

CONTRIBUTIONS

Pseudoscaphirhynchus spp.: A Bibliography

Vadim J. Birstein

The Sturgeon Society

331 West 57th Street, Suite 159
New York, NY 10019 USA

The three species of *Pseudoscaphirhynchus* (*Scaphirhynchinae*), *P. fedtschenkoi*, *P. hermanni*, and *P. kaufmanni* are the Central Asian endemics which recently inhabited the Syr (*P. fedtschenkoi*) and Amu (*P. hermanni* and *P. kaufmanni*) Darya rivers (Berg, 1905, 1948a; Nikolskii, 1938, 1950; Birstein, 1997). At present, *P. kaufmanni* is Endangered, while *P. fedtschenkoi* and *P. hermanni* are Critically Endangered (IUCN, 1996). All three species have become the victims of the Aral Sea ecological catastrophe (Birstein, 1993, 1997; Birstein et al., 1997; Zholdasova, 1997).

The bibliography presented below includes titles of all papers and monographs published on *Pseudoscaphirhynchus*. If species of *Pseudoscaphirhynchus* are only mentioned in the paper, pages and/or figure numbers with the description and/or images of *Pseudoscaphirhynchus* are given. For the papers published in local Central Asian magazines (which are unavailable in the main libraries), only titles are given.

Abdusalymov, I. A., G. S. Davydov, and A. I. Sokov. 1980. Rare and endangered animals of Tadzhikistan. In: Materials for the Tadzhik SSR Red Data Book (Rare and Endangered Animal and Plant Species). Dushanbe, Donish. Pp. 7-12 (in Russian).

Allamuratov, B. A. 1961. Parasites of the Surkhan Darya River Basin fishes. Ph.D. Thesis, Kiev (in Russian).

Alyev, D. S., L. P. Pavlovskaya, and V. B. Salnikov. 1986. Some results of biological study on fishery in Lake Sarykamыш. In: Tezisy Dokladov 19-oi Konferentsii Biologicheskiye Osnovy Rybnogo Khozayistva Vodoemov Srednei Azii i Kazakhstana. Ashgabad, Ylym. Pp. 168-169 (in Russian).

Amanov, A. A. 1985. Ecology of Fishes of the Southern Uzbekistan and Adjacent Republics. Tashkent, FAN. 160 pp. (in Russian).

Anonymous. 1983. Order Acipenseriformes. In: Rass, T. S. (ed.) Life of Animals. Vol. 4. Amphioxi, Cyclostomata, Ganoidomorpha, Teleostei. Pp. 83-95 [pp. 92-93; Plate 5, fig. 12] (in Russian).

Axelrod, H. R., W. E. Burgess, N. Pronek, and J. G. Walls. 1993. Dr. Axelrod's Atlas of Freshwater Aquarium Fishes. 7th Edition. T.F.H. Publ., Inc. 1151 pp. [figs. pp. 110-111].

Bailey, R. M., and F. B. Cross. 1954. River sturgeons of the American genus *Scaphirhynchus*: characters, distribution, and synonymy. Pap. Mich. Acad. Sci., Arts and Lett. 39 :169-208 [pp. 171-173].

Bakkal, C. N., A. V. Bardin, and I. S. Darevskii. 1989. Rare Animals of Our Country. Leningrad, Nauka Publ. 311 pp. [pp. 191-193; fig.] (in Russian).

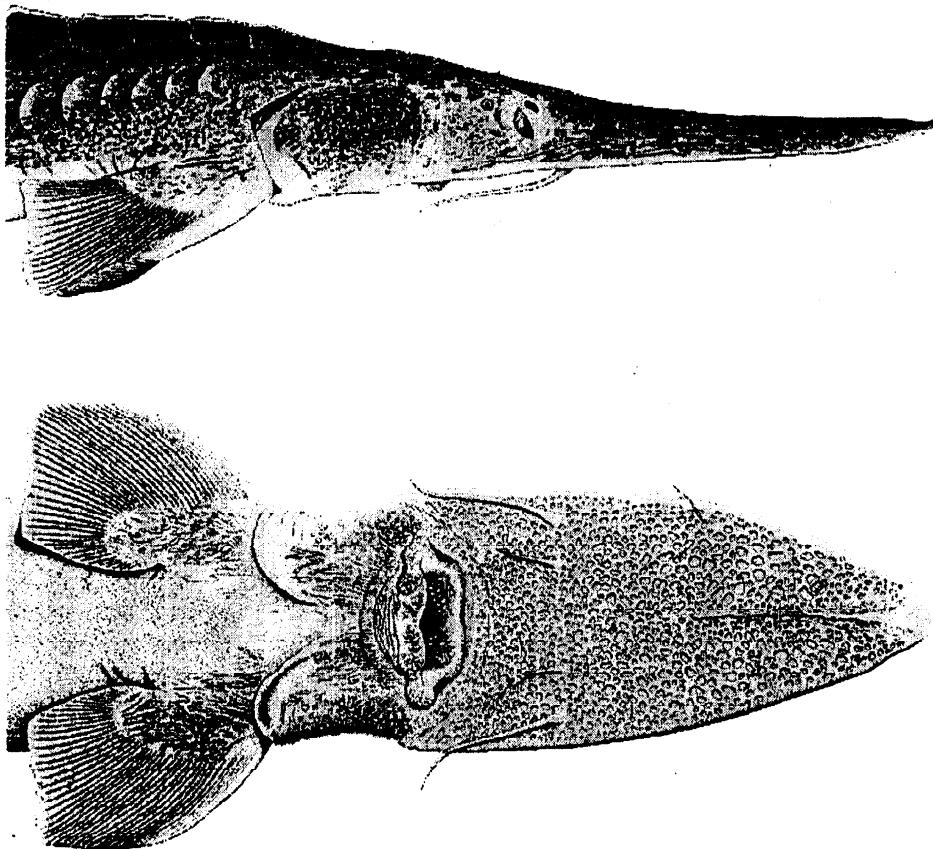
Baltabaev, A. B. The Syrdar'ya shovelnose sturgeon *Pseudoscaphirhynchus fedtschenkoi* (Kessler) of the Karadarya River. Voprosy Ikhtiol. 12 (6) :1118-1120 (in Russian;

- English translation: J. Ichthyol. 12 (6) :1116-1118).
- Bemis, W. E., and E. K. Findeis. 1994. The sturgeons' plight. Nature 370 :602.
- Bemis, W. E., E. K. Findeis, and L. Grande. 1997. An overview of Acipenseriformes. In: Birstein, V. J., J. R. Waldman, and W. E. Bemis (eds.) Sturgeon Biodiversity and Conservation. Kluwer Acad. Press, Dordrecht. Pp. 25-71.
- Berg, L. S. 1900. Fishes and fishery in the Amu Darya River mouth and the Aral Sea. Trudy Obshchestva Sudokhodno-Promyslovoogo Otdela, Part 2. Pp. 63-163 (in Russian).
- Berg, L. S. 1904. Zur Systematik der Acipenseriden. Zool. Anz. 27 :665-667.
- Berg, L. S. 1905. Fishes of Turkestan. Scientific Results of the Aral Sea Expedition No. 6. St. Petersburg. 261 pp. [pp. 24-38; figs. 1-5] (in Russian).
- Berg, L. S. 1907. Verzeichniss der Fische von Russisch Turkestan. Ezhegodnik Zoologicheskogo Muzeya Akademii Nauk 10 (1905) :316-332 (in German).
- Berg, L. S. 1909. Fishes of the Amur River Basin. Zapiski Akademii Nauk po Fiziko-Matematicheskому Otdeleniyu 24 (9) :1-270 (in Russian).
- Berg, L. S. 1911. Fishes (Marsipobranchii and Pisces). Fauna of Russia and Adjacent Countries. Vol. 1. St. Petersburg. 337 pp. [pp. 308-320] (in Russian).
- Berg, L. S. 1912. Über die Zusammensetzung und Herkunft der Fischfauna des Amur-Flusses mit Bezug auf die Frage von den zoogeographischen Regionen für die Süßwasserfische. Zool. Jahrb. 32 :475-520.
- Berg, L. S. 1916a. A catalogue of the freshwater fishes of Russia. Ezhegodnik Zoologicheskogo Muzeya Akademii Nauk 21 (in English).
- Berg, L. S. 1916b. Freshwater Fishes of the Russian Empire. Moscow. 563 pp. [p. 284] (in Russian).
- Berg, L. S. 1923. Freshwater Fishes of Russia. 2nd ed. Gosudarstvennoe Izdatelstvo, Moscow. 365 pp. (in Russian).
- Berg, L. S. 1929. Juvenile fishes from the lower Amu Darya River. Izvestiya Otdeleniya Prikladnoi Ikhtiol. 9 (2) :225-230 (in Russian).
- Berg, L. S. 1932. Freshwater Fishes of the USSR and Adjacent Countries. 3rd ed. Vsesoyuznyi Institute Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad. Part 1. 543 pp. [pp. 67-70; figs. 77-83] (in Russian).
- Berg, L. S. 1948a. On the position of the Acipenseriformes in the system of fishes. Trudy Zoologicheskogo Instituta 7 :7-57. (in Russian).
- Berg, L. S. 1948b. Freshwater Fishes of the USSR and Adjacent Countries. 4th ed., Akademiia Nauk USSR, Moscow & Leningrad. Part 1. 466 pp. [pp. 104-108; figs. 79-87] (in Russian, English translation published by Israel Program for Scientific Translations, Jerusalem. 505 pp. [pp. 105-111; figs. 79-86]).
- Berg, L. S. 1949. Freshwater Fishes of the USSR and Adjacent Countries, 4th ed., Akademiia Nauk USSR, Moscow & Leningrad. Part 3. 927-1382 pp. [pp. 1197; 1264] (in Russian English translation published by Israel Program for Scientific Translations, Jerusalem. 505 pp. [pp. 284; 335]).
- Birstein, V. J. 1993. Sturgeons and paddlefishes: threatened fishes in need of conservation. Conserv. Biol. 7 :773-787.
- Birstein, V. J. 1997. Threatened fishes of the world: *Pseudoscaphirhynchus* spp. (Acipenseridae). In: Birstein, V. J.,

- J. R. Waldman, and W. E. Bemis (eds.) *Sturgeon Biodiversity and Conservation*. Kluwer Acad. Publ., Dordrecht. Pp. 381-383.
- Birstein, V. J., W. E. Bemis, and J. R. Waldman. 1997. The threatened status of acipenseriform fishes: a summary. In: Birstein, V. J., J. R. Waldman, and W. E. Bemis (eds.) *Sturgeon Biodiversity and Conservation*. Kluwer Acad. Publ., Dordrecht. Pp. 423-431.
- Birstein, V. J., R. Hanner, and R. DeSalle. 1997. Phylogeny of the Acipenseriformes: cytogenetic and molecular approaches. In: Birstein, V. J., J. R. Waldman, and W. E. Bemis (eds.) *Sturgeon Biodiversity and Conservation*. Kluwer Acad. Publ., Dordrecht. Pp. 127-155.
- Birstein, V. J., A. I. Poletaev, and B. F. Goncharov. 1993. The DNA content in Eurasian sturgeon species determined by flow cytometry. *Cytometry* 14 (4) :377-383.
- Bogdanov, M. 1874. A report on a newly discovered acipenserid fish at the meeting of Zoological Section. Trudy Sankt-Peterburgskogo Obshchestva Ispytatelei Prirody 5:48 [Figs. 25-26] (in Russian).
- Bogdanov, M. N. 1882. Essays on the Nature of the Khiva Oasis and Karakum Desert. Tashkent [pp. 106-110; Figs. 1-4 & 1-3] (in Russian).
- Borodin, N. 1904. Essays on the present state of fishery in the Amu Darya River. *Vestnik Rybopromyshlennosti* Nos. 10-11 (in Russian).
- Bugajew, J. J. 1930. Über den Bau des Oberkieferapparatus bei den Acipenseroidei und den niederen Haifischen. Anat. Anz. 68 (18/21) :385-408 [pp. 394-396; Figs. 9 & 10].
- Burmakin, E. V. 1963. Acclimatization of freshwater fishes in the USSR. *Izvestiya GosNIORKh* 53 (in Russian).
- Dettlaff, T. A., A. S. Ginsburg, and O. I. Schmalhausen. 1993. *Sturgeon Fishes: Developmental Biology and Aquaculture*. New York: Springer Verlag. 300 pp. [pp. 173-186; figs. Pl. XV-Pl. XX].
- Djalilov, U. D. 1966. Parasitofauna of fishes from the Vakhsh River and flood lakes. Ph.D. Thesis. Dushanbe (in Russian).
- Dragomirov, N. I. 1954. Early stage of larval development of the shovelnose. Doklady Akademii Nauk SSSR 96 (6) :1265-1268 (in Russian).
- Dragomirov, N. I., and M. P. Nikolskaya. 1978. Gradients in the development of the spiracle-branchial row of neuromasts during ontogenesis of sturgeons. Doklady Akademii Nauk SSSR 241 (3) :699-702 (in Russian; English translation: 241 (1-6) :332-334 (1979)).
- Dragomirov, N. I., and O. I. Schmalhausen. 1952. Ecological-morphological features of the shovelnose larvae. Doklady Akademii Nauk SSSR 85 (6) :1399-1402 (in Russian).
- Dukravetz, G. M., and V. P. Mitrofanov. 1982. Rare and endangered fishes of Kazakhstan ichthyofauna. In: *Animal World of Kazakhstan and Problems of Its Protection*. Nauka Publ., Alma-Ata. Pp. 68-70 (in Russian).
- Filatov, D. P., and S. I. Duplakov. 1925. Materials on the Aral Sea studies. Bulletin Sredneaziatskogo Gosudarstvennogo Universiteta Nos. 14 :203-230 (southern shore) (in Russian).
- Filatov, D. P., and S. I. Duplakov. 1927. Materials on the Aral Sea studies. Bulletin Sredneaziatskogo Gosudarstvennogo Universiteta Nos. 15 :339-380 (north-eastern shore) (in Russian).
- Findeis, E. K. 1993. Skeletal anatomy of the North American shovelnose sturgeon *Scaphirhynchus platorynchus* (Rafinesque, 1820) with comparisons to other Acipenseriformes. Ph.D. Thesis, University of Massachusetts, Amherst. 444 pp. [pp. 222-227; 272-280; 376; 389-413; figs. 46, 48, 55, 58, 59, 61, 62, 75].
- Findeis, E. K. 1996. Osteology and phylogenetic relationships of recent sturgeons. In: Birstein, V. J., J. R. Waldman, and W. E. Bemis (eds.) *Sturgeon Biodiversity and Conservation*. Kluwer Acad. Publ., Dordrecht. Pp. 73-126.
- Forbes, S. A., and R. E. Richardson. 1905. On a new shovelnose sturgeon from the Mississippi River. *Bull. Ill. St. Lab. Nat. Hist.* 7 :37-44.
- Goncharov B. F., O. I. Shubravy, and V. K. Uteshev. 1986. On the problem of conservation of the large Amu-Dar shovelnose sturgeon by creating populations maintained in captivity. In: *Formation of Sturgeon Resources Under Conditions of Complex Use of Aquatic Resources*. Abstracts. TsNIORKh, Astrakhan. Pp. 75-76 (in Russian).
- Goncharov B. F., O. I. Shubravy, and V. K. Uteshev. 1991. Reproduction and early development of the large Amu-Dar shovelnose (*Pseudoscaphirhynchus kaufmanni*) under artificial environmental conditions. *Ontogeny* 22 (5) :485-492 (in Russian; English translation: *The Soviet J. Devel. Biol.* 22 (5) :296-301).
- Gosteeva, M. N. 1953. Finding of the shovelnose sturgeon, *Pseudoscaphirhynchus kaufmanni* (Bogd.), in brackish water. *Voprosy Ikhtiolozii* 1 :115-116 (in Russian).
- Grande, L., and W. E. Bemis. 1996. Interrelationships of Acipenseriformes, with comments on "Chondrostei". In: Stiassny, L. J., L. R. Parenti, and G. D. Johnson (eds.) *Interrelationships of Fishes*. Acad. Press, San Diego. Pp. 85-115.
- Gratsianov, V. I. 1907. An Attempt of a Review on Fishes of the Russian Empire. Trudy Ikhtiolicheskogo Obshchestva Akklimatizatsii Zhivotnykh i Rastenii 4. Moscow [pp. 52-54] (in Russian).
- Grunberg, V. 1904. Fishery in the Chinaz part of the Syr Darya River. *Vestnik Rybopromyshlennosti* 19 :691-715 (in Russian).
- Hochleithner, M. 1996. Störe. Verbreitung, Lebensweise, Aquacultur. Österreichischer Agrarverlag, Wien. 208 pp. [pp. 84-86, 98; fig. p. 86].
- IUCN. 1996. The 1996 IUCN Red List of Threatened Animals. IUCN, Gland. 369 pp. [p. 70: *P. fedtschenkoi*, *P. hermanni*, and *P. kaufmanni*].
- Iwanzow, N. 1887. Der *Scaphirhynchus*. Vergleichend-Anatomische Beschreibung. Bull. Soc. Imp. Natur. Mosc., Nat. Ser., 1 :1-41 [Plate II, figs. 1, 3 & 4].
- Kamilov, G. K. 1973. Fishes and Biological Basis for Establishing Fisheries in Reservoirs of Uzbekistan. FAN, Tashkent. 220 pp. (in Russian).
- Kazakh SSR Red Data Book. 1983. Part 1. Vertebrates. Alma-Ata, Kaynar. 206 pp. [*P. fedtschenkoi*] (in Russian).
- Kessler, K. F. 1872. On a remarkable fish of the family of sturgeons discovered by A. P. Fedtchenko in the Syr Darya River. *Izvestiya Obshchestva Lyubitelei Estestvoznanija, Antropologii i Etnografii* 10 (1) :70-76 [Pl. 12, fig. 36-41] (in Russian).
- Kessler, K. F. 1873. On a remarkable fish of the family of sturgeons discovered by M. A. P. Fedtchenko in the River Suirdar. *Ann. & Mag. Nat. Hist.*, Ser. 4, No. 70 : 269-276.

- Kessler, K. F. 1874. A. P. Fedtchenko's Journeys to Turkestan. Fishes. Vol. 2. Vypusk 3. Part 4. *Izvestiya Obshchestva Lyubitelei Estestvoznanii, Antropologii i Etnografii* 8, Supplement :1-200 [p. 48, Pl. VI, fig. 28 & 29; Pl. VI, fig. 30-35] (in Russian).
- Kessler, K. F. 1877. Fishes of the Aralo-Caspian-Pontine region. *Trudy Aralo-Kaspiskoi Ekspeditsii* No. 4. Sain-Petersburg. 360 pp. [pp. 190-196] (in Russian).
- Kessler, K. F. 1885. *Pisces (Fishes)*. In: Lansdell, H. Wissenschaftlicher Anhang zu Russisch-Central-Asiennebst Kuldsha, Buchara, Chiwa und Merw. Leipzig, F. Hirt und Sohn. S. 37-40.
- Keyvanfar, A. 1988. Étude comparative des protéines sériques et cellulaires de quatre espèces d'esturgeons anadromes de la Mer Caspienne. *Ann. Inst. océanogr. (Paris)* 64 (1) :25-64 [pp. 30-34].
- Kochetov, A., and S. Kochetov. 1994. Wizard fish... The legend and reality. *Freshwater and Marine Aquarium* 17 (5) :40-43.
- Kozhin, N. I. 1964. Acipenserids of the USSR and their reproduction. *Trudy Vsesoyuznogo Nauchno-Issledovatelskogo Instituta Morskogo Rybnogo Khozyaistva i Okeanografii* 52 :21-58 [pp. 33-34] (in Russian).
- Kozhin, N. I. 1970. Rare acipenserids. *Trudy TsNIORKh* 2 (in Russian).
- Krayushkina, L. S., and S. N. Moiseenko. 1977a. Reactions of the freshwater sturgeons, the Baikal sturgeon and the large Amu-Dar shovelnose sturgeon, to the change in salinity of the environment. *Doklady AN SSSR* 232 (2) :496-499 (in Russian; English translation: 232 (1-6) :15-18).
- Krayushkina, L. S., and S. N. Moiseenko. 1977b. Functional osmoregulation peculiarities of the ecologically different sturgeon species (family Acipenseridae) in hypertonic environment. *Voprosy Ikhtiol* 17 (3/107) :503-509 (in Russian).
- Lebedev, V. D., V. D. Spanovskaya, K. A. Savvaitova, L. I. Sokolov, and E. A. Tsepkin. 1969. Fishes of the USSR. Izdatelstvo Mysl, Moscow. 447 pp. [pp. 61-63; figs. 23-24] (in Russian).
- Magnin, E. 1959. Repartition actuelle des Acipenserides. *Rev. Trav. Inst. Pêches marit.* 23 (3) :277-285 [p. 282].
- Makeeva, A. P. and N. I. Sagitov. 1979. Materials on the gametogenesis and reproduction of the large Amu-Dar shovelnose sturgeon. In: Berdichevskii, L. S. (ed.) *Biological Bases of Development of Sturgeon Stock in the USSR Reservoirs*. Nauka Publ., Moscow. Pp. 155-169 (in Russian).
- Maksunov, V. A. 1959. Notes on the fecundity of some fishes from Tadzhikistan. *Voprosy Ikhtiol* No. 12 :85-88 (in Russian).
- Maksunov, V. A. 1971. Non-anadromous spawning of some fishes of Soviet Central Asia. *Voprosy Ikhtiol* 11 (2/67) :240-247 (in Russian; English translation *J. Ichthyol.* 11 (2) :192-199).
- Massino, B. G. 1927. The 9th All-Union helminthological expedition to old Bukhara. In: The Activity of the 28th USSR Helminthological Expedition (in Russian).
- Mayden, R. L. and B. R. Kuhajda. 1996. Systematics, taxonomy, and conservation status of the endangered Alabama sturgeon, *Scaphirhynchus suttkusi* Williams and Clemmer (Actinopterygii, Acipenseridae). *Copeia* 1996 (2):241-273.
- Mitrofanov, V. P., G. M. Dukravets, H. E. Pesaridi and A. N. Poltorkhina. 1986. Fishes of Kazakhstan. Vol. 1. GYLYM Press, Alma-Ata. 271 pp. [pp. 162-163; fig. 35] (in Russian).
- Muratov, D. M. 1947. On the biology of *Pseudoscaphirhynchus kaufmanni* (Bogd.) *Bulletin AN UzSSR* No. 9 (in Russian).
- Muratov, D. M. 1949. Shovelnose sturgeons. *Bulletin Sredneaziatskogo Gosudarstvennogo Universiteta* No. 28 (in Russian).
- Muratov, D. M. 1959. On the biology of *Pseudoscaphirhynchus fedtchenkoi* (Kessler). *Trudy Sredneaziatskogo Gosudarstvennogo Universiteta*, Vypusk 123, Biologicheskye Nauki, Book 27 (in Russian).
- Murgoci, A. A. 1942. Contributions à l'étude des Acipenseridés de Roumanie. *Ann. Sci. Univ. Jassy* 28, Sec. 2, Fasc. 2 :289-384 [pp. 328-336; fig. 11].
- Nikitin, V. N. 1922. On the phylogeny of the dermal bones of the pectoral girdle in Vertebrata. I. *Epistermus* in the cartilaginous ganoids. *Trudy Osoboi Zoologicheskoi Laboratorii Sevastopol'skoi Biologicheskoi Stantsii AN SSSR*. Seriya 2, No. 8 :83-92 [fig. 5] (in Russian with English summary).
- Nikolskaya, M. P. 1978. Intergeneric differences and peculiarities in the "nervous sacks" development in acipenserid larvae. In: *Ecological-Morphological and Ecological-Physiological Studies of Fish Development*. Nauka Publ., Mosow. Pp. 99-107 (in Russian).
- Nikolskaya, M. P. 1983. Development of the ampullar electrophoretic system in the ontogeny of *Polyodon* and *Acipenseridae*. *Doklady Akademii Nauk SSSR* 268 (2) :474-477 (in Russian; English translation: 268 (1-6) :19-22).
- Nikolskaya, M. P. 1985. Development of the accumulator receptor system in the acipenserids (*Chondrostei, Acipenseriformes*) and its functional significance. In: Akoev, G. N. (ed.) *Signalization and Behavior of Fishes*. Murmanskii Institut Morskoi Biologii AN SSSR, Apatity. Pp. 46-56 (in Russian).
- Nikolskaya, M. P. 1989. Development of the system of ampullar organs in the large Amu-Dar shovelnose sturgeon, *Pseudoscaphirhynchus kaufmanni* (Bogd.). In: Pavlov, D. S., and Yu. N. Sbikin (eds.) *Morphology, Ecology, and Behavior of the Acipenserids*. Nauka Publ., Moscow. Pp. 71-89 (in Russian).
- Nikolskii, A. N. 1887. On the fishery in the waters of the Aral Sea basin. *Izvestiya Russkogo Geograficheskogo Obshchestva* 23 (5) (in Russian).
- Nikolskii, A. N. 1900. *Pseudoscaphirhynchus rossikowi* n. gen. et sp. *Ezhegodnik Zoologicheskogo Muzeya Akademii Nauk* 5 (1-2) :257-260 (in Russian and Latin).
- Nikolskii, A. N. 1903. New fish species from Central Asia. *Ezhegodnik Zoologicheskogo Muzeya Akademii Nauk* 8 (in Russian).
- Nikolskii, G. V. 1937. Notes on the variability of Central Asian acipenserids. *Zoologicheskii Zhurnal* 16 (2) :230-238 (in Russian).
- Nikolskii, G. V. 1938. Fishes of Tadzhikistan. *Izdatelstvo Academii Nauk SSSR*, Moscow-Leningrad. 228 pp. [pp. 62-74; figs. 25-29] (in Russian).
- Nikolskii, G. V. 1950. Special Ichthyology. *Gosudarstvennoe Izdatelstvo Sovetskaya Nauka*, Moscow. 436 pp. [pp. 78, 91, 92; fig. 65] (in Russian; English translation published by Israel Program for Scientific Translations, Jerusalem, 1961. 538 pp. [pp. 90, 107-108; fig. 69]).
- Nikolskii, G. V. 1952. Fish remains from the Neolithic site Djambaskala No. 4. *Trudy Khorezmkskoi Ekspeditsii* 1 (in Russian).
- Nikolskii, G. V., V. Ya. Pankratov, and C. I. Yagudina. 1933.

- Materials on the fishery in the middle and lower reaches of the Amu Darya River. Trudy Aralskoi Rybokhozyastvennoi Stantsii 1 :1-80 [p. 63] (in Russian).
- Oliva, O. 1958. A note on *Pseudoscaphirhynchus kaufmanni* (Bogdanov) (Osteichthyes, Acipenseridae). Acta Soc. Zool. Bohemosl. 22 (1) :6-9.
- Oliva, O. 1960. A further note on *Pseudoscaphirhynchus kaufmanni* (Bogdanow) (Osteichthyes: Acipenseridae). Acta Univ. Carol. Biol. No. 1 :35-36.
- Osmanov, S. O. 1952. On the helminthofauna of the acipenserids from the Amu Darya River delta. Izvestiya AN UzSSR No. 6 (in Russian).
- Osmanov, S. O. 1959. On the illness of the Aral Sea fishes. Trudy Karakalpaksogo Kompleksnogo Instituta 1 (in Russian).
- Osmanov, S. O. 1965. The influence of the large Amu-Dar shovelnose sturgeon's way of life on its helminthofauna. In: Materials to the Scientific Conference of the All-Union Society of Helminthologists. Part 1 (in Russian).
- Ostromov, B. G. 1949. Materials on the morphology and biology of a trypanosomoplasma from the large Amu-Dar shovelnose sturgeon. Soobshcheniya Tadzhikskogo Filiala AN SSSR No. 18 (in Russian).
- Pavlov, D. S., Yu. S. Reshetnikov, M. I. Shatunovsky, and N. I. Shilin. 1985. Rare and endangered fish species of the USSR and principles of their inclusion in the 'Red Data Book'. Voprosy Ikhtiol. 25 (1) :16-25 (in Russian; English translation: J. Ichthyol. 25 (1) :88-99).
- Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov, and S. S. Alekseev. 1994. Rare and Endangered Animals. Fishes. Vysshaya Shkola, Moscow, Russia. 334 pp. [pp. 89-93; figs. 12 & 13] (in Russian).
- Pavlovskaya, L. P. 1995. Fishery in the lower Amu-Darya under the impact of irrigated agriculture. In: Petr, T. (ed.) Inland Fisheries under the Impact of Irrigated Agriculture: Central Asia. FAO Fish. Circ., No. 894. Pp. 42-57.
- Pavlovskaya, L. P. and V. B. Salnikov. 1990. Formation and development of fish populations in desiccating basins: the case of Lake Sarykamysh. Gidrobiologicheskii Zhurnal 26 (1) :39-47 (in Russian; English translation Hydrobiol. J. 26 (1) :52-59).
- Pavlovskaya, L. P., and I. M. Zholdasova. 1991. Anthropogenic changes in the fish fauna of the Amu Darya River (based on data from sampling drift of eggs and larvae). Voprosy Ikhtiol. 31 (4) :585-595 (in Russian; English translation: J. Ichthyol. 31 (4) :106-117).
- Pokrovskii, A. S. 1917. Essay on the present state of fishery in the Aral Sea basin. Turkestanskoe Selskoe Khozyaistvo Nos. 4-5 (in Russian).
- Reshetnikov, Yu. S., and F. M. Shakirova. 1993. A zoogeographical analysis of the ichthyofauna of Central Asia including a list of freshwater fishes. Voprosy Ikhtiol. 33 (1) :37-45 (in Russian; English translation: J. Ichthyol. 33 (4) :99-110).
- Rochard, E., P. Williot, G. Castelnau, and M. Lepage. 1991. Elements de systematique et de biologie des populations sauvages d'esturgeons. In: Williot, P. (ed.) Acipenser. CEMAGREF Publ., Bordeaux. Pp. 475-507.
- Rostami, I. 1961. Biologie et Exploitation des Acipenséridés Caspiens. Thèse. Doct. Sci. Nat. Paris. 210 pp. [p.12].
- Rustamov, A. K., and O. Sopyev. 1994. Vertebrates in the Red Data Book of Turkmenistan. In: Fet, V., and K. I. Atamuradov (eds.) Biogeography and Ecology of Turkmenistan. Kluwer Acad. Publ., Dordrecht. Pp. 202-230 [pp. 226-227].
- Sadov, I. A. 1963. The structure and formation of egg membranes in acipenserids and some teleosts. Trudy Instituta Morfoloziia Zhivotnykh AN SSSR 38 :110-188 [pp. 113 & 129; fig. 8] (in Russian).
- Sagitov, N. I. 1966. Materials on the morphology and biology of the small Amu-Dar shovelnose sturgeon, *Pseudoscaphirhynchus hermanni* (Kessler). Vestnik Karakalpaksogo Filiala AN UzSSR No. 3 (in Russian).
- Sagitov, N. I. 1968a. Some questions of the morphology and biology of small Amu-Dar shovelnose sturgeon. Tezisy Doklada na Konferentsii po Voprosam Rybnogo Khozyaistva Respublik Srednei Azii i Kazakhstana (in Russian).
- Sagitov, N. I. 1968b. On the maturation and fecundity of the large Amu-Dar shovelnose sturgeon, *Pseudoscaphirhynchus kaufmanni* (Bogd.). Vestnik Karakalpaksogo Filiala AN UzSSR No. 1 (in Russian).
- Sagitov, N. I. 1968c. On the morphological-biological heterogeneity of the large Amu-Dar shovelnose sturgeon, *Pseudoscaphirhynchus kaufmanni* (Bogd.), population. Vestnik Karakalpaksogo Filiala AN UzSSR No. 2 (in Russian).
- Sagitov, N. I. 1968d. On the morphology of the large Amu-Dar shovelnose sturgeon. Voprosy Ikhtiol. 8 (5/52) :809-819 (in Russian).
- Sagitov, N. I. 1969a. On the dwarf form of the large Amu-Dar shovelnose sturgeon. Nauchnye Doklady Vyshei Shkoly No. 6 :12-15 (in Russian).
- Sagitov, N. I. 1969b. On the growth of the large Amu-Dar shovelnose sturgeon. Vestnik Karakalpaksogo Filiala AN UzSSR No. 1 (in Russian).
- Sagitov, N. I. 1969c. Amu-Dar shovelnose sturgeons *Pseudoscaphirhynchus kaufmanni* (Bogdanov) and *Pseudoscaphirhynchus hermanni* (Kessler). Ph.D. Thesis. Frunze. 20 pp. (in Russian).
- Sagitov, N. I. 1970. Feeding of the large Amu-Dar shovelnose sturgeon. Bulletin Moskovskogo Obshchestva Ispytatelei Prirody, Otdel Biologicheskii 75 (4) :34-41 (in Russian).
- Sagitov, N. I. 1971. Feeding of the large Amu-Dar shovelnose sturgeon juveniles. Uzbekskii Biologicheskii Zhurnal No. 5 :64-65 (in Russian).
- Sagitov, N. I. 1983. Fishes and Fodder Invertebrates in the Middle and Lower Course of the Amu Darya. Tashkent, FAN. 115 pp. (in Russian).
- Salikhov, T. V., and B. G. Kamilov. 1995. Ichthyofauna of the Mid-Syr Darya Basin. Voprosy Ikhtiol. 35 (2) :229-235 (in Russian; English translation: J. Ichthyol. 35 (6) :61-71).
- Salnikov, V. B. 1994. Formation of the fish population in the artificial hydrographic network of Turkmenistan (the Amudarya River Basin). In: Fet, V., and K. I. Atamuradov (eds.) Biogeography and Ecology of Turkmenistan. Kluwer Acad. Publ., Dordrecht. Pp. 365-387.
- Salnikov, V. B. 1995. Possible changes in the composition of the ichthyofauna after completion of the Karakum Canal in Turkmenistan. Voprosy Ikhtiol. 35 (3) :365-373 (in Russian; English translation: J. Ichthyol. 35 (7) :108-121).
- Salnikov, V. B., V. J. Birstein, and R. L. Mayden. 1996. The contemporary status of the two Amu Darya River shovelnose sturgeons, *Pseudoscaphirhynchus kaufmanni* and *P. hermanni*. Sturgeon Quart. 4 (3) :10-14.



Right side and underside of a *Pseudoscaphirhynchus hermanni* head (specimen P-1904 from the Zoological Museum, Moscow State University, Moscow, Russia). Original drawing by Paul Vescei, 1997.

- Salnikov, V. B., and Yu. S. Reshetnikov. 1991. Formation of fish populations in artificial waters in Turkmenistan. *Voprosy Ikhtiologii* 31 (4) :565-575 (in Russian; English translation: J. Ichthyol. 31 (8) :82-92).
- Schmalhausen, O. I. 1991. Development of the large Amu-Dar shovelnose larvae. *Ontogenet* 22 (5) : 493-513. (in Russian, English translation: The Soviet J. Devel. Biol. 22 (5) :302-315).
- Sewertzoff, A. N. 1926. Studies on the bony skull of fishes. Q. J. Microsc. Sci. 70 :451-540 [pp. 514-536; fig. 38].
- Severzow, N. A. 1873. Vertical and horizontal distribution of Turkestanian animals. *Obshchestvo Estestvoznaniya, Antropologii i Etnografii* 8 (2) (in Russian).
- Shaposhnikova, G. Kh. 1950. Fishes of the Amu Darya River. *Trudy Zoologicheskogo Instituta AN SSSR* 9 (1) : 16-54 (in Russian).
- Shilin, N. I. 1984. Present status of rare and disappearing fish forms included in the second edition of the USSR Red Book. In: *Scientific Elements of Protecting and Rational Use of the Animal World*. Moscow, VNII Okhrany Prirody i Zapovednogo Dela. Pp. 8-16 (in Russian).
- Shubravyi, O. I., B. F. Goncharov, and V. K. Uteshev. 1989. An experience of keeping and breeding *Pseudoscaphirhynchus kaufmanni* Bogdanov, 1874 in captivity. In: Davletova, L. V. (ed.) *Problems of Domestication of Animals*. Institut Evolusionnoi Morfologii Zhivotnykh AN SSSR, Moscow. Pp. 202-206 (in Russian).
- Shulman, S. S. 1954. A review on the parasites of the acipenserids. *Trudy Leningradskogo Obshchestva Estestvoispytatelei* 72 (4) (in Russian).
- Skyrabin, K. N. 1922. The 5th helminthological expedition to Turkestan Region. Moscow. (in Russian).
- Skyrabin, K. N. 1948. Two nematodes of the suborder Spirurata, fish parasites. *Trudy Gelmintologicheskoi Laboratori 1* :136-140 (in Russian).
- Skyrabina, E. S. 1974. Helminths of Sturgeons (Acipenseridae Bonaparte, 1831). Nauka Publ., Moscow. 167 pp. (in Russian).
- Sokolov, L. I., and L. S. Berdichevskii. Acipenseridae Bonaparte, 1831. In: Holcik, J. (ed.) *The Freshwater Fishes of Europe. Volume 1, Part II, General Introduction to Fishes, Acipenseriformes*, AULA-Verlag, Wiesbaden. Pp. 150-153.
- Sukhanova, A. I. 1985. Morphological development of eggs and young pelagic fishes of the Karakum Canal and Amu Darya River. *Izvestiya AN Turkmen SSR, Seriya Biologicheskikh Nauk* No. 5 :40-50 (in Russian).
- Tatarko, K. I. 1936. Apparatus of the operculum and its connection with the hyoid and maxillary arches in the Acipenseridae. *Trudy Instituta Biologii Akademii Nauk USSR* 10 :5-53 [Pl. IV, fig. 12] (in Ukrainian, with Russian and German Summaries).
- Tieuov, R. T. 1967. On the change in the feeding of the Aral Sea basin acipenserids. *Vestnik Karakalpanskogo Filiala AN UzSSR* Nos. 3-4 (in Russian).
- Tieuov, R. T. 1981. A New Regime of the Aral Sea and Its Influence on Ichthyofauna. FAN, Tashkent. 190 pp. (in Russian).
- Tieuov, R. T., Ye. Adenbaev, and L. N. Guseva. 1967. Downstream migration and feeding of the young Aral ship sturgeon. *Vestnik Karakalpanskogo Filiala AN UzSSR* No. 1 :49-54 (in Russian).
- Tieuov, R. T., and N. I. Sagitov. 1973. Acipenserid Fishes of the Aral Sea. FAN, Tashkent. 155 pp. [pp. 72-146; figs. 4-11] (in Russian).

- Russian).
- Tleuv, R. T., and Sh. Tleubergenov. 1974. Fishes of Karakalpakiya. Nukus, Karakalpakstan, 95 pp. [p. 63, fig.] (in Russian).
- Turdakov, F. A. 1952. Fishes of Kirgiziya. Frunze (in Russian).
- Turdakov, F. A. 1963. Fishes of Kirgiziya. Frunze, Izdatelstvo AN KirgSSR. 283 pp. (in Russian).
- USSR Red Data Book. 1984. Vol. 1. Moscow, Lesnaya Promyshlennost. 390 pp. [P. fedtschenkoi, P. hermanni, and P. kaufmanni] (in Russian).
- Uzbek SSR Red Data Book. 1983. Vol. 1. Vertebrates. Tashkent, FAN. 127 pp. [P. hermanni and P. kaufmanni] (in Russian).
- Vladkov, V. D., and J. R. Greeley. 1963. Order Acipenseridae. In: Bigelow, H. B., C. M. Breder, D. M. Cohen, G. W. Mead, D. Merriman, Y. H. Olsen, W. C. Schroeder, L. P. Schultz and J. Tee-Van (ed.) Fishes of the Western North Atlantic, Mem. Sears Found. Mar. Res. 1. Pp. 24-60 [27-28].
- Zharov, A. I. 1968. On the morphology and biology of the large shovelnose sturgeon from the lower reaches of the Vakhsh River. Izvestiya Otdeleniya Biologicheskikh Nauk Akademii Nauk TadzhSSR, No. 2(13) (in Russian).
- Zholdasova, I. 1997. Sturgeons and the Aral Sea ecological catastrophe. In: Birstein, V. J., J. R. Waldman, and W. E. Bemis (eds.) Sturgeon Biodiversity and Conservation. Kluwer Acad. Publ., Dordrecht. Pp. 373-380.
- Zholdasova, I. M., L. P. Pavlovskaya, L. N. Guseva, and V. T. Utebaeva. 1990. Status of Populations of Rare and Threatened Species of the Amu Darya River and Measures Purposed to Protect Them. Information No. 483. FAN, Tashkent. 12 pp. (in Russian).
- Zholdasova, I. M., L. P. Pavlovskaya, and S. K. Lyubimova. 1991. On the death of fishes in the Tuyamuyun water reservoir (Amu Darya River). Bulletin Karakalpaksogo Otdeleniya AN UzSSR No. 1: 18-24 (in Russian).
- Zograff, N. 1878. On some of the affinities between the Ganoidei, Chondrostei and other fishes. Nature 34 :70.
- Zograf, N. Yu. 1887. Materials to understanding of the organization of the sterlet. Izvestiya Obschestva Lyubitelei Estestoznaniya, Antropologii i Etnographii 52 :1-72 [pp. 48-50; 54-57; 63-64; 66-69; figs. 24, 66, 69-70, 84, 89, 91-93, 96, 100-101, 103] (in Russian).
- Zograf, N. 1896. Note sur l'odontographie des Ganoidei Chondrostei. Ann. Sci. Nat. Zoologie, Ser. 8, 1 :197-219 [figs. 9-12].
- Recent evidence of a long distance saltwater migration of white sturgeon (*Acipenser transmontanus*) in North America**
- William R. Bennett, E. David Lane, and Gordon Edmondson
Malaspina University College, 900 Fifth Street, Nanaimo, British Columbia, Canada
- In 1994 and 1995 white sturgeon, *Acipenser transmontanus*, were found for the first time in the mouth of the Somass and Cowichan rivers on Vancouver Island (British Columbia, Canada). Sturgeon (species unknown) have also been seen in the lower parts of the Gordon and Sarita rivers on the west coast of Vancouver Island. Past
- evidence of long distance saltwater migrations of white sturgeon along the coast of British Columbia and North America are mostly anecdotal. As yet, it is unknown whether the white sturgeon found in the Somass and Cowichan rivers originated from the Fraser or Columbia River. However, the Columbia River is considered as the source of white sturgeon for the Fraser River following the last glaciation 10,000 years ago (Brown et al., 1992). Based on this historic migration and recent measurement of upstream spawning migrations, white sturgeon would be capable of migrating from either the Fraser or Columbia rivers (McCabe and Tracy, 1994; Devore et al., 1995). It is also unknown whether white sturgeon in the Somass and Cowichan rivers are reproducing.
- White sturgeon in Canada are classified as vulnerable by the Committee on the Status of Endangered Wildlife (Lane, 1991). Therefore, the beginning of a new population of white sturgeon on Vancouver Island has implications for the maintenance of their population and possible removal of their vulnerable status. The natural establishment of a "failsafe" population in habitat other than the Fraser or Columbia River in British Columbia is important for white sturgeon populations in Canada.
- In addition, the length of this migration has serious implications for the management of natural populations of white sturgeon in North America. For instance, Canada and the United States may have to manage the white sturgeon as one stock population rather than three separate stock populations, i.e., Fraser River, Columbia River, and Sacramento River stocks. Clearly, more study is needed to resolve the unknowns of white sturgeon migrations and populations in North America.

References

- Brown, J. R., A. T. Beckenbach, and M. J. Smith. 1992. Influence of Pleistocene glaciations and human intervention upon mitochondrial DNA diversity in white sturgeon (*Acipenser transmontanus*) populations. Can. J. Fish. Aquat. Sci. 49 :358-367.
- Devore, J. D., B. W. James, C. A. Tracy, and D. A. Hale. 1995. Dynamics and potential production of white sturgeon, *Acipenser transmontanus*, in the unimpounded Lower Columbia River. Trans. Am. Fish. Soc. 124 :845-856.
- Lane, E. D. 1991. Status of white sturgeon, *Acipenser transmontanus*, in Canada. Can. Field Nat. 105 :161-168.
- McCabe, G. T., and C. A. Tracy. 1994. Spawning and early life history of white sturgeon, *Acipenser transmontanus*, in the Lower Columbia. Fish. Bull. 92 :760-772.

Danube Caviar in Danger

Nicolae Bacalbasa-Dobrovici
University "Dunarea de Jos" Galati, Str. Domeneasca 47,
6200 Galati, ROMANIA

Introduction

The commercial exploitation of sturgeons in the Danube River has occurred for more than 2,000 years (see Bacalbasa-Dobrovici, 1997; Hensel and Holcik, 1997).