray removal on survival and estimated harvest rate of white sturgeon in the Sacramento-San Joaquin Estuary. Calif. Fish. Game. 65(3):173-177.

Fin ray removal caused substantial mortality in first year, with estimated survival rate of 0.88 compared with 0.95 for controls in first year.

Kohlhorst, D. W. 1980. Recent trends in the white sturgeon population in California's Sacramento-San Joaquin estuary. Calif. Fish. Game. 66(4):210-219.

Population decreased from 1967-74, and increased from 74-79. Total catch declined through 77, while mean size of fish caught increased from 64-74, then decreased through 78. Decline likely due to low recruitment from mid-50's year classes.

Kohlhorst, D. W., L. W. Miller, and J. J. Orsi. 1980. Age and growth of white sturgeon collected in the Sacramento-San Joaquin Estuary, California, **1965-1970** and 1973-1976. Calif. Fish. Game. 66(2):83-95.

Estimated growth rates similar for male and female and for the two periods, but lower than in 1954, although this may be due to differences in ageing technique.

Korobochkina, Z. S. 1951. The migration and feeding habits of young sturgeons in the Don. Fisheries 8:49-51.

Korobochkina, Z. S. 1953. The biology of the young husen in the river period of life. Documents. Academy of Sciences. USSR 93(4):733-736.

Kostyuchenko, V. A. 1955. Biology and the state of the sturgeon industry in the Sea of Azov before river flow regulation. Tr. All-Union Research Institute of sea fisheries and oceanoarohv 31 (2):174-187.

Kovtun, I. F., T. S. Bondarenko, and Yu. I. Rekov. 1984. Characteristics of the Azov sturgeon fishery. J. of Ichthyology 24(6):119-124. Catch, effort, age composition by species for commercial fishery in Azov Sea

Kramer, M. 1980. Everything you wanted to know about caviar. Pac. Northwest Mag. 1980 (Sept):45-46.

Kreitman, G. M. 1984. Present fisheries and management of Columbia River sturgeon. Appendix E. In Fickeisen, D. H., et al. White Sturgeon Research Needs: Workshop Results. Battelle Pacific Northwest Laboratories, Richland, Washington.

Kreitman, G. M. Various dates. [Several memoranda on sturgeon.] Wash. Dept. Fish., Vancouver, Washington.

Kreitman, G. M., and S. D. King. 1984. Evaluation of the experimental, large-mesh, gill-net sturgeon fishery on the lower Columbia River, January-February 1984. Ore. Dept. Fish and Wildl. Inform. Rept. 84-4. 18pp.

Corroborated previous year's experimental fishery findings that gill nets are superior to setlines in terms of targeting sturgeon of legal size.

Kukulina, G. **M.**, and **R.** P. Khodorevskaya. 1982. The application of ecological methods for protection of sturgeon fingerlings from entering the water intake. Biological Productivity in the Azor and Caspian Seas. **VNIRO**, Moscow, USSR. pp. **75-88**. **SFA 28(4)**.

Lamb, A. 1976. The white sturgeon. Western Analina and the Environment **2(2):30-37**.

Lane, E. D. 1985. A bibliography on the white sturgeon, (**Acipenser transmontanus**) Richardson, 1836. Canadian Manuscript Report of Fisheries and Aquatic Sciences, No. 1828. **33pp**.

Bibliography including many memoranda and mimeo reports.

Lavrova, E. A., Yu. V. Natochin, and E. **L.** Shakhmatova. 1984. Electrolytes in the tissues of sturgeon and bony fishes in fresh and salt water. J. Ichthvol. **24(5):156-160**.

Russian sturgeon shown to compensate for increased **osmolarity** and sodium in blood by increasing potassium in muscle. Magnesium content did not change significantly.

Leach, G. C. 1920. Review of sturgeon culture in the United States. U. S. Fish Comm Rep. for 1919, App. **III. 5pp**.

Lee, D. S., C. R. Gilbert, C. **H. Hocutt**, R. E. Jenkins, D. E. McAllister, and J. **R.** Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina State Mus. Nat. Hist. **867pp**.

Lindley, D. W. 1983. White sturgeon comes to California. Aquacult. **MO(1):22-24**.

Review of production by The Fishery.

Love, **M. S.**, and **M.** Moser. 1983. A checklist of parasites of California, Oregon, and Washington marine and **estuarine** fishes. NOAA Tech. Rept. NMFS-SSRF-777:576pp.

Luk'yanenko, V. I., A. V. Popov, and E. A. Mishin. 1971. Protein spectrum of blood serum in different age groups of the white sturgeon, *Huso huso*. Izv. Akad. USSR Ser. **3:428-433**.

Lukens, J. R. Job Performance Report, Project F-73-R-8. Idaho Dept. of Fish and Game

Lukens, J. R. 1981. Snake River sturgeon investigations (Bliss Dam upstream to Shoshone Falls). Rept. prepared by Idaho Dept. of Fish and Game for Idaho Power Company.

Population reduced due to three dams and overfishing prior to catch and release since 1970. All fish caught (20) were > 75 cm, indicating poor recruitment.

Lukens, J. R. 1982. River and Stream Investigations. Status of white sturgeon populations in the Snake River. Bliss Dam to Givens Hot Springs. Snake River fisheries investigations, Job Performance Report, Project F-73-R-4. Idaho Dept. of Fish and Game.

915 white sturgeon were caught in 1979-81. stomach contents of 10 fish indicated chironomids and crayfish most common prey items. Age ranged from 2 to 45 yrs in sample of 565. 69% < 3ft; 29% > 3 ft and < 6 ft; 2% > 6 ft.

Lukens, J. R. 1983. River and Stream Investigations. Hells Canyon fishery investigations. Job Performance Report, Project F-73-R-5. Idaho Department of Fish and Game.

Lukens, J. R. 1984. River and stream investigations. Hells Canyon white sturgeon investigations. Job Performance Report, Project F-73-R-6. Idaho Dept. of Fish and Game.

Lutes, P. B. 1983. Ovarian maturation and induced spawning in the white sturgeon (Acipenser transmontanus Richardson). Univ. Calif. Davis, Ph. D. Dissertation. 84pp. Diss. Abs. 45(02-B):450.

Examined induction of ovarian maturation by various materials.

Lutes, P. B., and S. I. Doroshov. 1983. Spawning induction and hatchery procedure for the white sturgeon, Acipenser transmontanus. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug. 16-20, 1983. p. 102.

Description of induction of ovulation and procedures for artificial spawning.

MacPhail, J. D., and C. C. Lindsey. 1970. Freshwater fishes of northwestern Canada and Alaska. Bull. Fish. Res. Bd. Can. 173:381.

Magnin, E. 1964. Croissance en longueur de trois esturgeons d'Amérique du Nord: Acipenser oxyrin Mitchell, Acipenser fulvescens Raf. et Acipenser brevirostris LeSueur. Verh. Internat. Verein Limno. XV:968-974.

Magnin, E. 1966. Quelques données biologiques sur la reproduction des esturgeons Acipenser fulvescens Raf. de la rivière Nottaway, tributaire de la baie James. Can. J. Zool. 44(2):257-263. [French, with Eng abstract]

From examination of gonads, spawning takes place in June, sites are numerous, probably in small rapids.

Magnin, E. 1966. Recherches sur les cycles de reproduction des esturgeons Acipenser fulvescens Raf. de la rivière Nottaway tributaire de la baie James. [Some biological data on the reproduction of sturgeon, Acipenser fulvescens Raf., of the Nottaway River, tributary of James Bay. (J.W. Emig, transl.)] Can. J. Zool. 44(2): 257-263.

Magnin, É., and G. Beaulieu 1960. Déplacements des Esturgeons (Acipenser fulvescens et Acipenser oxyrinchus) du Fleuve Saint-Laurent d'Après les Données du Marquage. [Movement of tagged sturgeon in the St. Lawrence River.] Naturaliste Canadien 87(11):237-252. [French]

Makarov, E. V. 1970. Evaluation of the dynamics and schooling structure of Azov sturgeons. Tr. All-Union Research Institute of Sea Fisheries and Oceanography 21: 121-136.

Makarov, E. V. 1970. The dynamics and schooling structure of Azov sturgeons: Dissertation in Biological Sciences. M.: VNIRO 31pp.

Malm, G. 1980. USFWS Sturgeon Workshop.

Malm, G. W. 1981. White sturgeon (Acipenser transmontanus) population characteristics in the Bonneville Reservoir of the Columbia River (1976-1978). U. S. Fish and Wildlife Service, Fisheries Assistance Office, Vancouver Washington. 28pp. + tables.

Mark-recapture study, population estimate given, growth rate and length-weight relationships, comparison with growth rates in other river systems.

Markov, K. P. 1976. J. Ichthyology 15(5):739-749

Mauser, G., and N. Homer. 1982. Regional fishery management investigations. Region 1 stream investigations. Report, Project F71-R6(1)3 Idaho Dept Fish and Game, 10pp.

Low abundance of sturgeon in Kootenai River appears due to lack of recruitment, although effects of habitat alteration and exploitation are not quantified. Sturgeon population in the Idaho reach of the Kootenai River estimated at 1266. No recruitment demonstrated in 1966-69, 73, or 76-81. Sport catch about 50 fish/yr appears stable.

May, B., and J. E. Huston. 1977. Kootenai River fisheries investigations--March 1, 1976 through April 30, 1977. Ann. Prog. Rept. Montana Dept. Fish and Game

May, B., and J. Huston. 1979. Kootenai River fisheries investigations. Montana Dept. Fish and Game, Fisheries Div. Final Job Rept. 57pp.

McCabe, G., and R. Emmett. 1984. White sturgeon studies under way in the lower Columbia River. U. S. Dept. of Commerce, National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Quarterly Report, Oct-Dec 1984, Seattle, Washington, pp. 13-14.

Report on efforts to sample for young of the year and larvae below Bonneville Dam. Some larvae and YOY reported.

McClain, D. 1981. Columbia River sturgeon fishing-what will be or might have been? Ore. Sportsman's Digest pp.27-28.

McCleave, J. D., S. M. Fried, and A. K. Towt. 1977. Daily movements of shortnose sturgeon, Acipenser brevirostrum, in a Maine estuary. Copeia 1:149-157.

Movements studied by ultrasonic telemetry.

McEnroe, M., and J. J. Cech. 1983. Osmoregulation in juvenile and young adult Acipenser transmontanus. American Fisheries Society, 113th Annual Meeting, Milwaukee, Wisconsin. Abstracts, pp. 99-100.

McGuire, A. 1979. The big fish--restoring California's sturgeon population. Calif. Agriculture 33(10):4-6.

Review of overfishing for sturgeon in US and UC Davis program for development of hatchery technology.

McGuire, A. B. 1980. First U. S. sturgeon hatchery started at University of California Davis campus. Aquaculture 6(6):4-6.

Review of hatchery technique at Davis.

McGuire, H. D. 1896. The third and fourth annual reports of the state Fish and Game Proctor of the State of Oregon, 1895-1896. W. H. Leeds, Salem, Oregon, 115pp.

McKechnie, R. J., and R. B. Fenner. 1971. Food habits of white sturgeon, (Acipenser transmontanus), in San Pablo and Suisun Bays, California. Calif. Fish. Game 57(3):209-212.

Stomach content analysis dominated by benthic invertebrates, particularly clams. Barnacles, crabs, and shrimp also taken although seldom annelids. Herring eggs important seasonally and several small fishes also noted.

Meehan, W. E. 1909. Experiments in sturgeon culture. Trans. Amer. Fish. Soc. 39:85-91.

Account of holding adult shortnosed sturgeon in ponds until ripe, spawning, and incubation. Describes washing eggs in muck to remove adhesive coating.

Merrell, T. R. 1961. Unusual white sturgeon diet. Oregon Fish. Comm. Res. Brief. 8(1):77.

Stomach contents of sturgeon taken below Willamette Falls (Willamette River, Oregon), included 14 salmonids up to 11 1/2 inches.

Meyer, J. 1982. Science closing US-USSR sturgeon gap. Outdoor Calif. Jan-Feb 1982:21-25.

Review of UC Davis program.

Migdalski, E. C. 1962. Angler's Guide to the Fresh Water Sport Fishes of North America. Ronald Press, N.Y. 431 pp.

Description, review of reported large catches, and account of angling for sturgeon in Hell's Canyon.

Mikhalyev, Yu. V. 1967. The biology of the diadromous sturgeon in the Yenisey river and regulation of the sturgeon fishery. In: Ryby i kormovyye resursy basseynov rek i vodokhranilishch Vostochnoy Sibiri (The Fishes and Food Resources of the River and Reservoir Basins of Eastern Siberia.) Krasnoyarsk.

Miller, D. J., and R. N. Lea. 1972. Guide to the coastal marine fishes of California. Calif. Fish and Game, Fish. Bull. 157. pp. 52-53.

Very brief description.

Miller, L. W. 1971. The sturgeon party boat fishery 1964-1969. Calif. Dept. of Fish and Game, Anadromous Fisheries Admin. Rept. 71-1: 10pp.

Six years of catch data. Fishery remained stable, with average catch of 1824/year, mostly white sturgeon, with some green sturgeon. Ave. length of catch 49-52 in.

Miller, L. W. 1972. Migrations of sturgeon tagged in the Sacramento-San Joaquin estuary. Calif. Fish Game 58(2):102-106.

Show white sturgeon migration from the bay into the lower Sacramento River in winter, and on up the river from March through June, apparently to spawn. Green sturgeon shown to migrate along Pacific Coast.

Miller, L. W. 1972. White sturgeon. Pp. 54-56 In Ecological Studies of the Sacramento-San Joaquin Estuary. Calif. Dept. Fish and Game Delta Fish and Wildl. Protection Study, Rept. 8.

Miller, L. W. 1972. White sturgeon population characteristics in the Sacramento-San Joaquin estuary as measured by tagging. Calif. Fish Game 58(2):94-101.

Disk tags used at either anterior or posterior part of dorsal fin. Tag loss rate estimated at 0.5 for three years in the posterior position, but only 0.02 in the anterior position. Exploitation rates were estimated at 0.073 in 1967 and 0.063 in 1968. Natural mortality was estimated at 0.065. A population estimate is also given.

Miller, R. R. 1974. Threatened freshwater fishes of the United States. Trans. Am. Fish. Soc. 103(4):239-252.

Idaho lists white sturgeon as rare and endangered, Montana lists it as rare.

Milstein, V. V. 1972. Sturgeon culture. Pishch. Prom., Moscow, 129pp. (in Russian).

Minckley, W. L. 1973. Fishes of Arizona. Arizona Dept. Fish and Game. 292 pp.

Moiseeva, E. B. 1975. Histophysiology of th hypothalamopituitary system of some marine fishes in relation to the spawning type. Tr. Vsesoyuz. n.-i. in-ta morsk. rybn. khoz-va i okeanogr. 111:106-125.

Molin 1861. Denkschr. kaiserl. Akad. Wissensch. Eien. Math.-Naturw. Cl. 19, Abt. 2: 189-338.

Monaco, G. 1981. Growth of white sturgeon (Acipenser transmontanus) under hatchery conditions. Presented at World Mariculture Society Technical Session, Seattle, Washington, March 1981.

Fingerlings raised on natural diets (brine shrimp, tubifex, ground fish) gained 6% body wt/da. OMP and OMP/natural food mixtures produced 1-4% per day. However, a portion of the fish (20%) established strong performance on the artificial diet and grew at twice the rate of those on the natural diets.

Monaco, G., R. K. Buddington, and S. I. Doroshov. 1981. Growth of white sturgeon (Acipenser transmontanus) under hatchery conditions. J. World Mariculture Soc. 12(1):113-121.

Fingerlings raised on natural diets (brine shrimp, tubifex, ground fish) gained 6% body wt/da. OMP and OMP-natural food mixtures produced 1-4% per day. However, a portion of the fish (20%) established strong performance on the artificial diet and grew at twice the rate of those on the natural diets. Growth rates were greater than are reported for first year for other species of sturgeons.

Monaco, G., and S. I. Doroshov. 1983. Mechanical de-adhesion and incubation of white sturgeon eggs (Acipenser transmontanus Richardson) in jar incubators. Aquaculture 35(2):117-123.

Similar survival for either manual or mechanical de-adhesion (57 and 54% from fertilization to hatch). Description of de-adhesion technique.

Mongeau, J.-R., J. Leclerc, and J. Brisebois. 1982. La dynamique de la reconstitution des populations de L'Esturgeon jaune Acipenser fulvescens du Lac des Deux Montagnes, Province de Québec, De 1964 A 1979. Government de Québec. Ministère du Loisir, de la Chasse et de la Pêche. Direction régionale de Montréal. Rapport Technique No. 06-33. ISBN 2-550-02177-0.

Moreau, G., and L. Legendre. 1979. Relation entre habitat et peuplements de poissons: Essai de definition d'une methode numerique pour des rivieres nordiques. [Relation between habitat and fish communities--experiment for definition of numerical method for northern rivers.] Hydrobiologia 67(1):81-87. [in French with English summary].

Application of discriminant analysis of fish communities to determine effects of physical habitat on species composition. Conclude that low species diversity and relatively homogeneous environment require such methods to predict effects of alterations.

Morrow, J. E. 1980. Freshwater Fishes of Alaska. Alaska N. W. Pub. Co., Anchorage. 248pp.

Moyle, P. B. 1976. Inland Fishes of California. Univ. of Calif. Press, Berkeley. 405pp.

Muir, W. D., R. L. Emmett, and R. J. McConnell. 1985. Food habits of juvenile white sturgeon (Acipenser transmontanus) in the Lower Columbia River and its estuary.

Murray, T. B. 1936. Notes on the sturgeon of the Snake River (Acipenser transmontanus). Northwest Science 10(1):13-15.

National Marine Fisheries Service. 1971-1976. Fishery statistics of the United States (1968-1973). U.S. Dept. Comm., Natl. Oceanic and Atmos. Admin., Natl. Mar. Fish. Serv., Stat. Dig. 62-67.

Various pagination.

Neill, W. H. 1971. Distributional ecology and behavioral thermoregulation of fishes in relation to heated effluent from a steam-electric power plant (Lake Monona, Wisconsin). Ph. D. Thesis, Univ. of Wisconsin. 203 pp.

Netboy, H. 1980. America set to farm the sturgeon. Fish Farming Int. 7(4):24-25.

Neuwer, H. 1984. Sturgeon survival. Equinox 18.III(6):126-127.

Nicol, J. A. C. 1969. The tapetum lucidum of the sturgeon. Contrib. Mar. Sci. 14:5-18.

Histological study of white sturgeon eye.

Nicoll, C. S., B. A. White, and F. C. Leung. 1980. Evolution of prolactin, its functions and receptors. In: R. M. Macleod and U. Scapagnini, eds. Central and Peripheral Regulation of Prolactin Function. Raven Press, New York. xxiv+394pp.

Review of literature. Suggest that ancestral role of prolactin as osmoregulator has been retained in fishes.

Nikolskii, G. V. 1961. Special ichthyology. U. S. Dept. Comm., Off. Tech. Serv., OTS 60-21817, pp. 90-107.

Review of Acipenseridae in Russian rivers.

Oregon Dept. of Fish and Wildlife 1979. Willamette Basin fish management plan. ODFW, Corvallis, Oregon. 88pp.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1976. Status Report. Columbia River fish runs and fisheries 1957-1975. Ore. Dept. Fish. Wildl. and Wash. Dept. Fish. 2(1):74pp.

Review of sport, tribal, and commercial catch data.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1977. Columbia River fish runs and fisheries 1957-1976. Vol. 2(2), 68pp.

Review of catch data.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1978. Columbia River fish runs and fisheries 1957-1977. Status Report 2(3):69pp.

Review of catch data.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1979. Columbia River Fish Runs and Fisheries. 1957-1978. Status Report, Vol. 2(4):68pp.

Summary data on commercial, tribal, and sport catch for 1978. Table and figure show total landings 1957-1978.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1981. Columbia River fish runs and fisheries 1957-1979. Vol. 2(5), 73pp.

Review of catch data.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1982. Columbia River Fish Runs and Fisheries. 1960-1981. Status Report 83pp.

Summary data on commercial, tribal, and sport catch for 1980-81. Table and figure show total landings 1960-1981.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1983. Report concerning winter commercial seasons, shad, and sturgeon seasons and general regulations for 1983. ODFW, Corvallis, Oregon. 26pp.

Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries. 1984. Columbia River Fish Runs and Fisheries. 1960-1983. Status Report 76pp.

Review of catch data.

Oregon Fish Commission. 1950 -1956. Columbia River Investigations. Monthly and quarterly progress reports.

Compilation of sections of reports that relate to sturgeon. Includes catch data, size, tagging studies, artificial propagation, age determination.

Oregon Fish Commission. 1956. Notes on Columbia River white sturgeon. Mar 16, 1956.

Oregon Fish Commission. 1959. Columbia River Investigations. Oct. 1957-April 1958. Progress Report.

Oregon Fish Commission and Washington Dept. of Fisheries. 1959. Biologists' report on the Columbia River commercial fisheries. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1960. Biologists' report on the Columbia River commercial fisheries. Oregon Fish Commission, Corvallis Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1961. Biologists' report on the Columbia River commercial fisheries. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1964. Status Report of the Columbia River Commercial Fisheries. 1963. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries 1965. Status Report of the Columbia River Commercial Fisheries. 1964. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1966. Status Report of the Columbia River Commercial Fisheries. 1965. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1967. Status Report of the Columbia River Commercial Fisheries. 1966. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1968. Status Report of the Columbia River Commercial Fisheries. 1967. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1969. Status Report of the Columbia River Commercial Fisheries. 1968. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of Fisheries. 1970. Status Report of the Columbia River Commercial Fisheries. 1969. Oregon Fish Commission, Corvallis, Oregon.

Oregon Fish Commission and Washington Dept. of fisheries. 1971. Status Report: Columbia River fish runs and commercial fisheries. 1938-1 970. Fish. Comm. of Ore. and Wash. Dept. of Fish.

Commercial catch data, landings in thousands of pounds.

Oregon Fish Commission and Washington Dept. of Fisheries. 1972. Status Report: Columbia River fish runs and commercial fisheries. 1938-1 970. 1971 Addendum. Fish. Comm. of Ore. and Wash. Dept. of Fish. Joint Invest. Reprt. 1(2):44pp.

Commercial Catch data, landings in thousands of pounds.

Oregon Fish Commission and Washington Dept. of Fisheries. 1974. Status Report: Columbia River fish runs and commercial fisheries. 1938-1970. 1973 Addendum. Fish. Comm. of Ore. and Wash. Dept. of Fish. Joint Invest. Rept. I(4).

Commercial catch data, landings in thousands of pounds.

Oregon State Game Commission. 1949. How old is a sturgeon? Oregon State Game Commission Bulletin 4(11):4.

Orsi, J. J., L. W. Miller, and D. W. Kohlhorst. 1980. Age and growth of white sturgeon collected in the Sacramento-San Joaquin Estuary **1965-1970** and **1973-1976**. Calif. Fish and Game 66(2):83.

Page, T. L. 1976. Sedimentation and turbidity effects from excavation in the Columbia River at WNP-2 August through **October** 1975. Prepared for Burns and Roe under contract No. 2311200735, **Battelle-Northwest, Richland, Washington.**

Page, T. L., R. H. Gray, and D. A. Neitzel. 1976. Fish impingement studies at the Hanford Generating Project (HGP) December 1975 through April 1976. Battelle, Pacific Northwest Laboratories, Richland, WA **22pp.**

Page, T. L., R. H. Gray, and E. G. Wolf. 1975. Report on impingement studies conducted at the Hanford Generating Project, March and April 1975. Battelle, Pacific Northwest Laboratories, **Richland, WA 9pp.**

Page, T. L., R. H. Gray, and E. G. Wolf. 1976. Final Report on Aquatic Ecological Studies Conducted at the Hanford Generating Project, **1973-1974**. Battelle, Pacific Northwest Laboratories, **Richland, WA.**

Page, T. L., R. H. Gray, E. G. Wolf, and M. J. Schneider. 1976. Final Report on aquatic ecological studies conducted at the Hanford Generating Project **1973-1974**. WPPSS Columbia River Ecology Studies, **Vol 1**, Battelle Pacific Northwest Laboratories, **Richland, WA 206 pp.**

Page, T. L., D. A. Neitzel, and R. H. Gray. 1977. Impingement studies at 100-N Reactor water intake. BNWL-2401. Battelle, Pacific Northwest Laboratories, **Richland, WA 29pp.**

Parks, N. B. 1978. The Pacific Northwest commercial fishery for sturgeon. Marine Fish. Rev. 40(7):17-20.

Most catch incidental to salmon fishery. Hence older fish are largely unexploited and may support an increase in catch, which is observed in Columbia River.

Partridge, F. 1980. Kootenai River fishery investigations. Ann. Rept. **Contract DACW67-79-C-1 33**. Idaho Dept. Fish and Game. **25pp.**

Partridge, F. 1980. River and Stream Investigations. Kootenai River fisheries investigations. Job Performance Report, Project F-73-R-2, Idaho Dept of Fish and Game.

Catch statistics, age/length data. SCA indicated plant material, chironomids, fish and clams.

Partridge, F. 1981. River and Stream Investigations. Kootenai River fisheries investigations. Job Performance Report, Project F-73-R-3, Idaho Dept of Fish and Game.

Partridge, F. 1982. River and Stream Investigations. Kootenai River fisheries investigations. Job Performance Report, Project F-73-R-4, Idaho Dept of Fish and Game.

Partridge, F. 1983. River and Stream Investigations. Kootenai River fisheries investigations. Job Completion Report, Project F-73-R-5, Idaho Dept of Fish and Game.

Pashkin, L. M. 1972. Spawning of the beluga and Russian sturgeon in the dam region of the Volograd hydro-development. Tr. Volgogr. Otd. Gos. Nauchno-Issled. Inst. Ozern. Rechn. Rybn. Khoz. 6:65-78.

Perry, L. E. (chairman). 1957. Columbia River Basin fisheries program, Part II, Inventory of streams and proposed improvements for the development of the fishery resources. Columbia Basin Interagency Committee Fishery Steering Committee, Portland, Oregon.

Proposals for rehabilitation, habitat improvements, passage improvements, and water quality and flow improvements on tributaries above McNary Dam.

Petkevich, A. N. 1952. The biology and reproduction of the sturgeon in the Middle and Upper Ob' in connection with hydraulic engineering works. Tr. Tomsk. gos. univ., 119.

Platts, W. S. 1964. The white sturgeon; a prize trophy. Idaho Wildlife Review 16(5):8-10.

Platts, W. S. 1965. High dams against the sturgeon. Idaho Wildlife Review 18(2):3-5.

Podubnyy, A. G., L. K. Malinin, and A. M. Svirskiy. 1974. Behavioral characteristics of the stellate sturgeon Acipenser stellatus Pallas stopped by the dam of the Fedorovsk hydro development on the Kuban River. Vopr. Ikhtiol. 14(5):894-902.

Telemetry near a dam shows path of approach of sevryuga to change annually in response to changes in channel morphology and hydrology.

Post, H. 1890. Sturgeon experiments in hatching. Trans. Amer. Fish. Soc. 19:36-40.

Account of spawning lake sturgeon and hatching in Seth Green shad-hatching boxes.

Potts, W. T. W., and P. P. Rudy. 1972. Aspects of osmotic and ionic regulation in the sturgeon. J. Exp. Biol. 56:703-715.

Osmoregulation of white and green sturgeon shown similar to that of euryhaline telosts, although on transfer between saline and fresh water, the regulation of salt balance was slower for the sturgeons.

Pratt, I., and R. Herrmann. 1962. Nitzchia quadritestes sp. n. (Monogenea: Capsalidae) from the Columbia River sturgeon. Journ. Parasit. 48(2):291-292.

New species of trematode, found primarily in sturgeon from saline waters.

Priegel, G. R., and T. L. Wirth. 1974. The lake sturgeon; its life history, ecology and management. Wisconsin Dept. of Nat. Res., Pub. 4-3600(74). Madison, Wisconsin. 20pp.

Review of information on lake sturgeon, including feeding habits, spawning, growth, longevity, mortality, harvest, and management.

Priegel, G. R., and T. L. Wirth. 1975. Lake sturgeon harvest, growth, and recruitment in Lake Winnebago, Wisconsin. Dept. of Natural Resources. Tech. Bull. 83. 25pp.

Catch data, 1955-1969. Population estimate, and recommended harvest rate. Use of cattle-type Monel self-piercing tags and plastic dart tags.

Priegel, G. R., and T. L. Wirth. 1978. Lake sturgeon populations, growth and exploitation in lakes Poygan, Winneconne, and Lake Butte des Morts, Wisconsin. Tech. Bull. No. 107., Dept. Nat. Res. Madison, WI.

Report on efforts to monitor populations subject to sport fishery in order to prevent overfishing.

Probst, R. T., and E. L. Cooper. 1955. Age, growth and production of the lake sturgeon (Acipenser fulvescens) in the Lake Winnebago region, Wisconsin. Trans. Am. Fish. Soc. 84:207-227.

Length and age of lake sturgeon in spear fishery. Regression equation for length-weight relationship and growth rates.

Pruter, A. T. 1972. Review of commercial fisheries in the Columbia River and in contiguous ocean waters. Pp. 81-120 In A. T. Pruter and D. L. Alverson (eds), The Columbia River estuary and adjacent ocean waters: bioenvironmental studies., Univ. of Wash. Press, Seattle.

Historical overview of Columbia River sturgeon fishery. Commercial catch data 1889-1966.

Pycha, R. L. 1955. A quick method for preparing permanent fin-ray and spine sections. Prog. Fish Cult. 17(4):192.

Description of cutting, polishing, and mounting method.

Pycha, R. L. 1955. A quick method of preparing permanent fin ray and spine sections. Job Perf. Rept., Project F-9-R. Calif. Dept. Fish and Game.

Pycha, R. L. 1956. Progress report on white sturgeon studies. Calif. Fish Game 42(1):23-35.

Tagging study (several types used). Length frequency data, growth rates, length-weight relationship, population estimates,

Quast, J. C., and E. L. Hull. 1972. List of fishes of Alaska and adjacent water with a guide to some of their literature. NOAA Tech. Rep. NMFS-SSRF-658. 47pp.

Radtke, L. D. 1966. Distribution of smelt, juvenile sturgeon, and starry flounder in the Sacramento-San Joaquin Delta with observations on food of sturgeon. pp. 115-129 In J. L. Turner and D. W. Kelley, eds, Ecological Studies of the Sacramento-San Joaquin Delta (Part II, Fishes of the Delta). Calif. Fish and Game, Fish Bull 136.

Information on distribution of juvenile sturgeons in the Delta. Major food items were mysids and Corophium.

Rafinesque, C. S. 1817. Addition to the observation on the sturgeons of North America. Amer. Monthly Mag. 1:288.

Rasmussen, L. E. 1980. Comparative distribution of nitrogenous compounds in Acipenser transmontanus and Hydrollagus coliei: enzyme kinetics and isozyme ratios alterations. Comp Biochem and Physiol. 67B(4):665-677.

Sturgeon slower to eliminate excess urea than more advanced teleosts or rattfish (which retain urea for osmoregulation).

Rau, C. 1885. Prehistoric fishing in Europe and North America. Smithsonian Contributions to Knowledge 25:1-342.

Prehistoric use of sturgeon in the Oregon territory. p. 303. (a. John Dunn).

Ray, V. F. 1938. Lower Chinook ethnographic notes. Univ. Wash. Publ. Anthro. 7:29-165.

Prehistoric use of sturgeon by lower chinook. p. 109.

Reid, W. W., W. H. Goodnight, and B. Bowler. 1973. Snake River fisheries investigations. Job Perf. Rept. Proj. F-63-R-2. Idaho Dept. Fish and Game.

Reiger, G., and G. L. Schelling. 1977. Native fish in troubled waters. Audubon 79(1):18-41.

Includes summary of catch and use of sturgeons, discussion of effects of dams. Unreferenced popular article.

Richardson, J. 1836. Fauna Boreali Americana: or the Zoology of the Northern Parts of British America. Part III: The Fish. Richard Bentley, London. pp. 278-285. [Reprinted, Arno Press, New York, 1978].

Species description, from near Fort Vancouver.

Riser, N. W. 1948. Amphilina bipunctata n. sp. A North American cestodarian. Journ. Parasit. 34(6): 479-485.

Species description, from coelom of sturgeon near Dodson, Oregon.

Rodman, D. T. 1963. Anesthetizing and air-transporting young white sturgeons. Prog. Fish. Cult. 25(2):71-78.

Did not respond to MS 222 or tertiary amyl alcohol at concentrations tested. Dry ice sedated for transport from Seattle to Japan.

Romanycheva, O. D. 1976. The modern condition of the development of the marine sturgeon culture for commercial purposes and its perspectives. Proc. 5th Japan-Soviet Joint Symp. on Aquaculture. Tokai Univ., Tokyo, pp. 353-365.

Rostlund, E. 1952. Freshwater fish and fishing in native North America. Univ. Calif. Pub. in Geography, Vol. IX. Univ. Calif. Press, Berkeley and Los Angeles. 313 pp.

Review of historical and prehistorical presence and use of sturgeons. Includes references to ancient tribal fisheries.

Roussow, G. 1957. Some considerations concerning sturgeon spawning periodicity. Can. Fish. Res. Bd. J., 14(4):553-572.

Uses fin ray to determine spawning periodicity by presence of dense belts. Estimates female periodicity at 4-7 yrs for *A. fulvescens*.

Ryder, J. A. 1890. The sturgeons and sturgeon industries of the eastern coast of the United States, with an account of experiments bearing upon sturgeon culture. Bull. U. S. Fish Comm. 8:231-328.

Sasaki, S. 1962. Sturgeon. Calif. Dept Fish and Game, Delta Fish Wildl. Prot. Study Rep. 1:111-123.

Savchuk, M. Ya. 1975. The feeding habits of sturgeons in the present-day regime of the Sea of Azov. Tr. All-Union Research Institute of Sea Fisheries and Oceanography 109:164-181.

Savelyeva, E. A., and V. I. Beresovskaya. 1982. Discussion on hydropower on sturgeon. Sport Fish. Abs. 28(4) 83-002752

Savelyeva, E. A., V. I. Beresovskaya, J. I. Kovalenko, and B. B. Ponomarev. 1982. [Reproduction of sturgeons in the Azov Sea-Kuban River area.] Biological Productivity in the Azov and Caspian Seas. VNIRO, Moscow, USSR., pp. 45-53. (In Russian, Eng. summary).

Hydropower development led to sharp decline in natural reproduction and artificial propagation of sturgeons. Hatcheries must collect spawners in the sea as an inadequate number enter the river. The run takes place in a shorter time period, limiting capacity of hatcheries. Urgent measures are needed to provide adequate drawdown for migration, protect fish from water intakes, construct supplementary farms to maintain spawners, and to transport juveniles to adaptation lagoons.

Schreiber, M. R. 1960. Observations on the systematics of juvenile white sturgeon and green sturgeon. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report 60-15, 5pp.

Age 0 white and green sturgeon characteristics compared with keys. Number of lateral line scutes, gill rakers, or dorsal fin rays were found to separate the species. Of these, scutes are the easiest to count. Sample size was limited.

Schreiber, M. R. 1962. Observations of the food habits of juvenile white sturgeon. Calif. Fish Game 48(1):79-80.

Stomach contents of 30 age 0 sturgeon. Nine were empty, others only small amount of material mostly amphipods, shrimp, and midges.

Schrenkeisen, R. 1938. Field Book of Fresh-Water Fishes of North America, North of Mexico. G. P. Putnam's Sons, N.Y. 312 pp.

Brief description.

Scott, W. B., and E. J. Crossman. 1973. Freshwater Fishes of Canada. Fish. Res. Board Can., Bull 184, 966pp.

Semakula, S. N. 1963. The age and growth of the white sturgeon (Acipenser transmontanus Richardson) of the Fraser River, British Columbia, Canada. M. S. Thesis, Univ. British Columbia, Vancouver, 115pp.

Length-weight and growth rate relationships. Found females grow faster than males after age 20 yrs. Males start spawning at age 11, females at 25-27. Spawning frequency may be 5 to 10 yrs.

Semakula, S. N., and P. A. Larkin. 1968. Age, growth, food, and yield of the white sturgeon (Acipenser transmontanus) of the Fraser River, British Columbia. J. Fish. Res. Bd. of Canada 25(12):2589-2602. MS Thesis.

Examined incidental catch (in salmon gillnet fishery). Estimates natural mortality (0.05) and fishing mortality (0.17) rates. Provides summary of Fraser River catch from 1880-1963. Recommendations for management of the fishery.

Seydoux, F., S. Bernhard, O. Pfenninger, M. Payne, and O. P. Malhotra. 1973. Preparation and active-site specific properties of sturgeon muscle glyceraldehyde-3-phosphate dehydrogenase. Biochem. 12(21):4290-4300.

White sturgeon muscle glyc-3-P dehydrogenase found to have highest reported activity and reproducible active site stoichiometry. Details of preparation and properties are given. Significance is primarily of interest to enzymologists interested in studying glyc-3-P dehydrogenase as the sturgeon enzyme, unlike most others, can be isolated free of bound-NAD⁺.

Seymour, G. 1968. Sturgeon. This unique fish is the largest freshwater fish in the world. Outdoor Calif. Mar/Apr 1968: 5-6. [Wildlife Leaflet].

Brief popular review.

Simpson, F. E. 1951. Fishes of Idaho No. 14. White sturgeon (*Acipenser transmontanus*) Richardson. Idaho Wildl. Rev. 3(6):7.

Simpson, J. C., and R. L. Wallace. 1978. Fishes of Idaho. Univ Press of Idaho, Moscow. pp. 51-53.

Brief description.

Skinner, J. E. 1957. Status of the striped bass-sturgeon study and suggestions for its future. Calif. Inland Fisheries Administrative Report 57(11):1-16.

Skinner, J. E. 1962. An historical review of the fish and wildlife resources of the San Francisco Bay area. Calif. Dept. Fish and Game, Water Proj. Br. Rept. 1:255pp.

Smith, H. M. 1894. [Sturgeon and sturgeon fishery (Pacific Coast)]. Bull. U. S. Fish Comm. 14:245-279.

Smith, H. M. 1895. Notes on a reconnaissance of the fisheries of the Pacific coast of the United States in 1894. U. S. Bur. Fish. Bull. 1894 (1895). Vol. XIV:223-288.

Smith, H. M. 1898. The sturgeons. pp. 189-191 In Brice, J. A Manual of Fish Culture Based on the Methods of the United States Commission of Fish and Fisheries. Rep. U. S. Comm. Fish. 1897 (Appendix) [Also pp. 191-193 in Rev. ed. (1900)]

Smith, H. M. 1914. Passing of the sturgeon. Rept. U. S. Comm. Fish. for 1913. pp. 66-67.

Smith, S. E. 1962. Changes in saltwater angling methods and gear in California. Marine Fish. Rev. 41(9):32-44.

Review of sport fishing method for sturgeon in San Francisco Bay. Very few taken prior to 1964 when bay shrimp were discovered to be an effective bait.

Smith, T. I. J., E. K. Dingley, and D. E. Marchette. 1980. Induced spawning and culture of Atlantic sturgeon. Prog. Fish. Cult. 42(3):147-151.

Induction with sturgeon pituitary, fertilization, and subsequent hatching.

Sokolov, L. I. 1965. Maturation and fecundity of the Siberian sturgeon in the Lena River. Vopr. kichtiol., 5(1):30.

Sokolov, L. I. 1965. The growth of the Siberian sturgeon in the Lena River. Vestn. MGU, ser. biol., No. 1.

Sokolov, L. I., and N. V. Akimova. 1976. Age determination of the Lena River sturgeon Acipenser baeri. Journal of Ichthyology 15(4):594-606.

Spinden, H. J. 1908. The Nez Percé Indians. Mem. Am. Anthro. Assoc. 2:165-274.

Anthropological use of sturgeon by Nez Percé. p. 210.

Steinhart, P., and L. Psihoyos. 1986. The caviar connection. National Wildlife (Dec-Jan 1986):22-27.

Review of UC Davis research and potential for commercial propagation.

Stevens, D. E., and L. W. Miller. 1970. Distribution of sturgeon larvae in the Sacramento-San Joaquin River system. Calif. Fish and Game 56(2):80-86.

Describes cone-shaped tow nets used for larval sampling. Larvae caught at temps from 16 to 22 C. Most were 10 to 24 mm. Yolk sac was apparently absorbed at 17.6-18.5 mm. Speculate that larvae were demersal and moved downstream into the delta from upstream spawning sites.

Stockley, C. 1967. Miscellaneous species (shad, smelt, carp, sturgeon) Fishery. Wash. Dept. Fish. Annual Rept. 77:51.

Columbia River commercial catch in 1967 of 155,000 lbs. (22% less than in 1966).

Stockley, C. 1979 [The Elusive Sturgeon Fry--a progress report] Wash. Dept. Fisheries Memo to D. Laramie, July 13, 1979.

Report on 1979 larval sampling below Bonneville Dam. 11 yolk-sac fry and 1 without yolk sac taken at RM 136-138.

Stockley, C. 1980. [Sturgeon] Wash. Dept. Fisheries Memo to D. Laramie, June 30, 1980.

Report on gillnet drifts to mark sturgeon near Mount Pleasant and Corbett. C/E 3.3 sturgeon/hr.

Stockley, C. 1980. [Sturgeon and Mt. St. Helens] Wash. Dept. Fisheries Memo to D. Laramie, July 8, 1980.

Report on test fishing for sturgeon in area impacted by mud flows from Cowlitz River. No sturgeon caught in impact zone, a few on edges of zone, and usual numbers or higher in non-impacted areas. Caught 6 green sturgeon near Grays Bay Light (RM 21).

Stockley, C. 1980. [Sturgeon from Hanford Area] Wash. Dept. Fisheries Memo to D. Austin, Sept. 25, 1980.

Analysis of catch data from D. Dauble, 1974-1977. Length distribution indicates recruitment is lower than in the lower river, and that exploitation is lower.

Stockley, C. 1980. [Sturgeon Larvae Sampling] Wash. Dept. Fisheries Memo to D. Laramie, June 24, 1980

Report on 1980 larval sampling between Camas and Bonneville Dam. Six larvae caught, date and locations given.

Stockley, C. 1980. [Sturgeon stock condition] Wash. Dept. Fisheries Memo to D. Laramie, May 16, 1980.

Report on size distribution of incidental catch of sturgeon near Reed Is (RM 124). Demonstrates strong recruitment. Also records of egg take near Prindle, etc.

Stockley, C. 1980. [Sturgeon Workshop of June 25, 1980] Wash. Dept. Fisheries Memo to D. Laramie, June 26, 1980.

Summary of workshop, including specific data from G. Malm on size/growth in Bonneville pool, C. Bosley on PCB and pesticide concentrations, P. Lutes on culture at UC Davis

Stockley, C. 1981. Columbia River sturgeon. Progress Report No. 150, Washington Dept. Fisheries 28pp.

Review of fishery, review of tags, tag-recovery to monitor movements indicates upstream movement in spring, some movement into ocean and to other river systems. Reports of catch of eggs and fry below Bonneville. Attempts to catch eggs and fry above Bonneville, including John Day and McNary Pools were not successful. Recommends establishing a protected zone below each dam.

Stockley, C. 1982. Note re: Sturgeon larvae sampling in Hanford Reach of Columbia River, Washington. Wash. Dept. of Fish., Memo to D. Austin, Jan. 28, 1982.

Quotes Dauble's report of no sturgeon fry taken in Hanford Reach.

Stone, L. 1900. The spawning habits of the lake sturgeon (Acipenser rubicundus). Trans. Amer. Fish. Soc. 29:118-128.

Account of spawning by lake sturgeon in tributary river.

Sunde, L. A. 1961. Growth and reproduction of the lake sturgeon (Acipenser fulvescens Raf.) of the Nelson River in Manitoba. M.S. Thesis, Univ. of British Columbia, 93pp.

Growth rates and length-weight relationships. Discussion of Nelson River fishery.

- Suzuki, K., and G. Nishi. 1976. Rearing of sturgeons in Japan. Presented at Fifth Japan-Soviet Joint Symp. on Aquaculture, Tokyo, Japan, Sept 14, 1976 and Sapporo, Japan, Sept 15, 1976. Tokai Univ., Tokyo. (pp. 379-393).
- Swallow, R. L. 1983. Changes in plasma free amino acids during ovarian maturation in the white sturgeon, Acipenser transmontanus. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug. 16-20, 1983. p. 98.
- Tanasiychuk, V. S., and P. N. Khoroshko. 1958. The spawning of sturgeon below Volgograd in connection with the construction of artificial spawning grounds. Rybn. khoz., No. 9.
- Teit. 1900. Prehistoric use of sturgeon by Thompson Indians. p. 253.
- Thompson, R. N., J. B. Haas, L. M. Woodall, and E. K. Holmberg. 1958. Results of a tagging program to enumerate the numbers and to determine the seasonal occurrence of anadromous fish in the Snake River and its tributaries. Fish. Comm. of Oregon. Final Report. 202pp.
- Turney-High, H. H. 1941. Ethnography of the Kutenai. Mem. Am. Anthro. Assoc. No. 56. Anthropological use of sturgeon by Kutenai. p. 45.
- U. S. Army, Corps of Engineers, Portland Dist. 1958. Information bulletin fish passage facilities Bonneville Dam. Rept. No. 66-1, 68pp.
- U. S. Army, Corps of Engineers. 1968. Annual fish passage report, Oregon and Washington, 1968. U. S. Army Engineer Districts, Portland and Walla Walla. (NPD PL-79) 15pp. + 79 tables, 27 plates.
- U.S. Army, Corps of Engineers, North Pac. Div. 1956. Investigations and field studies relating to numbers and seasonal occurrences of migratory fish entering the Columbia River above Bonneville and the Snake River and their final distribution among principal tributaries thereto. Prog. Rept., Fish. Eng. Res. Program.
- Univ. Calif. Davis. White sturgeon intensive rearing husbandry table. Unpub, mimeo, 3pp.
- Urist, M. R., and K. A. Van de Putte. 1967. Comparative biochemistry of the blood of fishes: Identification of fishes by the chemical composition of serum. pp. 271-285 In Gilbert, P. W., R. F. Mathewson, and D. P. Rall, eds., Sharks, skates, and rays. Johns Hopkins Press, Baltimore, Maryland.
- Veshchev, P. V. 1981. Effect of dredging operation in the Volga River on migration of sturgeon larvae. J. of Ichthyology, Acad. of NAUK 21(1):108-112.
- Significant loss of prolarval sturgeon estimated on basis of collections showing them near bottom in area where extensive dredging was taking place.
- Vladychenskaya, N. S., and O. S. Kedrova. 1982. Genome structure of fish hybrids obtained by interspecific hybridization. Gemnetika 18(10):1721-1727.

Vladykov, V. D., and J. R. Greeley. 1963. Order Acipenseroidae. In Y. H. Olsen (ed) *Fishes of the Western North Atlantic, Part 3*, pp. 24-60. Mem. Sears Found. Mar. Res., Yale Univ. 1.

Key to Atlantic and Pacific species, descriptions for Atlantic species only.

Votinov, N. P. 1958. Osetrovyye ryby Obskogo basseyna. (The sturgeons of the Ob' basin.) Tyumen' Book Press, Tyumen'

Votinov, N. P. 1963. Biological principles of the artificial reproduction of the Ob' sturgeon. Tr. Ob'-Tazovsk. otd. Gos. n.-i. inst. ozern. i rechn. rybn. khoz., 3.

Votinov, N. P., and V. P. Kas'yanov. 1978. The ecology and reproductive efficiency of the Siberian sturgeon, Acipenser baeri, in the Ob as affected by hydraulic engineering works. J. of Ichthyology 18(1):20-29.

Reduction in recruitment related to changes in hydrology due to dams.

Votinov, N. P., and V. P. Kas'yanov. Date not available. The state of stocks of the sturgeon (Acipenser baeri) in Siberian rivers and measures to increase their abundance. J. of Ichthyology (Academy of NAUK). pp. 689-698.

Overview of status of Siberian sturgeon in Ob'-Irtys' basin and Yenisey and Lena Rivers. Recruitment is reduced due to overfishing and to construction of hydroelectric dams (block migration, loss of spawning habitat).

Votinov, N. P., V. P. Kas'yanov, and N. N. Ogurtsova. 1972. Concerning the reproduction of the Siberian sturgeon in the Ob' basin under conditions of regulated discharge. In: Tez. otchetn. sessii Tsent. n.-i. inst. osetrovogo khoz. (Report meeting of the Central Sturgeon Fisheries Research Institute, abs. of proceedings, Astrakhan.

Wales, J. H. 1946. Sturgeon from Shasta Lake. Calif. Fish and Game 32(1):31.

First recorded account of a sturgeon in Shasta Lake after impoundment. This specimen had a large tumorous growth blocking the junction of the stomach and intestine, which was fatal.

Wang, J. C. S. 1981. Taxonomy of the early life stages of fishes. *Fishes of the Sacramento-San Joaquin Estuary and Moss Landing Harbor, Elkhorn Slough, Calif.* Ecological Analysts, Concord, Calif. pp. 5-6.

Wang, Y. L. 1983. Effects of water temperature on early development of the white (Acipenser transmontanus) and the lake (Acipenser fulvescens) sturgeons. Univ. Calif. Davis, Davis, Calif. 54pp. [M.Sc. Thesis]

Wang, Yuan, and F. P. Binkowski. 1983. Effects of water temperature on early development of the white (*Acipenser transmontanus*) and the lake (*Acipenser fulvescens*) sturgeons. Abstr. AFS 113th Annual Meeting, Milwaukee, Wisc., Aug. 16-20, 1983. p. 99.

Best embryonic survival and growth found at 12-16 C, best larval survival and growth at 16-22 C.

Washington Public Power Supply System. 1977. Final Environmental Impact Statement on Continued Operation of Hanford Generating Project. WPPSS, Richland, Washington, Jan. 1977

Washington Public Power Supply System. 1978. Supplemental Information on the Hanford Generating Project in support of a 316(a) Demonstration. WPPSS, Richland, Washington, Nov. 1978.

Weddle, F. 1966. A fish that's too big to keep. *National Wildlife* 4(3):29-30.

Wendler, H. O. 1959. Review of Columbia River white sturgeon. Wash. Dept. Fish. Staff Rept. 7pp. (mimeo).

Review of sport fishery, estimate of sport catch, notes attributed to Donaldson on condition, size at maturity.

Wendler, H. O. 1960. [Sport catch of white sturgeon] In-house report, Wash Dept Fish, Olympia, WA

White, J. 1980. Sturgeon Day, U.S.A. *Outdoor Calif.* Jul/Aug 1980:28.

Account of release of UC Davis hatchery-raised sturgeon into the Sacramento River.

White, R., and T. Cochnauer. 1975. Stream resource maintenance flow studies. Idaho Fish and Game, Completion Rept. 136pp.

Wilcox, W. A. 1893. Sturgeon fishery of the Columbia River. *U. S. Bur. Fish. Rep.* 1893 (1895):250-253.

Report on development of the commercial fishery, catch data, and decline from rapid overfishing.

Wilimovski, H. J. 1954. List of fishes of Alaska. *Stanford Ichthyol. Bull.* 4(5):279-294.

Wydoski, R. S., and R. R. Whitney. 1979. pp. 16-19 In *Inland Fishes of Washington*. Univ. of Wash. Press, Seattle. 220pp.

Brief review of life history, distribution, use, and fishery.

Yamaguti, S. 1961. *Systema Helminthum*. Vol. III: The nematodes of vertebrates, Part I. Interscience, New York, New York. 679 pp.