Project Status Report

Upper Mississippi River
Long Term Resource Monitoring Program
U.S. Geological Survey

River Levels and Largemouth Bass Populations in the Illinois River[1]

by
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Although the population dynamics of largemouth bass *Micropterus salmoides* (Figure 1) in ponds, lakes, and reservoirs have been studied extensively, less is known about largemouth bass population dynamics in temperate, large river-floodplain ecosystems. River levels likely affect fish populations in these systems during certain times of the year (e.g. spawning) because they can determine habitat availability and quality. Because river level regimes vary annually, long-term data sets are needed to understand fish population dynamics in these systems over a wide array of environmental conditions.

While floods are generally perceived to have negative impacts on humans, studies indicate fish populations in large river-floodplain systems benefit from seasonal flood pulses. The magnitude of the effect of these flood pulses is determined by water temperature, rates of water rise and fall, and the extent and duration of floodplain inundation. Because most Illinois River backwater lakes presently lack vegetation and have soft, silty substrates, they are less than ideal habitats for spawning fish. Spawning fish may utilize annual spring floods to access inundated terrestrial vegetation and previously dry, compact substrates on the Illinois River floodplain.

(over)

Figure 1. Largemouth bass taken in the Illinois River. *(Photo by Paul T. Raibley)*

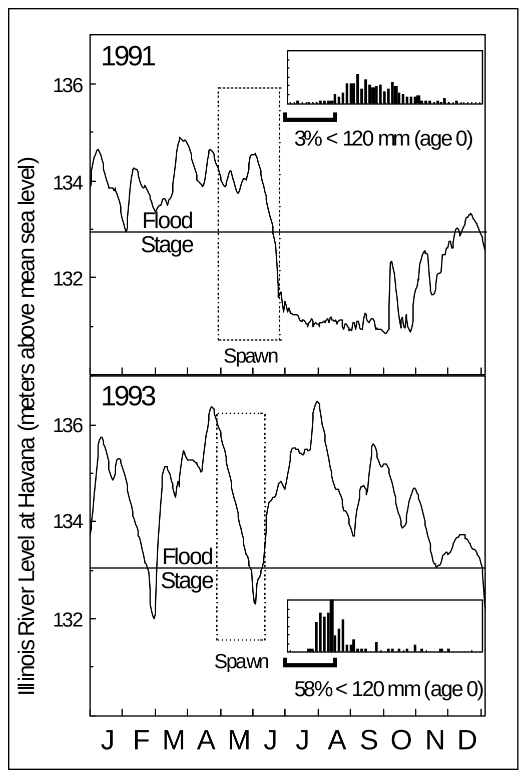

Figure 2. River levels at Havana, IL in 1991 and 1993. In 1991 river levels fell below flood stage in June and remained low all summer. In 1993 river levels fell slightly below flood stage in May, but rose again within a few days, covering the flood-plain throughout summer. Age-0 largemouth bass (< 120 mm long) accounted for 3% of all bass collected in 1991 and 58% in 1993.

We examined the relationship of river level and temperature to largemouth bass population structure in La Grange Reach (a 125.6-km segment between La Grange Lock & Dam and Peoria Lock & Dam) of the Illinois River from 1990 to 1995. Fish were collected with a pulsed-DC electrofishing boat along randomly selected segments of backwater, side channel, and main channel shoreline as part of the Long Term Resource Monitoring Program (LTRMP). Each year sampling was conducted between 15 June and 30 October with effort distributed uniformly throughout the sample season. We used the percent of the fish less than 120 mm (5 inches) long from each year's sample as an index of year class strength for young-of-the-year (age-0) fish. Of 218 bass we aged since 1993 that were less than 120 mm long, 96.8% were age 0.

We made 591 electrofishing collections (150.6 hours) from 1990 through 1995 and collected a total of 2,563 bass. In three of the six years (1990, 1993 and 1995) age-0 fish made up more than 20% of the total catch indicating strong year classes were produced. These year classes remained strong in subsequent years as evidenced by their presence in our annual collections. Flood waters coincided with warming water temperatures and bass spawning times in each of these years. In 1993 water covered the floodplain (Figure 2) for nearly nine months (March through October), greatly expanding spawning and nursery habitat which resulted in high fish production and low mortality; age-0 bass comprised 58.3% of our catch that year. Although river levels fell during spawning in 1993, the floodplain remained inundated throughout most of that time and river levels remained low for only a few days before rising again, reinundating the floodplain. As a result, bass mortality due to nest abandonment and stranding may have been low.

In 1991, 1992 and 1994, age-0 fish made up less than 7% of our catch indicating weak year classes were produced. In 1991 river levels fell rapidly during June, draining the floodplain and probably causing fish to abandon nests. Because river levels fell rapidly, many age-0 fish may have been flushed off the floodplain or become stranded, resulting in high mortality. In 1992 and 1994 river levels were low and fluctuating as temperatures warmed and bass were spawning. Under these conditions, suitable spawning habitat may have been limited and survival rates of age-0 fish may have been low due to predation.

The coincidence of flood events with the production of strong largemouth bass year classes in La Grange Reach (1990, 1993, 1995) indicates floods are often beneficial to Illinois River fish populations. Other nest-building fish species in La Grange Reach (bluegill *Lepomis macrochirus*, black crappie *Pomoxis nigromaculatus* and white crappie *Pomoxis annularis*) exhibited population dynamics similar to largemouth bass and seemed to benefit from high spring and early-summer river levels. We also documented strong cohorts of age-0 gizzard shad *Dorosoma cepedianum* (a major food source for Illinois River fish) when river levels were high during spring, which may have enhanced bass survival.

Over the past six years we have gained insight into the relationship between spring river levels and fish production in La Grange Reach, but our knowledge is still lacking in many areas. For example, what are the effects of droughts on fish populations in La Grange Reach? As we continue to monitor Illinois River fish populations and other LTRMP biologists continue to monitor Mississippi River fish populations, our understanding of fish population dynamics in temperate, large river-floodplain ecosystems will improve. ❐

[1] Expanded from Illinois Natural History Survey Reports No. 344, March/April 1997.

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