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THE STATUS OF NEBRASKA FISHES IN THE MISSOURI RIVER.

2. BURBOT (GADIDAE: *LOTA LOTA*)

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Federal Aid in Sport Fish Restoration, Dingell-Johnson Project F-75-R-10

ABSTRACT

Burbot harvest represented 5.1% of the fish-harvest in the tailwater of Gavins Point Dam in July 1956, one year after the dam was closed. Harvest increased from 510 in 1956 to 4,280 in 1958, but represented only 2% of the 1958 harvest. By 1961 burbot were no longer routinely caught in the tailwater, and their density decreased in the remainder of Nebraska's portion of the Missouri River. At present they are very rare and should be listed as endangered in Nebraska.

† † †

Lota lota (Linnaeus)

Burbot (Fig. 1) are slender, minute-scaled fish with a single barbel in the center of the chin and two dorsal fins, and can attain a maximum weight of 34 kg (Keleher, 1961). The anterior dorsal fin is short and non-spinous; the posterior fin is nearly half the length of the body and is more rigid. The anal fin is nearly as long as the posterior dorsal fin. The caudal fin is rounded and separated from the dorsal and anal fins. The pelvic fins are pointed and their insertion point lies slightly anterior to the point of insertion of the pectoral fins (Pflieger,

1975). In life, the burbot is a mottled fish with olive color, shading through brown to black. The belly is white, shading to yellow.

DISTRIBUTION

The burbot is the only freshwater representative of a widely distributed family of cod (Gadidae), which are mostly marine. It is a northern fish, occurring as far south as Missouri (Pflieger, 1975). Cross (1967) reported that burbot in Kansas were recorded from the Missouri River mainstem near Kansas City, Leavenworth, Atchison, St. Joseph, and White Cloud (Fig. 2). Formerly, they were found in the Kansas River after large floods on the Missouri (Cross, 1967). Johnson (1942) collected one from the Niobrara River (Nebraska) and reported them in the Platte River; however he suggested their range was primarily restricted to the Missouri River and lower ends of larger tributaries. Bailey and Allum (1962) reported that burbot are found east of the Black Hills in the Cheyenne River system, and in the Missouri River where they were common. Burbot are found throughout the area north of a line from southern Oregon through central Missouri to north-

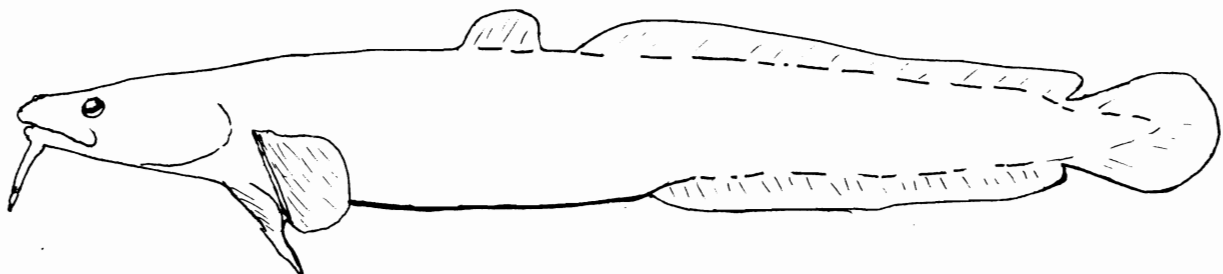


Figure 1. Burbot, *Lota lota*.

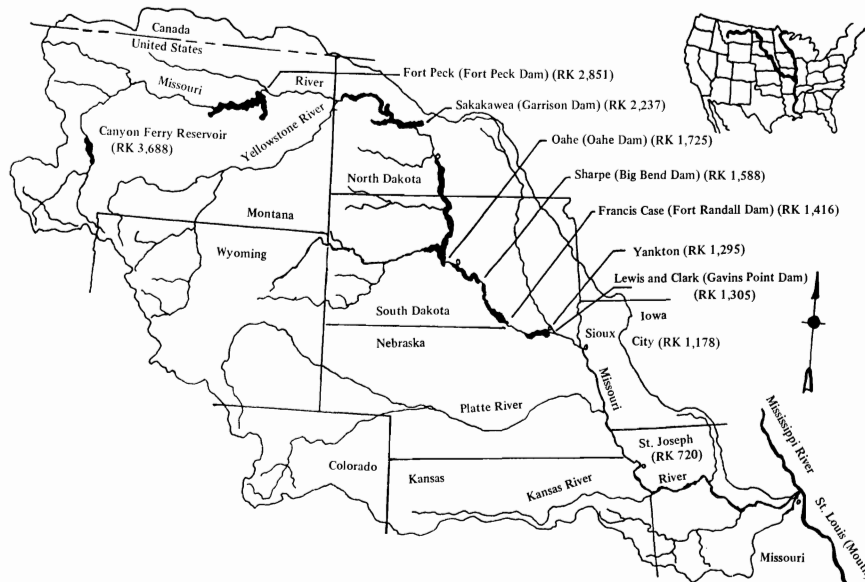


Figure 2. Map of the Missouri River basin showing the location of the main stem dams, unchannelized reaches (between Fort Randall Dam and Lewis and Clark Lake and between Gavins Point Dam and Sioux City) and the channelized section (Sioux City downstream to the Mississippi River). RK = river kilometer.

ern Virginia (Carson, unpublished paper, Nebraska Game and Parks Commission, undated), including interior Alaska, Canada, the Great Lakes Basin, from Maine and New York to the northern Rocky Mountain states (Bruesewitz, 1990; Chen, 1969; Ghan and Sprules, 1989; Lee et al., 1980; Williams, 1970). Nebraska lies on the southern edge of their range. Iowa presently lists burbot as threatened (*Endangered and Threatened Plant and Animal Species*, Iowa Administrative Code 57—Chapter 77). Burbot populations were described as healthy in Montana (personal communication, Chris Hunter, Biologist, Montana Department of Fish, Wildlife, and Parks, Helena, MT), and in Wyoming (personal communication, Dave Dufek, Biologist, Wyoming Game and Fish Department, Cheyenne, WY).

HABITAT REQUIREMENTS

Pflieger (1971) suggested that the presence of burbot in the Mississippi River valley dated back to the Pleistocene, when drainages were re-arranged by glaciation, allowing faunal exchange with more northerly systems. Pflieger (1975) and Harlan et al. (1987) suggested that burbot were secretive fish, hiding during daylight among snags, aquatic vegetation, rock piles

and other underwater structure. Young burbot foraged actively at night in crevices and holes among snags and banklines primarily for amphipods such as *Hyaella* sp. and *Gammarus* sp. (Hanson and Qadri, 1980.) While adult burbot looked for fish, crawfish, and crustaceans, especially in summer (Bailey, 1972). Cross (1967) confirmed that burbot lived among large rocks, collapsed bridges, fallen trees, and erosional areas where falling banks provided overhead cover.

Breaser et al. (1988) suggested that burbot are sedentary except during spawning movements. They documented lengthy upstream migration associated with breeding periods. Burbot were found to prefer the turbid glacial rivers in Alaska, moving into clear tributaries only late in the summer after velocity declined (Breaser et al., 1988; Chen, 1969; Mecum, 1984,).

Burbot spawn communally in water a meter or less deep, over gravel or compacted sand, at night, in winter. Young burbot inhabit weed beds on gravel bottoms in swift current (Cross, 1967). Cahn (1936) reported observing burbot spawning under the ice when the air temperature was -28°F (-33°C).

BIOMETRIC DATA—STATUS OF POPULATIONS

Adult fish

Commercial fishermen harvested 1,500 kg of burbot from Lake Sakakawea (Garrison Dam on the mainstem Missouri River in North Dakota) in 1960; none from 1961 through 1974; 11 kg in 1975 and none through 1984 (unpublished report, North Dakota Game and Fish Department, Bismarck).

Benson (1968) listed burbot as rare in Lewis and Clark Lake but common in lakes Fort Peck, Sakakawea, Oahe, and Francis Case (Fig. 2), during the period shortly following dam construction. However, sport fishing survey information for 1959–62 showed a declining harvest of burbot in the tailwater of Oahe (viz. 2.0% in 1959, 1.7% in 1960, 0.3% in 1961, and 0.4% in 1962). During those four years 4,408 burbot weighing 5,333 kg were caught among 372,913 total angler-caught fish (Benson, 1968).

Sport-fishermen user surveys in the tailwater of Fort Randall Dam were completed annually from 1955 through 1959; 7,950 burbot weighing 6,567 kg were harvested among 410,078 other fish. In contrast with the Oahe tailwater burbot fishery, the percentage of total fish made up by burbot increased (viz. 1.3% in 1955, 2.0% in 1956, 1.2% in 1957, 2.9% in 1958 and 2.9% in 1959; Benson 1968). However, in 1990 no burbot were harvested in the Fort Randall Dam tailwater among 11,109 other fish caught by anglers (Stone and Wickstrom, 1991).

Burbot were commonly harvested by sport fishermen in the tailwater of Gavins Point Dam (Fig. 2) for several years after it was closed in July of 1955. Orr (1958) reported 510 burbot (5.1% composition) harvested there in 1956; 4,780 (2%) in 1958, 0 in 1961 (out of 539,945 fish harvested), and 0 in 1962 (out of 710,389 fish harvested) (Orr, 1962). Sport fishermen along the Missouri River in Nebraska were surveyed during 1972 (Groen, 1973). Burbot were not harvested in the tailwater of Gavins Point Dam nor from the unchannelized reach downstream. However, six burbot (1% by composition) were harvested by sport fishermen downstream from Omaha, Nebraska. User surveys conducted in 1978, 1984 and 1992 did not report any burbot as harvested or caught and released from Nebraska's portion of the Missouri River.

Walburg (1964, 1976) reported that burbot and seven other species of fish were collected from Lewis and Clark Lake in 1955–57, shortly after the dam was closed, but they were not represented in 1958–74 fish collections. He concluded this was the result of converting the riverine habitat into a reservoir environ-

ment and because of the pattern of water releases. Walburg et al. (1971) collected 11 burbot among 5,486 large fish (0.2%) gill-netted from the tailwater of Gavins Point Dam in 1968–69.

During 1987–88 a graduate student from the University of South Dakota at Vermillion collected a burbot that measured 102 mm from Lewis and Clark Lake while trawling near the bottom of the old river channel near the dam. The fish was among 22,000 other fish collected during the study (Scott Wessel, personal communication, Nebraska Game and Parks Commission, Norfolk).

Biological surveys of the channelized Missouri River in eastern Nebraska (1970–1975) included 20 burbot among 29,493 large fish (0.07%; Table I; Hesse and Wallace, 1976). Since 1983 we have electrofished 2,019 large fish from these same locations and have not collected burbot. Electrofishing in the unchannelized Missouri River sections in northeast Nebraska collected 7,024 large fish which included 4 (0.06%) burbot (Table I). The largest sample of burbot was obtained during 1970–75. Length-frequency, length-weight distribution, and condition factors by month are presented in Hesse et al. (1978).

Larval fish

Collections of larval burbot indicating reproduction in northeastern Nebraska portions of the Missouri River were obtained in 1984 (two specimens) in the tailwater of Gavins Point Dam; three larvae were collected in 1985 (two in the tailwater and one upstream at Niobrara), and one in 1986 (16 km downstream from Gavins Point Dam; Table I). These six larvae were very rare among more than 150,000 fish larvae collected from nearly 400,000 cubic meters of river water.

FACTORS AFFECTING BURBOT

A. The construction of dams on the mainstem of the Missouri River and on most of its tributaries has prevented the burbot from migrating to satisfactory breeding grounds. Channelization of the Missouri River from Ponca, Nebraska to St. Louis, Missouri has eliminated essential off-channel habitat, which was important for young burbot. These areas provided abundant aquatic insect life. Snagging was done for more than 100 years on the mainstem and on large tributaries. This large woody debris was essential as selected habitat for burbot and as a substrate for aquatic insect life, which was important for young burbot and other small fish which attracted adult burbot and other native predators such as sauger and catfish species. The reduced availability of coarse particulate organic matter (CPOM), due to settling out in large reservoirs and

Table I. Information on the length, weight, site and date of collection for all burbot collected from the Missouri River (1970–92), Nebraska. Methods of collection included hoop net, electrofishing, explosive, and plankton drift net.

Site	Day	Month	Year	Length (mm)	Weight (g)
Adult					
Blair	25	9	70	366	—
Brownville	20	11	70	261	—
Blair	15	10	74	344	184
Blair	19	8	74	431	310
Blair	28	5	74	289	140
Blair	16	9	74	438	300
Blair	22	4	74	385	330
Blair	13	2	74	293	227
Brownville	17	10	74	380	260
Brownville	27	8	74	432	375
Brownville	31	10	74	270	95
Brownville	5	6	74	360	270
Brownville	22	5	74	365	328
Brownville	20	11	74	125	13
Brownville	6	3	74	448	737
Blair	23	9	75	344	180
Blair	10	6	75	367	242
Brownville	31	3	75	381	392
Brownville	1	5	75	366	322
Brownville	17	4	75	347	268
Niobrara River	11	9	78	—	—
Nebraska City	—	—	—	291	—
Gavins Point	1	8	83	392	—
Gavins Point	19	10	83	434	—
Gavins Point	10	6	85	377	—
Gavins Point	18	10	88	327	—
Sunshine Bottom	24	4	89	314	—
Sunshine Bottom	24	4	89	316	—
Larvae					
Gavins Point	5	4	84	4	—
Gavins Point	16	4	84	4	—
Niobrara area	3	4	85	50	—
Gavins Point	20	5	85	9	—
Gavins Point	20	5	85	10	—
St. Helena	31	3	86	5	—

reduced flooding, has reduced the availability of amphipod shredders.

B. After dam construction was completed, burbot became vulnerable to overfishing in tailwater areas where they were stopped in their annual migration in search for spawning substrates. They were most likely overfished in the reach between Fort Randall Dam and Gavins Point Dam shortly after these dams were closed

in the mid-1950s. The fact that some reproduction has been documented in recent years, suggests that a few adult specimens remain; however, a single mature female may lay more than a million eggs (Cross, 1967). There may be only a very few left in this reach. Harvest should be closed for burbot in Nebraska.

C. Disease or predation has not been investigated in Nebraska, therefore it is not known whether burbot suffer from any significant diseases or parasites that might restrict their survival. The loss of turbidity, due to the elimination of sediment transport may contribute to the vulnerability of young burbot to sight feeding predators such as walleye, smallmouth bass, and northern pike, and other researchers have noted the attraction provided by turbid flows.

D. Existing regulatory mechanisms do not adequately protect burbot from habitat loss, the elimination of snags and CPOM, the elimination of sediment turbidity, reduction of aquatic insect populations, or the migration barrier presented by dams.

E. It is unlikely that any new projects are planned that would rapidly diminish remaining burbot; however, there is a need to expedite implementation of the restoration of habitat projects such as hydraulic reconnection of cut-off backwaters, return to a semblance of a natural hydrograph, restoration of sediment and organic matter dynamics, recovery of large woody debris in the river, and construction of fish bypasses at selected dams.

I recommend that burbot be listed as endangered under the Nebraska Nongame and Endangered Species Conservation Act 37-430 to 37-438.

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