Changes in Fish Fauna of Stillwater Creek, Payne and Noble Counties, Oklahoma from 1938 to 1965[1]

W. FRANK WADE and RICHARD E. CRAVEN

Oklahoma State University, Stillwater

The fishes in Stillwater Creek and principal tributaries, Payne and Noble Counties, Oklahoma, were studied from 20 collecting stations in 1938 (Moore and Mizelle, 1939) and from six stations in 1947-48 (Cross, 1950). Many of the stations in 1938 above Stillwater were intermittent pools, and those below had moderate flow because of the processed sewage (750,000 gal. daily) released from the city of Stillwater. During 1947-48, the daily discharge of sewage was 1,600,000 gallons (Cross, 1950). The daily discharge during our investigation was approximately 2,500,000 gallons.

Stillwater Creek meanders 38.37 miles through Permian soils from Lake Carl Blackwell to its confluence with the Cimarron River near Ripley. The channel averages 20 to 30 feet wide, has steep banks, a mud bottom, is less than four feet deep and is littered with debris. The stream banks are well covered with elm, oak, pecan and cottonwood, with a considerable shrub and weed understory.

The stream in 1938 was turbid, with a wide fluctuation in volume of flow. The tendency to flood has been reduced by Lake Carl Blackwell, a 8,300-acre flood control impoundment constructed in 1938, 16.37 river miles upstream from Stillwater. However, one of the most severe floods in the history of Stillwater occurred in 1957. Another change in the stream is an increase in the sewage load of approximately 1,000,000 gallons daily. The lake effects have been: (1) maintenance of flow through formerly intermittent portions of the stream, (2) stabilization of flow because of the collection of runoff water, (3) a slight reduction in the turbidity due to the settling effect, (4) increased number of fish species introduced by government agencies, bait dealers, and fishermen, and their subsequent escape into the creek, and (5) other organisms (e.g., *Chaoborus*, predominantly a lake dweller) now occur in the tailwaters.

Influences of the increased sewage load below Stillwater have been: (1) reduced soil turbidity and increased fertility, which have stimulated the production of large amounts of fish foods; and (2) occasional oxygen deficiency resulting in fish kills.

[1]Contribution #424 from the Zoology Department, Oklahoma State University.

Moore and Mizelle took 28 species of fishes; 26 of these were taken by Cross, and we took a total of 30 in 1965. Cross took 14 additional species not taken in the other two surveys. A total of 39 species was taken over the 27-year period (Table I). This total probably will be expanded, because of the construction of Keystone Reservoir below the creek mouth and the introduction of additional species into impoundments, e.g., *Menidia audens* into Boomer Lake in 1961 (Sisk and Stephens, 1964).

We divided the river system into four zones: Zone A, Lake Carl Blackwell and its tributaries; Zone B, from Lake Carl Blackwell to the west edge of Stillwater; Zone C, the Stillwater area to Brush Creek; Zone D, from Brush Creek to the Cimarron River (Fig. 1.). Moore and Mizelle collected from September to December of 1938, Cross from October, 1947 to August, 1948, and we worked from August to October, 1965.

The collecting methods employed were: seines by Moore and Mizelle, seines and gill nets by Cross, and electric shocker (Zone D) and seines in our collections.

Zone A, includes four of Moore and Mizelle's stations, none of Cross's, and one of ours.

Zone B, includes six of Moore and Mizelle's stations, two of Cross's and four of ours.

Zone C, includes the area of the old sewage plant and the inflow from the new plant on Brush Creek. This includes three of Moore and Mizelle's stations, three of Cross's and three of ours.

Zone D, includes six of Moore and Mizelle's stations, two of Cross's, and two of ours. This Zone had the greatest total abundance of fishes.

The Lake Carl Blackwell dam was provided with water gates designed to permit lowering the water level and to maintain some flow of water in Stillwater Creek. Some time after completion of the dam, one of the valves became inoperable. This resulted in leakage affording a fairly constant water flow below the lake. Doubtless this constant flow was conducive to a buildup in fish populations and contributed to the success of Cross (1950). By 1965, the valve had ceased its leakage so that only minor seepage from the dam was feeding the creek between the lake and the sewage effluent.

Above the sewage outlet into Stillwater Creek, fishes such as *Ictalurus punctatus, Notropis lutrensis, Lepomis macrochirus, L. microlophus* and *Hybognathus placitus,* although not abundant, were in excellent condition.

The new sewage disposal plant has reduced the amount of only primary treated sewage entering the creek but a large quantity of sludge is still present in the outflow. The new plant discharges about 2,500,000 gallons per day, whereas the old plant discharged 1,600,000 gallons per day. The detergent foam is about four feet deep at the outlet flume and extends about 150 feet down and 30 feet up the creek. The new plant empties into Brush Creek which enters Stillwater Creek ¼ mile from the outlet flume. Seine samples in the outlet area were relatively sterile. Moth fly cases (Psychodidae) covered the water below the foam area. The crayfish, *Procambarus simulans,* was taken from the heavy sludge area, indicating the presence of sufficient oxygen to maintain the species. The sludge area, 18 inches deep at the outlet flume into Brush Creek, continues to Stillwater Creek, where the sludge depth was only 12 inches, indicating some flushing of the bottom by the combined flow of the two creeks.

TABLE I. THE FISHES OF STILLWATER CREEK, RANKED IN DECREASING ORDER OF ABUNDANCE, INCLUDED IN THE COLLECTIONS OF MOORE AND MISHLER (MM) 1938, CROSS (C) 1950 AND WADE AND CRAVEN (W) 1965. Pr = SPECIES NOT TAKEN BUT PROBABLY PRESENT OR REPORTED BY OTHERS.

Zone	A			B			C			D		
Species	MM	C	W	MM	C	W	MM	C	W	MM	C	W
Lepisosteus osseus											23	12
Hiodon alosoides											Pr	
Dorosoma cepedianum			1		13			17	6	11	5	1
Carpiodes carpio					12	8		10	7	6	4	3
Cyprinus carpio			7					18			27	2
Hybopsis storeriana											17	
Hybopsis aestivalis										10	6	9
Notemigonus crysoleucas	5					8		6	6		23	8
Notropis percobromus										3	8	11
Notropis pilsbryi	One specimen taken by Cross 1950 not tabulated											
Notropis blennius											14	
Notropis lutrensis	4		2		1		4	1	2	4	3	5
Notropis girardi										2	2	
Notropis stramineus											27	9
Notropis buchanani											20	
Phenacobius mirabilis					8						27	11
Hybognathus placitus									6	1	1	2
Pimephales promelas	1			2	3	2		7	3		15	11
Pimephales vigilax					5			8			23	12
Pimephales notatus								15				
Campostoma anomalum								15				
Ictalurus punctatus					10			14			7	7
Ictalurus melas	3		7	3	14	6	1	11	5		11	12
Ictalurus natalis						9						12
Pylodictis olivaris												12
Anguilla rostrata											Pr	
Fundulus notatus							6	5				

TABLE I. (Contd.)

Zone	A			B			C			D		
Species	MM	C	W	MM	C	W	MM	C	W	MM	C	W
Fundulus kansae										9	19	
Gambusia affinis			4		4	1			1		9	12
Roccus chrysops			3								12	6
Micropterus salmoides			8		16	7	3	15			20	7
Chaenobryttus gulosus								18				
Lepomis cyanellus	2		5	1	6	4	2	12	4	5	13	11
Lepomis humilis	6		8	4	7	8		4		7	10	12
Lepomis megalotis			3		9	3		13	7		16	11
Lepomis macrochirus			6		11	8	1	2		8	17	12
Lepomis microlophus								16	7			12
Pomoxis annularis			4	5	2	9	4	3			20	10
Pomoxis nigromaculatus					15		5	9				
Aplodinotus grunniens											23	4

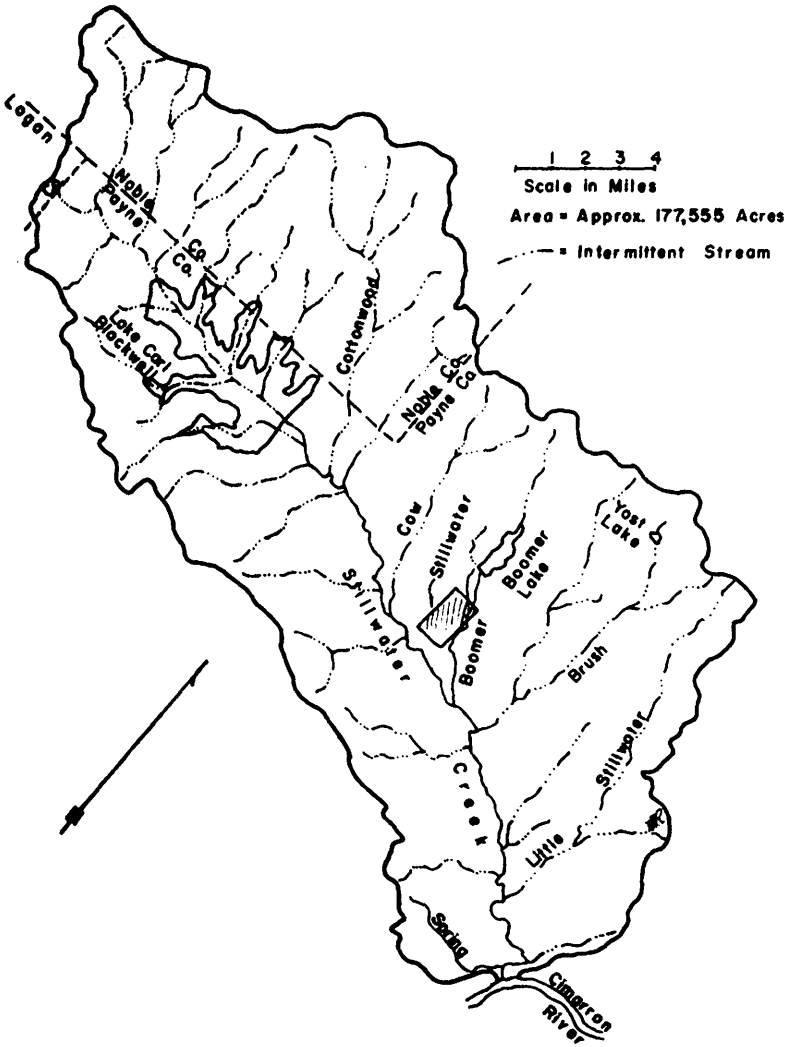

Fig. 1. Map of the Stillwater Creek Drainage Basin (Modified from Cross, 1950).

At the mouth of Brush Creek, the only fish species taken was *Gambusia affinis*. Since the mosquito fish can utilize surface oxygen and predatory species were absent, a large population was found at this station.

Immediately below the mouth of Brush Creek, fishes were few in number and species, represented by *Ictalurus melas, Gambusia affinis* and *Lepomis cyanellus* (one specimen in poor condition). Several miles downstream a heavy algal bloom was encountered. Here the most abundant species was *Dorosoma cepedianum*, capable of utilizing the algae.

The introduction of *Menidia audens* into Boomer Lake (Sisk and Stephens, 1964) will allow this fish access to the Cimarron and Arkansas River drainage basins. It has been collected two miles below Boomer Lake.

A 12-inch specimen of *Stizostedion vitreum* was taken from Lake Carl Blackwell, but this species has not been found in recent years. This fish was introduced into the lake with bait stock from the North Canadian River below Canton Reservoir, according to the local dealer who discarded the predatory fingerlings from his holding tanks.

The white bass, *Roccus chrysops*, has been successful in the lake, where introduced, although long known to occur in lower Stillwater Creek. We took a 15.5-inch specimen in Zone D.

Shortly after impoundment of Lake Carl Blackwell, several barrels of "crappie and bream" were procured by local sportsmen, in keeping with the spirit of the time, from the Federal Hatchery at Tishomingo. Moore (personal communication), while riding on the truck delivering the stock, dipped samples from the barrels. The stock did contain *Pomoxis annularis, P. nigromaculatus*, and *Lepomis macrochirus*, the intended stock, but also six or seven other species including *Pimephales vigilax, P. notatus*, and *Notemigonus crysoleucas*. These introduced species probably did change the species composition of Stillwater Creek, but all could be expected in Payne County.

Notropis pilsbryi, reported as *N. zonatus* by Cross (1950) on the basis of one specimen, has not been taken since. It is inconceivable that this inhabitant of clear, cooler streams of the Ozark Region could succeed in Stillwater Creek.

Gambusia affinis has gained the number one position in rank possibly because of its tolerance of sewage.

Dorosoma cepedianum has become an abundant fish of the creek system, possibly owing to an increased food supply.

Lepomis spp. were abundant throughout the basin area and remain the most stable fish in the 27-year period.

Notemigonus crysoleucas, formerly abundant above Lake Carl Blackwell, is now reduced in number probably as a result of predation, although increased farming in that area, resulting in a heavier silt load carried by tributaries, may be an important factor.

The following fishes probably never will be abundant in Stillwater Creek: *Hiodon alosoides, Hybopsis storeriana, Notropis pilsbryi, N. blennius, N. girardi, N. stramineus, Campostoma anomalum, Anguilla rostrata, Chaenobryttus gulosus*, and *Aplodinotus grunniens*.

The size of the stream will probably restrict *H. alosoides, A. rostrata* and *A. grunniens*.

Certain requirements, e.g., stone and gravel for spawning, by

Campostoma anomalum will also be a restricting factor for population establishment.

Many of the fishes utilizing the Creek area only enter from the Cimarron River during heavy discharge of runoff water. This increased flow dilutes the effect of the sewage load.

Land use practices will doubtless affect future populations of fishes in Stillwater Creek. Overgrazing and denudation and burning of timber have increased erosion. The Soil Conservation Service has started a program of constructing small holding ponds in an attempt to halt some of this erosion. The use of windrows of timber as temporary terraces in the denuded area has helped. The increased construction in Stillwater will present additional problems. In the future, it will be interesting to see how the new sewage plant, soil conservation practices, introduction of additional species of fishes, and the improved farming practices change the character of Stillwater Creek and its tributaries.

Literature Cited

Cross, Frank Bernard. 1950. Effects of sewage and of a headwaters impoundment on the fishes of Stillwater Creek in Payne County, Oklahoma. Amer. Midl. Nat. 43(1): 128-145.

Moore, George A. and John D. Mizelle. 1939. A fall survey of the fishes of the Stillwater Creek drainage system (Payne and Noble Counties, Oklahoma). Proc. Okla. Acad. Sci. 19: 43-44.

Siak, Morgan E. and Robert R. Stephens. 1964. *Menidia audens* (Pisces: Atherinidae) in Boomer Lake, Oklahoma, and its possible spread in the Arkansas River system. Proc. Okla. Acad. Sci. 44: 71-73.