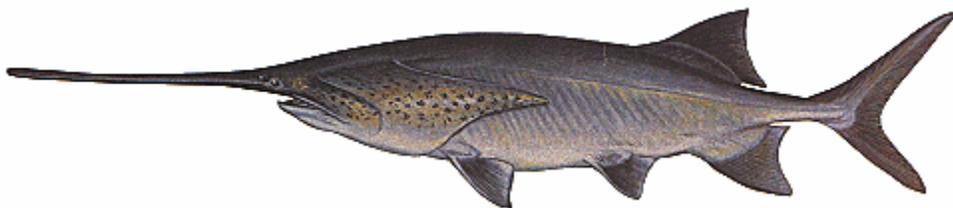
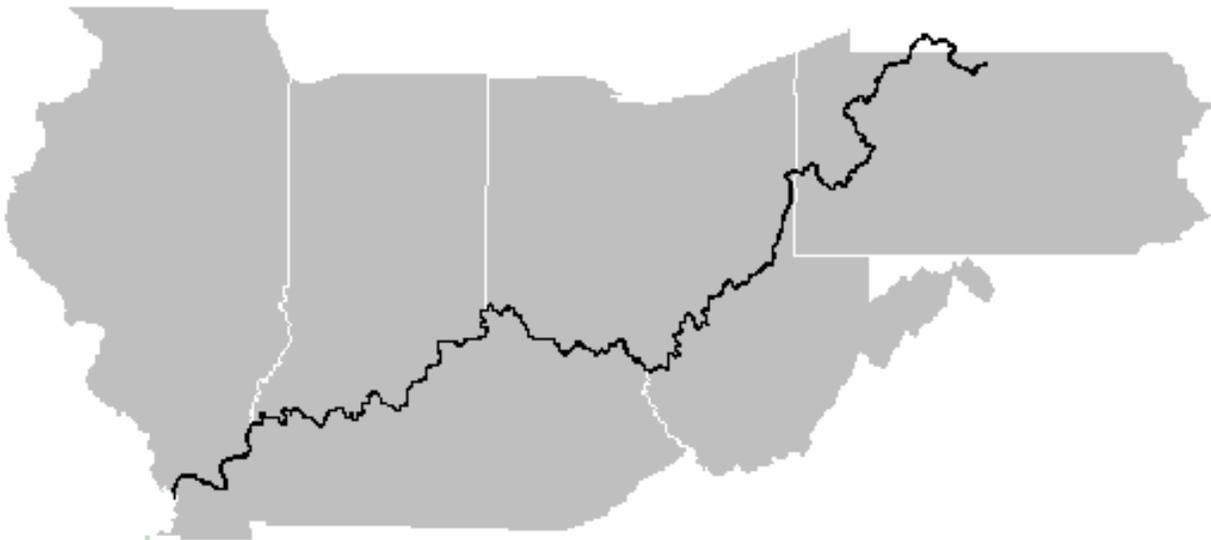


Paddlefish in the Ohio River Sub-basin: Current Status and Strategic Plan for Management



ILLINOIS



DEPARTMENT OF
NATURAL
RESOURCES



INDIANA DIVISION OF
FISH & WILDLIFE



Ohio River Fisheries Management Team

November 26, 2001

***Paddlefish in the Ohio River Sub-basin:
Current Status and Strategic Plan for Management***

Doug Henley

*Kentucky Department of Fish and Wildlife Resources
#1 Game Farm Road, Frankfort, KY 40601
doug.henley@mail.state.ky.us*

Les Frankland

*Illinois Department of Natural Resources
PO Box 206, Fairfield, IL 62837
lfrankland@dnrmail.state.il.us*

Scott Hale

*Ohio Department of Natural Resources
10517 Canal Road, SE, Hebron, OH 43025
scott.hale@dnr.state.oh.us*

Chris O'Bara

*West Virginia Division of Natural Resources
2311 Ohio Avenue, Parkersburg, WV 26101
cobara@dnr.state.wv.us*

Tom Stefanavage

*Indiana Department of Natural Resources
2310 East State Road 364, Winslow, IN 47598
tstefanavage@dnr.state.in.us*

***Ohio River Fisheries Management Team
Technical Committee***

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Executive Summary

The Ohio River Fisheries Management Team (ORFMT) Technical Committee has developed this overview of paddlefish status in the Ohio River Sub-basin at an important time. The Ohio River paddlefish population is a shared fishery resource at risk of overexploitation due to recent changes in global caviar markets that have increased the incentive for harvest. *Paddlefish in the Ohio River Sub-basin: Current Status and Strategic Plan for Management* provides current and historical information to guide management and policy. Our goal is to restore, enhance, and protect the paddlefish population in the Ohio River Sub-basin to ensure sustainable use and increase public awareness of paddlefish issues. To address this goal, strategic objectives were defined, fisheries problems were identified and prioritized, and problem-specific strategies were developed. Operational plans will be formed and implemented to address this strategic plan.

The paddlefish population in the Ohio River Sub-basin shows signs of extensive harvest that necessitate careful monitoring and a readiness to take regulatory action by the ORFMT. Estimates of total annual mortality, size structure, and age structure depict a population that is pushing its limit of sustainable harvest for optimal sustainable yield. Specific reasons for ORFMT concern include:

Current Status

- The Ohio River Sub-basin of the Mississippi River drainage comprises 22% of endemic paddlefish habitat.
- Paddlefish are listed as extirpated in Pennsylvania, protected in West Virginia, threatened in Ohio, a rough fish in Kentucky, and a sport and commercial fish in Indiana and Illinois.
- Exploitation, legal and illegal, is a serious threat to Ohio River Sub-basin paddlefish. The world supply of high-grade caviar decreased following collapse of Caspian Sea sturgeon fisheries, and demand for paddlefish eggs as a substitute is expected to increase.

Paddlefish are Mobile

- Paddlefish were highly mobile within pools of the Ohio River Sub-basin. Twenty-four percent of recaptured wild paddlefish were collected from a pool upstream or downstream of the original point of tagging, whereas 76% were recaptured within the original pool of tagging.
- One paddlefish tagged in Smithland Pool was recovered five pools upstream in Markland Pool (483 km (290 miles)), and another paddlefish tagged in Greenup Pool was recaptured five pools downstream in Cannelton Pool (526 km (316 miles)).
- Paddlefish tagged in other studies have been documented movement in and out of the Ohio River Sub-basin. One paddlefish tagged in South Dakota was recovered in the Ohio River Sub-basin (D. Henley personal communication) and three paddlefish tagged in the Ohio River Sub-basin were recaptured in Missouri and Arkansas (Timmons and Hughbanks 2000).

Paddlefish Caviar is a Valuable Resource

- Paddlefish eggs are marketed as high-grade caviar that retails for US\$423/kg (US\$192/lb) and yields commercial fishers at least US\$100-200/kg (US\$45-91/lb).
- Retail value of the Ohio River paddlefish egg harvest was nearly US\$4.3 million in 2000.
- Ohio River commercial fishers recently reported an increase in wholesale egg prices.

Commercial Fishery Issues

- Harvest can increase substantially from one year to the next given adequate market incentive and favorable river conditions. Reported commercial harvest was 63,827 kg (140,419 lbs) of flesh and 2,733 kg (6,013 lbs) of eggs during 1999, and 159,109 kg (350,040 lbs) of flesh and 10,071 kg (22,156 lbs) of eggs during 2000.
- Kentucky and Indiana licensed 366 commercial fishers during 2000. A commercial crew of two fishers reported harvest of 15,707 kg (34,904 lbs) of flesh and 2,812 kg (6,248 lbs) of eggs during 2000, which represented 28% of the annual egg harvest.
- Current market prices provide incentives for fishery participation and the Ohio River fishery has few barriers to entry. A 9-kg (20-lb) female paddlefish can be worth nearly US\$400 wholesale, yet a resident commercial fishing license costs US\$35-125, a paddlefish gillnet costs US\$100, and minimal equipment is required for a fisher with a small boat.

Red Flags for the Population

- Length-frequency distributions of Ohio River paddlefish were truncated at 85 cm eye-fork length (33 inches).
- The percentage of paddlefish estimated to be ages 10-14 declined by 2-12% annually between 1997 and 2001, and few older fish were observed in the population.
- Total annual mortality of Ohio River paddlefish ranged from 47-68% during 1995-2001, indicative of a population exposed to extensive harvest.

Important Sport Fishery

- A creel survey from Markland Tailwater during 2000-2001 indicated that 16% of anglers sought paddlefish and these anglers harvested 323 paddlefish during February through April.

Contaminant Advisories

- Contaminant advisories on Ohio River paddlefish products were downgraded from “do not eat” to a limit of six meals per year of flesh or eggs from the lower two-thirds of the river, although pregnant women, nursing mothers, infants, and children are advised to not eat paddlefish products.

Management Recommendations

- Establish full participation of all Ohio River Sub-basin states in cooperative management.
- Implement the proposed 2002-2010 strategic plan provided in this report.
- Initiate operational plans in 2002 to: 1) monitor abundance; 2) refine quantification of movement; 3) quantify exploitation; 4) monitor commercial harvest; 5) monitor sport fisheries; 6) improve data management; 7) provide public information.

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Introduction

Paddlefish (*Polyodon spathula*) are native to the Ohio River Sub-basin of the Mississippi River drainage, a linear distance that accounts for 20,856 km (13,035 miles), or 22% of endemic paddlefish habitats (Table 1). Habitat degradation, exploitation by sport and commercial fishers, and poaching have impacted paddlefish in the majority of their range for the past 100 years (Graham 1997). Exploitation, legal and illegal, is a renewed threat to paddlefish populations because paddlefish eggs are a high-grade substitute for sturgeon caviar that yield commercial fishers US\$100-200/kg (US\$45-91/lb) and currently retail for US\$423/kg (US\$192/lb).

Market demand for paddlefish is expected to increase because of declines in world sturgeon stocks and closure of Caspian Sea sturgeon fisheries (Birstein et al. 1997; Khodorevskaya et al. 1997). On June 25, 2001, a freeze on Caspian Sea sturgeon fisheries was initiated in Russia, Azerbaijan, Kazakhstan, and tentatively Turkmenistan through pressure from world trade regulators of the United Nations CITES Committee (Convention on International Trade in Endangered Species and Wild Fauna and Flora). This effort to help restore dwindling stocks of sturgeon did not include Iran, because their management practices are deemed acceptable (Associated Press International 6/25/2001). The Caspian Sea accounts for over 90% of the world supply of sturgeon caviar and value of the illegal trade is believed to exceed US\$1 billion annually, which is ten times the value of the legal harvest. Legal harvest of Caspian Sea sturgeon during 2000 decreased to one twentieth of that reported two decades ago (CNN 6/25/2001). Availability of sturgeon has been inversely related to the demand for paddlefish flesh and eggs since the early 20th Century (Carlson and Bonislawsky 1981; Pasch and Alexander 1986). These biological and macro-economic factors necessitate a better understanding of paddlefish within the Ohio River Sub-basin of the Mississippi River Basin in order to protect paddlefish or maintain sustainable fisheries.

Market demand for paddlefish will affect the Ohio River Sub-basin paddlefish stock because commercial fisheries operate in three of six border-states, and illegal harvest is a potential problem basin-wide. Paddlefish, like other chondrosteian fishes, have a combination of morphology, habits, and life history characteristics that make them extremely sensitive to exploitation (Boreman 1997).

Table 1. Total segment lengths (km and miles) and percentage of total segment lengths of each sub-basin with original paddlefish habitat excluding the Great Lakes region where paddlefish were historically reported, but are now considered extirpated (provided by Joanne Grady, USFWS).

Sub-basin	Segment length (km)	Segment length (miles)	Percent of total
Ohio River	20,856	13,035	22
Upper Mississippi River	8,707	5,442	9
Lower Mississippi River	27,330	17,081	29
Missouri River	27,638	17,274	30
Gulf Rivers	9,220	5,762	9

Approaches to paddlefish management differ among Ohio River Sub-basin states. Status of paddlefish in the Ohio River is categorized by border-states as extirpated in the upper river (Pennsylvania), threatened (Ohio) and protected (West Virginia) in mid-river reaches, and commercially harvested in mid-river and lower river reaches (Kentucky, Indiana, and Illinois). These differing strategies are a concern because separate management units, or stocks, are unlikely to exist in the Ohio River Sub-basin, the Ohio River, its tributaries, or navigational pools.

Paddlefish within the Ohio River migrate among inter-jurisdictional boundaries. Telemetry and tagging studies confirm that paddlefish are capable of traveling great distances and moving through navigational dams. Telemetry studies often indicate that inter-pool movement is common, although upstream movement has been less frequently reported than downstream movement. Southall and Hubert (1984), and Johnson et al. (1997) found that paddlefish in large rivers readily moved downstream through partially closed dam gates, yet exhibited limited upstream movement at high-flow conditions when dam gates were completely open. Under low-flow conditions, paddlefish monitored by Moen et al. (1992) moved downstream, but did not move upstream even when a lock and dam was fully open for 10 days. Downstream migrations of adult paddlefish (129-151 cm (52-60 in) eye-fork length) tracked by Johnson et al. (1997) were typically 70-130 km (42-78 miles) in 7-18 days during late spring in the Ohio River. Juvenile paddlefish (35-50 cm (14-20 in) eye-fork length) tracked by Pitman and Parks (1994)

traveled up to 270 km (162 miles) upstream in less than seven months and 161 km (97 miles) downstream in less than ten months in the Neches River system, Texas. The distances traveled by both adult and juvenile paddlefish monitored with radio-telemetry indicated that extensive movement is characteristic of paddlefish of all ages rather than limited to spring spawning movements by mature adults.

Extensive upstream and downstream movements of paddlefish also are verified through tagging studies. Rosen et al. (1982) reported average upstream movement of 21 km (13 miles) and downstream movement of 198 km (119 miles) in the Missouri River after the first year of a tagging study. An additional recapture was reported 2,000 km (1,200 miles) downstream. Other investigators have documented movement of over 167 km (100 miles) in the Yellowstone River, Montana, 242 km (145 miles) in the Missouri River, Montana, and 333 km (260 miles) in the Osage River, Missouri (Russell 1986). Reported recaptures from these studies verified upstream and downstream movements in rivers with and without lock and dam structures, although movement was more extensive in regions without navigational structures.

The highly migratory nature of paddlefish infers that gene flow is common among populations without definitive geographic isolation, therefore paddlefish within the Ohio River are unlikely to represent more than one genetic population. Epifanio et al. (1996) surveyed allozyme and mitochondrial DNA from six regions of the Mississippi River, Mobile Bay, and Pearl River drainages and identified essentially two major groups, one from the Mississippi River and Pearl River drainages, and the other from the Mobile Bay drainage. Results of their analyses did not indicate subdivisions of biological significance at local levels. However, the presence of rare alleles in maternal lineages of fish from Osage and Arkansas River populations, relative to other Mississippi River populations, lead Epifanio et al. (1996) to recommend a conservative approach of managing paddlefish at no less than major tributary levels when considering rehabilitation, restoration, or protection efforts. Carlson et al. (1982) also found little genetic variability among Mississippi River basin paddlefish when electrophoresis results were compared from Yellowstone, Missouri, Osage, Mississippi, and Cumberland river populations. The conclusions of Epifanio et al.

(1996) and Calson et al. (1982) were consistent with particularly low heterozygosity that characterizes the 120-chromosome acipenseriforms, which includes paddlefish (Birstein 1997).

Paddlefish harvest from the Ohio River Sub-basin has not been well documented during the past 20 years. Carlson and Bonislavsky (1981) reported that commercial harvest of Ohio River paddlefish declined from 1950-1980, but indicated that Ohio River Sub-basin harvest from the Tennessee and Cumberland rivers has historically represented a large portion of the total harvest in the United States. Pasch and Alexander (1986) described a historical pattern of overexploitation and recovery of paddlefish populations in the Tennessee River Valley, and provided case studies to demonstrate the ease at which these fish were overharvested in response to market demand. They suggested that sustainable fisheries are possible at exploitation rates of less than 15-20%, but expressed concern when harvest increased during the late 1970s after the United States stopped importing Iranian sturgeon caviar (Semmens and Shelton 1986). Following this period, Hoffnagle and Timmons (1989) documented 69% total annual mortality, a young population, and a low number of spawning paddlefish in the lower Tennessee River. High egg prices (US\$110/kg (US\$50/lb)) during 1984-1985 had encouraged harvest, but following the 1986 reintroduction of Iranian sturgeon caviar to the market egg prices decreased to US\$44/kg (US\$20/lb) and commercial fishery activity declined. Timmons and Hughbanks (2000) observed changes in the lower Tennessee River by 1992, where they estimated 3-year exploitation rates at 14%, a decrease in total annual mortality to 22%, and an increase in population size and age structure. During that time, 3-year cumulative exploitation in the lower Tennessee and Cumberland rivers ranged from 14% in Kentucky Lake, where 88% of harvest was commercial, to 25% in the Kentucky Dam tailwaters, where only sport fishing is permitted. Annual exploitation never exceeded 18% during any year of their study, and during 3 years never exceeded 12% by commercial fishers or 16% by sport fishers in Kentucky Lake, the Kentucky Dam tailwaters, or Lake Barkley.

Annual exploitation rates of less than 20% may be compatible with sustainable paddlefish fisheries. Combs (1982) documented annual exploitation rates of 15% (1979) and 19% (1980) in the Neosho River, Oklahoma sport fishery and believed that those harvest levels were not a detriment to the population. He also indicated that annual exploitation reported by researchers monitoring sport fisheries

of the Yellowstone, Missouri, Mississippi, and Osage rivers often ranged from 8-14% and had generally not been associated with overharvest. Exploitation rates are not presently known for Ohio River paddlefish, and commercial harvest of paddlefish had been coarsely quantified, or not at all, during the past two decades by the seven Mississippi River Basin states that allowed commercial fishing (Todd 1999).

The overwhelming documentation of paddlefish movement between pools of large river systems and vulnerability of paddlefish to overexploitation indicate the need for an inter-jurisdictional management perspective in the Ohio River Sub-basin. The objective of this Ohio River Sub-basin report was to develop a current situation analysis from which to initiate comprehensive inter-jurisdictional management of paddlefish in the Ohio River Sub-basin and scope a course of action for paddlefish management within the Ohio River. Each border state recognizes the vulnerability of paddlefish to exploitation, volatility of the global caviar market, and the influence of that market on paddlefish, and is working cooperatively on paddlefish issues through the Ohio River Fisheries Management Team (ORFMT).

Ohio River Fisheries Management Team (ORFMT)

The ORFMT was formed in 1990 to develop an inter-jurisdictional perspective to management of Ohio River fisheries resources. Impetus for the formation of the team was United States Supreme Court settlements that changed jurisdiction of the Ohio River from the exclusive jurisdiction of Kentucky to concurrent jurisdiction with the states of Ohio, Indiana, and Illinois. The Ohio Decree was entered on April 15, 1985 (Ohio v. Kentucky, 471 U.S. 153); the Indiana Decree was entered on November 4, 1985 (Indiana v. Kentucky, 474 U.S. 1); and, the Illinois opinion was decided on May 28, 1991 (Illinois v. Kentucky, 500 U.S. 380, No. 106, Orig.) (www.megalaw.com/fed/usopinions.php3). Shared jurisdiction necessitated cooperative management and led to the development of a Memorandum of Understanding among natural resource agencies that manage fisheries in Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois. Team objectives specified in a Memorandum of Understanding were:

- 1) Develop shared fisheries management objectives;
- 2) Coordinate regulatory responsibilities, conduct joint management programs and facilitate technical information exchange among the states with other governmental, public, and private interests;
- 3) Designate and maintain at least one agency representative to serve on an "Ohio River Fisheries Management Team";
- 4) Convene the "Ohio River Fisheries Management Team" at least annually to discuss, plan and report on cooperative fisheries management efforts;
- 5) Recognize that this memorandum of understanding shall neither obligate the parties to expenditure of funds nor in any way affect the legal authorities vested in the individual states; and,
- 6) Retain this memorandum of understanding until it is modified or terminated by those who signed this agreement.

The Ohio River Sub-basin report for paddlefish was an outcome of these objectives and the result of ORFMT participation in a national study of paddlefish coordinated by the Mississippi Interstate Cooperative Resource Association (MICRA). Twenty-two of the 28 states within the Mississippi River

Basin have participated in the basin-wide study that initiated in 1995 (Oven and Fiss 1996). The goal of the study was to assess the condition of paddlefish stocks throughout the entire Mississippi River Basin.

International Status of Paddlefish

Paddlefish have been listed under the Convention on International Trade in Endangered Species and Wild Fauna and Flora treaty (CITES) as an Appendix II species since 1992. The CITES treaty is an agreement among 145 nations to protect specific plant and animal species from unregulated international trade. Appendices I, II, and III provide categories of species status and monitoring action for species addressed by CITES and list specific species under each category. Appendix I protects threatened species from all international commercial trade. Appendix II regulates trade in species not threatened with extinction but which may become threatened if trade goes unregulated. Appendix III gives countries the option of listing native species already protected within their own borders (<http://international.fws.gov/facts/citesnew.html>). The listing of paddlefish and other acipenseriforms resulted from concerns related to the caviar market in the presence of observed reductions in abundances of paddlefish and sturgeons in much of their native range, and a general lack of information about their status (Graham and Rasmussen 1999).

Export of paddlefish flesh, roe, or live hatchery products requires a permit from the United States Fish and Wildlife Service (USFWS), Division of Scientific Authority. The procedures for the permitting process were summarized in a letter from the USFWS to Willem Wijnstekers, Secretary General, CITES Secretariat (Appendix A). Applicants for an exporting permit indicate origin of the product, the amount to be exported, the recipient, and provide an indication from state controlling authorities in the United States that the harvest was not detrimental to the species. The USFWS Division of Management Authority reviews each application for completeness, compliance with local regulations, and the presence of adequate scientific information and forwards the application to the USFWS Division of Scientific Authority. The Division of Scientific Authority reviews each application and approves applications that are deemed non-detrimental. A CITES permit costs US\$25 per shipment and can include a combination of products from different regions.

During 1997 through 2000, nine export permits were reviewed for paddlefish products with an Ohio River Sub-basin origin. All of the products, which were primarily paddlefish eggs sold for use as caviar, originated from Kentucky or Tennessee. Products included 6,247 kg (13,761 lbs) of eggs and an

undisclosed amount of live hatchery products (eggs, fry, and fingerlings), of which 3,206 kg (7,061 lbs) of eggs and all live hatchery products were deemed non-detrimental to fisheries and accepted for export. Permits from these transactions are available in Appendix B.

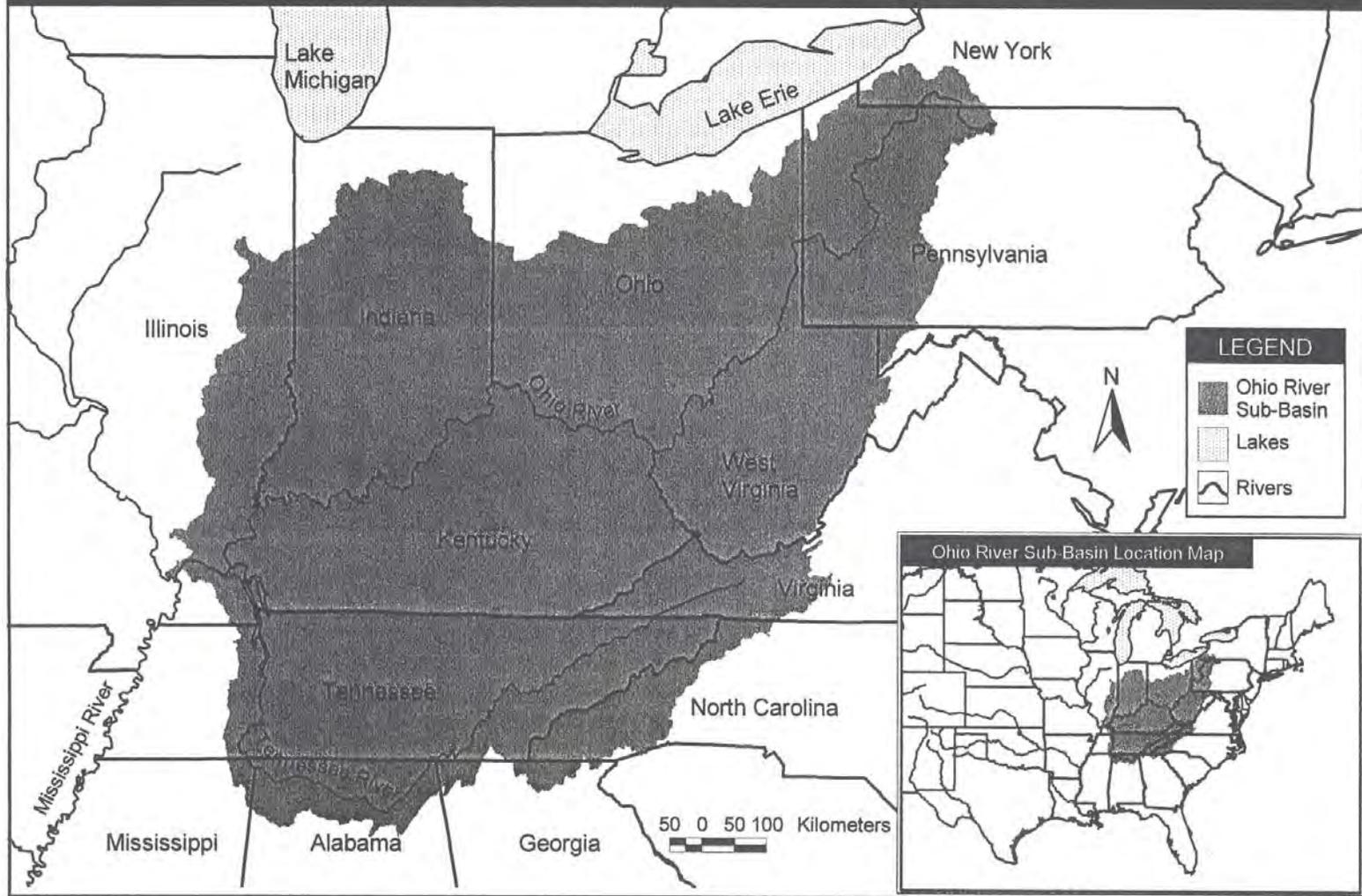
Study Area

The Ohio River Sub-basin includes portions of 11 states and comprises 20% of the Mississippi River watershed (Figure 1). Nearly 10 percent of the United States population lives in the 530,244 km² (203,940 square miles) Ohio River Sub-basin. The Ohio River forms in Pittsburgh, Pennsylvania at the confluence of the Allegheny and Monongahela rivers and flows 1,582 km (981 miles) to Cairo, Illinois where it enters the Mississippi River. A total of 69 tributaries with drainages greater than 2,600 km² (1,000 square miles) enter the Ohio River as it flows through Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois (Appendix C). The Tennessee, Wabash, and Cumberland rivers are the largest tributaries in the basin, and account for approximately 20%, 16% and 9% of the watershed, respectively (www.orsanco.org).

The Ohio River is an important source of water supply, commercial navigation, power generation, and recreation. Three million people currently use the Ohio River as a source of potable drinking water. Twenty navigational dams operate to facilitate commercial and recreational travel (Appendix D). These dams provide a 2.7 m (9 ft) minimum depth for commercial navigation. Over 207,000,000 metric tonnes (230,000,000 short (English) tons) of cargo transported on the river annually are composed primarily of coal and other energy products. Forty-nine power-generating facilities operate on the Ohio River and the combined capacity of these facilities exceeds 6% of the total generating capacity in the United States. Recreational fishing and boating also represents a significant portion of river use and these activities contribute to local and regional economies (Shell et al. 1996).

Approximately 159 fish species are found within the Ohio River and 285 are found within the sub-basin (Wallus et al. 1990). Species composition and abundance have changed dramatically during the past century as a result of dam construction, pollution and pollution abatement (Pearson and Krumholz 1984). Natural resource agencies of states which border the Ohio River currently consider 25 species sport fishes. No fish species indigenous to the mainstem of the Ohio River are federally listed as endangered, threatened, or are current candidates for federal listing.

Figure 1. Ohio River Sub-Basin



Historical Perspective, Status, and Current Management

Ohio River fisheries were important to native Americans and early European settlers who capitalized on the abundance and variety of fishes inhabiting the river. However, fish populations began to deteriorate by the late 1800s and early 1900s as a result of environmental degradation from settlement of the Ohio River Valley and commercial fishing (Ohio River Sanitation Commission (ORSANCO) 1962; Pearson and Krumholz 1984). Forests had been removed and products of eroded material entered the river. Factories discharged effluents into the river without restriction, urban centers discharged untreated human waste into the river, and dams were built along the entire reach. Concurrent with this environmental degradation was the advent of commercial fishing. The Ohio River has been fished commercially since the early 1800s and the harvest value of fishes such as lake sturgeon *Acipenser fulvescens*, shovelnose sturgeon *Scaphirhynchus platyrhynchus*, and paddlefish contributed to their decline in abundance (Pearson and Krumholz 1984).

Paddlefish, like other Ohio River fishes that require clean gravel substrates for spawning, have declined since dam construction began in the early 20th Century (Pearson and Krumholz 1984). Paddlefish were historically noted to be more abundant in the lower Ohio River, as is believed today. Lock-chamber studies along the Ohio River demonstrate historical gradients in paddlefish presence from the upper to the lower reaches of the river (Table 2).

Strategies for managing paddlefish vary among states within the Ohio River Sub-basin. Restoration and stocking programs are employed primarily in the upper Sub-basin where paddlefish harvest is prohibited, whereas commercial and sport fisheries operate in the lower Sub-basin. Five of eight states in the Ohio River Sub-basin have stocked 237,533 fish since 1986 (Table 3), and program objectives and stocking strategies vary. The Tennessee Wildlife Resources Agency (TWRA) has stocked the largest number of paddlefish in the Ohio River Sub-basin. During 1986-1997, TWRA stocked 154,889 paddlefish throughout the Tennessee and Cumberland river drainages. Unlike other states within the sub-basin that stock paddlefish, TWRA permits sport and commercial harvest of these fish.

Table 2. Mean number (\pm SE) of paddlefish sampled in lock-chamber studies each decade since 1960 in the Ohio River, 1960-1999. Sample size (N) in parenthesis indicates the number of lock-chamber studies during each decade (ORSANCO database).

Pool (lock)	1960-1969	1970-1979	1980-1989	1990-1999
Dashiields	0 (3)	0 (6)	0 (6)	0 (1)
Montgomery	0 (3)	0 (1)	0 (2)	0 (5)
New Cumberland	0 (2)		0 (7)	0 (2)
Pike Island	0 (3)	0 (5)	0 (7)	0.2 \pm 0.2 (5)
Hannibal	0 (1)	0 (4)	0 (7)	0 (1)
Willow Island	0 (2)	0 (1)	0 (6)	0 (5)
Belleville	0 (3)	0 (6)	0 (6)	0 (1)
Racine	0 (2)		0.2 \pm 0.2 (5)	0.17 \pm 0.17 (6)
Byrd	0 (3)	0 (6)	0 (5)	0 (2)
Greenup	0 (3)	0 (1)	0.25 \pm 0.25 (4)	0.5 \pm 0.29 (4)
Meldahl	0 (4)	6.5 \pm 6.17 (4)	0.67 \pm 0.67 (3)	1.0 \pm 0.58 (4)
Markland	0 (3)	10.6 \pm 9.10 (5)	1.5 \pm 1.5 (2)	9.5 \pm 6.01 (4)
McAlpine	0 (3)	9.25 \pm 6.76 (4)	1.5 \pm 1.31 (6)	0 (1)
Cannelton	0 (3)	1.67 \pm 1.09 (6)	3.5 \pm 1.5 (2)	2.0 \pm 1.76 (5)
Newberg	0.50 \pm 0.50 (2)	1.67 \pm 0.67 (3)	0.33 \pm 0.33 (3)	0 (1)
Myers	0 (2)	1.0 \pm 0.58 (4)	0.50 \pm 0.34 (6)	0.20 \pm 0.20 (5)
Smithland	0.50 \pm 0.50 (2)	20.33 \pm 10.65 (3)	0.67 \pm 0.67 (3)	0 (3)
Pool 53			0 (1)	

Table 3. Paddlefish stocking in the Ohio River Sub-basin, 1986-2000.

State	Year	Broodstock source	Location stocked	Number
New York	1998	Gavins Point	Allegheny River-Kinzua Reservoir	48
	1999	Ohio River	Allegheny River-Kinzua Reservoir	535
			Sub-total	583
Pennsylvania	1991	Gavins Point	Ohio/Allegheny Rivers	2,195
	1992	Gavins Point	Ohio/Allegheny Rivers	5,950
	1993	Gavins Point	Ohio/Allegheny Rivers	2,360
	1994	Gavins Point	Ohio/Allegheny Rivers	4,940
	1995	Gavins Point	Ohio/Allegheny Rivers	8,806
	1996	Gavins Point	Ohio/Allegheny Rivers	6,677
	1997	Gavins Point	Ohio/Allegheny Rivers	23,236
	1998	Gavins Point	Ohio/Allegheny Rivers	4,663
	1999	Gavins Point	Ohio/Allegheny Rivers	760
	2000	Gavins Point	Ohio/Allegheny Rivers	10,830
		Sub-total	70,417	
West Virginia	1992	Gavins Point	Kanahwa River	62
	1992	Gavins Point	Ohio River	81
	1993	Gavins Point	Kanahwa River	400
	1993	Gavins Point	Ohio River	6,094
	1994	Gavins Point	Ohio River	65
	1995	Gavins Point	Ohio River	1
	1996	Gavins Point	Kanahwa River	156
	1996	Gavins Point	Ohio River	1,459
	1997	Gavins Point	Kanawha	97
	1997	Gavins Point	Ohio River	1,300
	1998	Gavins Point	Kanahwa River	150
	1998	Gavins Point	Ohio River	1,365
	1999	Ohio River	Ohio River	7
2000	Ohio River	Ohio River	300	
		Sub-total	11,537	
Ohio	1992	Ohio River	Deer Creek Lake	81
	1993	Ohio River	Scioto River	26
			Sub-total	107

Table 3 (continued). Paddlefish stocking in the Ohio River Sub-basin, 1986-2000.

State	Year	Broodstock source	Location stocked	Number
Tennessee	1986	Edgar Farmer	Tennessee River-Cherokee Reservoir	10,709
	1987	Edgar Farmer	Tennessee River-Cherokee Reservoir	4,880
	1989		Cumberland River-Center Hill	1,600
	1990		Tennessee River-Cherokee Reservoir	3,523
	1990		Cumberland River-South Cross Creek	12
	1991		Tennessee River-Cherokee Reservoir	434
	1991		Cumberland River-Center Hill	250
	1992	Osage Catfish	Tennessee River-Cherokee Reservoir	3,035
	1992		Cumberland River-Old Hickory Reservoir	1,797
	1993		Cumberland River-Old Hickory Reservoir	1,000
	1993	Pvt John Allen NFH	Tennessee River-Cherokee Reservoir	5,255
	1993		Cumberland River-Center Hill	1,000
	1993		Tennessee River-Norris Reservoir	100,000
	1994	Carbon Hill	Tennessee River-Cherokee Reservoir	8,798
	1995		Cumberland River-Old Hickory Reservoir	2,931
	1995		Tennessee River-Cherokee Reservoir	2,934
	1997		Elk River	102
	1997	Pvt John Allen NFH	Big Elk Creek	3
	1997	Pvt John Allen NFH	Mississippi River	6,626
				Sub-total

In the northernmost portion of the Ohio River Sub-basin, paddlefish were among a group of highly migratory fishes present in the upper Allegheny River, New York before 1900. Paddlefish were overlooked in this region until Eaton et al. (1982) drew attention to early records at Olean and Salamanca, New York (Fowler 1907). Renewed interest in paddlefish and a loss of paddlefish in these habitats prompted the New York State Department of Environmental Conservation (NYSDEC) to initiate a program to re-establish paddlefish. The recovery plan was implemented in 1998 with experimental stocking of 46 fingerlings from the Gavins Point National Hatchery, South Dakota and the intent to stock 500 fingerling per year for the next five years. Five hundred and thirty-five fish were stocked in 1999 and 132 were stocked in 2000, all of which originated from McAlpine Pool, Ohio River broodstock (Table 3). Stocking at the mouth of Onoville Bay (Kinzua Reservoir) was in multi-jurisdictional waters and had the approval of Seneca Nation of Indians (SNI), Pennsylvania Fish and Boat Commission (PFBC), and United States Army Corps of Engineers (USACE).

Evaluation efforts by NYSDEC have not been planned for New York waters, which are upstream of Kinzua Reservoir, because sampling would be most successful in the reservoir but it is managed under the multi-jurisdictional authority of the PFBC, SNI, and USACE. Angler reports of incidentally caught paddlefish or sightings may be used to indicate stocking success. During 2000, one fish was incidentally caught by an angler below the tailrace near Warren, Pennsylvania (reported to Bill Martin, Pennsylvania Waterways Conservation Officer) and another floated ashore near Quaker Run of the upper reservoir, both of which were of sizes presumed to be from the 1998 stocking.

Similar to New York, paddlefish were native to Pennsylvania waters but became so rare that they were considered extirpated, and are now the focus of a restoration program. Restoration of paddlefish in Pennsylvania began in 1991 in response to improvements in Ohio River water quality during the past 30 years that aided recovery of native white bass (*Morone chrysops*), freshwater drum (*Aplodinotus grunniens*), smallmouth buffalo (*Ictiobus bubalus*), mooneye (*Hiodon tergisus*) and sand shiner (*Notropis stramineus*). A 64 km (40-mile) reach of the upper Ohio and lower Allegheny rivers were chosen for restoration stocking to reintroduce paddlefish to their historical range and develop a self-sustaining population. The PFBC believes that habitat in the Allegheny River will support a self-sustaining

population and has stocked 73,000 fish during the past 10 years (Table 3). Since 1995, these fish have been implanted with coded wire tags and stocking has been evaluated by sampling with gillnets. No fish have been sampled to date, but anglers have incidentally captured increasingly larger paddlefish since 1990 when stocking began, including a 10 kg fish (23 lbs) last year. Prior to 1990, the closest capture of a paddlefish was 480 km (300 miles) downstream.

Paddlefish were endemic to the West Virginia reach of the Ohio River and several large tributary rivers, but were considered extirpated since the early 1900s. Poor water quality, navigational structures, and over overexploitation were considered the primary factors leading to the decline of paddlefish and other large river species. Since the mid-1980s, the West Virginia Division of Natural Resources has implemented several measures to restore paddlefish. Commercial fishing was halted in 1989 on all species, including paddlefish, after concerns of overexploitation and contaminants were expressed. Paddlefish were reintroduced in 1992 and have been reported from the R.C. Byrd, Belleville, and Hannibal tailwaters on the Ohio River. Annual stocking is planned through 2005.

The goal of the WVDNR paddlefish program is to restore the population to provide a recreational fishery. Stocking, strict no harvest regulations, biological assessment, and habitat restoration are the program cornerstones. Paddlefish reared at the Palestine Hatchery since 1992 have been stocked in the Ohio and Kanawha rivers. Eggs were initially acquired from the Missouri River, South Dakota (The National Hatchery at Gavins Point Dam, SD), but since 1999 broodstock have been collected from the R.C. Byrd Tailwater, Ohio River (Table 3). All hatchery-reared paddlefish have been implanted in the rostrum with coded wire tags.

The WVDNR began assessment of Ohio River paddlefish and their habitat in 2000. The study will help evaluate the stocking program and indicate size structure, population structure, and movement patterns. It will also include targeted paddlefish collections throughout the Ohio River, tagging of all adult paddlefish encountered, and an evaluation of fatty acid composition as a measurement of population similarity. Additional studies will be conducted through a navigational cumulative impact assessment on the Ohio River. Habitat restoration and the mitigation of navigational activities will be addressed through the USACE Ohio River Ecosystem Restoration Program, as well as the Kanawha

River Mitigation Program. Efforts will be made to enhance instream paddlefish habitat and to mitigate for loss of habitat attributed to navigational activities.

In Ohio, paddlefish were once common in large Ohio River tributaries and portions of the mainstem. Abundance of paddlefish conspicuously declined during 1925-1950 following significant river and tributary impoundment circa 1915. Trautman (1981) noted that during the post-impoundment period paddlefish were more common west of Portsmouth, Ohio near the confluence of the Scioto and Ohio rivers, and this appears to remain true today.

Paddlefish were listed as an Ohio endangered species in 1974 under Section 1531.25 of Ohio Revised Code. This statute was the initial species protection act in Ohio. An Ohio endangered species is, "A native species or subspecies threatened with extirpation from the state. The danger may result from one or more causes, such as habitat loss, pollution, predation, inter-specific competition, or disease." Paddlefish were downlisted to threatened status in 1987 under the same statute as information about their distribution increased. An Ohio threatened species is, "A species or subspecies whose survival in Ohio is not in immediate jeopardy, but to which a threat exists. Continued or increased stress will result in its becoming endangered." Paddlefish remain listed as a state threatened species in Ohio (ODNR, DOW 1999).

Within Kentucky, paddlefish are native to the Mississippi, Ohio, Tennessee, Cumberland, Green, Salt, Kentucky, and Licking rivers, and Bayou du Chien (Burr and Warren 1986). Paddlefish were once considered a species of special concern among a list of state endangered, threatened, or rare fishes (Branson et al. 1981), but this listing has been considered unnecessary for over 15 years because paddlefish are more common than previously believed. Currently, paddlefish are designated as a rough fish in Kentucky under statute 301 KAR 1:060, and they are harvested by sport and commercial fishers.

Paddlefish were historically common to abundant in the larger Indiana rivers in the Wabash River drainage and bayous and oxbow lakes associated with the Ohio River. Most large Ohio River tributaries in Indiana historically contained paddlefish. Paddlefish also were found in some natural glacial lakes such as Lake Tippecanoe, located in the most upstream portion of the Wabash River drainage (Gerking 1945). Paddlefish were likely found in the Indiana portion of the upper Mississippi River Sub-basin at one

time because they currently exist in the Illinois River, Illinois; however, upstream movement of paddlefish into the Kankakee River, Indiana is blocked by dams on the Illinois River and prevents repopulation. Historical records of paddlefish do not indicate that they were ever found in the Indiana portion of the Lake Erie or Lake Michigan watersheds. Gerking (1945) first reported that paddlefish populations were declining during the 1940s, but also indicated that paddlefish were still abundant in some locations based on conversations with commercial fishers. Decreased abundance was attributed to excessive harvest with dynamite and large seines, poor water quality, and habitat degradation; and particularly dam construction, drainage of backwater lakes, and channelization. Little was known about paddlefish in Indiana until the INDNR began to participate in inter-jurisdictional paddlefish research during 1995. Prior to 1995, INDNR personnel occasionally collected paddlefish at various locations throughout the state and abundance was thought to be common to rare, and declining.

Paddlefish were commercially harvested throughout Indiana prior to creation of the Indiana Fish Commission. The Commission, later renamed the Indian Department of Natural Resources (INDNR), prohibited commercial paddlefish harvest prior to 1985. Sport fishing regulations prohibited anglers from harvesting paddlefish by snagging or foul-hooking, however, most sport-caught paddlefish were captured in this manner. Therefore, regulations that prohibited illegal capture were difficult for conservation officers to enforce. A November 1985 United States Supreme Court settlement between the State of Indiana and Commonwealth of Kentucky granted Indiana control over a portion of the Ohio River. Following this settlement, the INDNR aligned Ohio River regulations in Indiana with those of Kentucky to create a commercial and sport classification for paddlefish in the Ohio River.

Paddlefish have been harvested in Illinois for over 100 years. Commercial harvest is primarily for roe that is processed and sold as high-grade caviar. In 1899, the Illinois harvest was 88,609 kg (195,174 lbs), but 100 years later in 1999, it had declined to 29,502 kg (64,983 lbs). Commercial harvest is now only permitted in the Ohio River and portions of the Illinois and Mississippi Rivers. Paddlefish are both a sport and commercial species in Illinois.

Overview: Sport Fisheries

Paddlefish can be harvested in Kentucky and Indiana by sportfishers snagging with rod and reel or setting trotlines. Snagging fisheries typically operate below the major tailwaters of dams on the lower Ohio, Tennessee, and Cumberland rivers. Sport trotlines are those with 50 hooks or less and paddlefish caught with this gear are generally incidental.

Snagging for paddlefish has been popular in Kentucky since the 1940s. The first major fishery using this method was below Kentucky Lake Dam on the Tennessee River. This fishery still exists and is open year round. Several additional snagging fisheries have developed on the Ohio River. These fisheries are regulated by a season that opens on February 1 and closes on May 10. Anglers are restricted to snagging only from the bank and cannot snag from a boat or platform. Fish may be taken by snagging using a single hook or a treble hook. Paddlefish snagging is permitted statewide during all hours, except where specifically prohibited by administrative regulation. However, snagging is prohibited within 180 m (600 ft) of any dam and paddlefish snagged within this area, except in the Kentucky Dam Tailwater, must be released. The KDFWR enforces a 15 paddlefish creel limit at the Kentucky Dam Tailwater, but has no creel limit for paddlefish snagged elsewhere.

Indiana began regulation of an Ohio River sport paddlefish fishery in 1988. Initially, snagging for paddlefish was restricted to February 1 through May 10, but the number of fish harvested was not restricted. During this time, anglers were limited to snagging from shore with a single hook or a treble hook. Snagging from a boat, platform, or along a bay or tributary to the Ohio River was prohibited. Despite these regulations, INDNR concern grew for paddlefish because poaching and other illegal activity were being reported, particularly in the Indiana portion of the Ohio River. Most non-Ohio River violations involved snagging paddlefish in protected areas, whereas most Ohio River incidents involved egg sales from sport-snagged paddlefish.

Rampant illegal and questionable fishery activity related to paddlefish taking in Indiana resulted in emergency rule changes effective March 1998 that later became regulations. These regulations were developed under the belief that current levels of legally caught sport and commercial paddlefish would be

sustainable if illegal harvest was curbed and if “no harvest” or “sanctuary” areas were delineated. Of the six regulation changes, the following five pertained to sport fisheries:

1) Prohibit the take of paddlefish from all waters of Indiana except for the Ohio River.

This regulation change eliminated any confusion over whether a paddlefish was snagged or legally caught on a baited hook. It also designated most of the state as a paddlefish sanctuary.

2) Establish a two-paddlefish bag limit and four paddlefish possession limit from the

Ohio River. Biologists wanted to maintain a sport paddlefish harvest but could only do this by eliminating the means for sport harvest to provide illegal economic gain. An unlimited bag limit for a large fish with premium dollar value like paddlefish encouraged the illegal sale of sport-caught fish. The reduced bag limit is easily enforced and provides a reasonable amount of food for anglers who choose to eat their catch.

3) Require that the first two paddlefish taken by an Ohio River angler must be kept (there is no sorting or release of sport caught paddlefish).

This regulation change was intended to reduce the illegal sale of sport-caught fish by preventing sorting for large, egg-bearing females. Restricting harvest to the first two fish snagged reduces the opportunity to use snagging for commercial gain.

4) Require that an angler must stop snagging for the day after two paddlefish are

harvested. This was an attempt to eliminate a loophole whereby a sport fisher could say that they were snagging for other species after they caught their two paddlefish limit, even though they intended to cull for large female paddlefish.

5) Prohibit snagging within 183 m (600 ft) of a dam on the Ohio River.

This regulation change aligned Indiana and Kentucky regulations and provided paddlefish with a sanctuary from snagging within the Ohio River.

Overview: Commercial Fisheries

Commercial fishing for paddlefish has a strong tradition among lower Ohio River fishers and is presently permitted in Kentucky, Indiana, and Illinois. Commercial fishers licensed by these states have been required to report harvest of paddlefish flesh and eggs on a monthly basis since 1999 through a mandatory catch reporting system.

Commercial fishing in West Virginia has been prohibited since 1989 on all species, including paddlefish. Prior to this time, limited commercial fisheries for catfish operated primarily on the Ohio River.

The Ohio Department of Natural Resources (ODNR) has never licensed commercial fishing in the Ohio River. State of Ohio Statute 1533.54 prohibited citizens from commercial fishing outside of specific inland fishing districts in Ohio waters. However, Ohio residents were permitted to store commercial gear under specified conditions to accommodate fishers licensed as non-residents by Kentucky. The statute allowed Ohio residents that fished the Ohio River to possess nets for the sole purpose of storage, repair, drying, and tarring in specified southern portions of the state with the purchase of a US\$10 permit for each net (Appendix E).

Commercial fisheries have operated in Kentucky since the early 1800s. Beginning in the early 1920s, fishers were required to tag their gear by the Kentucky Division of Game and Fish (presently the Kentucky Department of Fish and Wildlife Resources (KDFWR)). Under Kentucky Revised Statute 150.025, the KDFWR regulated commercial fishers on the Ohio River and its tributaries by restricting gear types and the areas where gear could be fished. Fishery biologists began to assess the annual weight of the catch from the fishery in 1950 when only bait lines (baited trotlines), snag lines (unbaited trotlines), hoop and wing nets, and haul seines were legal gear (Tompkins et al. 1951). During 1950, 1,460 licensed fishers reported a total catch (all species) of 675,000 kg (1,500,000 lbs). Additional commercial fishery assessments were conducted in 1958 and 1959 (Carter 1959). Fishers noted that 1958 was a poor fishing year and 1,100 resident fishers reported a catch of 810,000 kg (1,800,000 lbs), of which 211,430 kg (469,845 lbs) were harvested from the Ohio River. The 1958 paddlefish harvest from the Ohio River was 3,394 kg (7,543 lbs). In 1959, 38% of the 2,583 licensed fishers worked the Ohio River and caught 675,000 kg (1,500,000 lbs) of fish, including 24,524 kg (54,498 lbs) of paddlefish. Gill and

trammel nets became legal commercial gear in the early 1960s. Renaker and Carter (1968) surveyed fishers in 1965 (3,015 licensed) and 1966 (3,116 licensed) about their harvest from the Ohio River and reported paddlefish catches of 5,804 kg (12,897 lbs) in 1965 and 869 kg (1,932 lbs) in 1966.

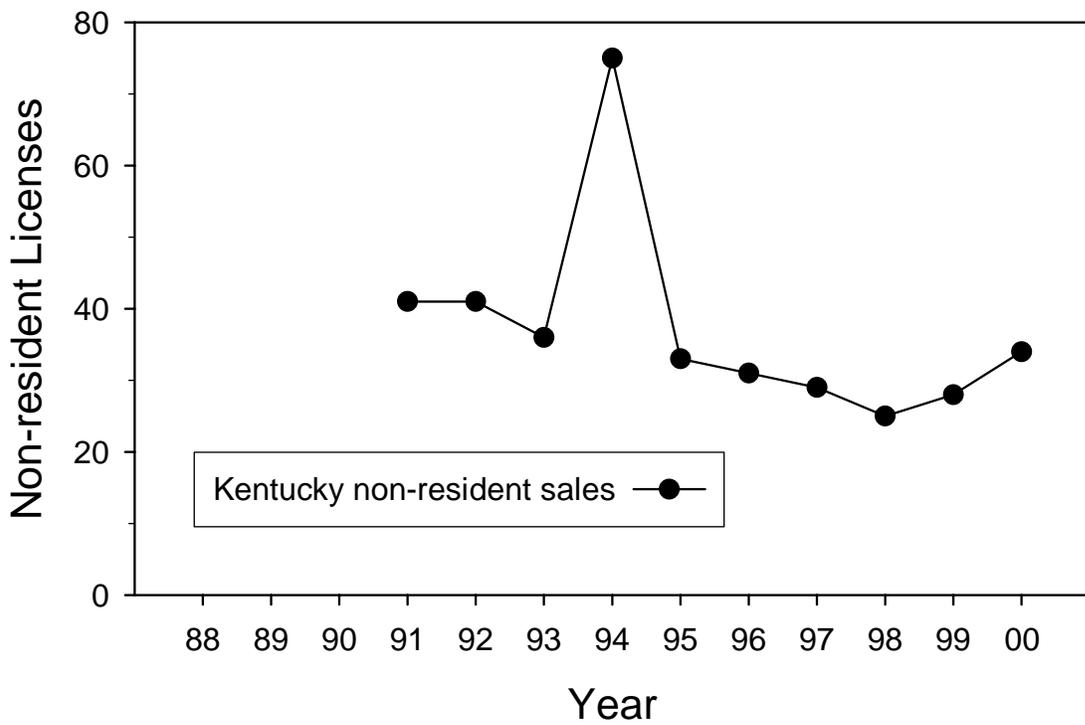
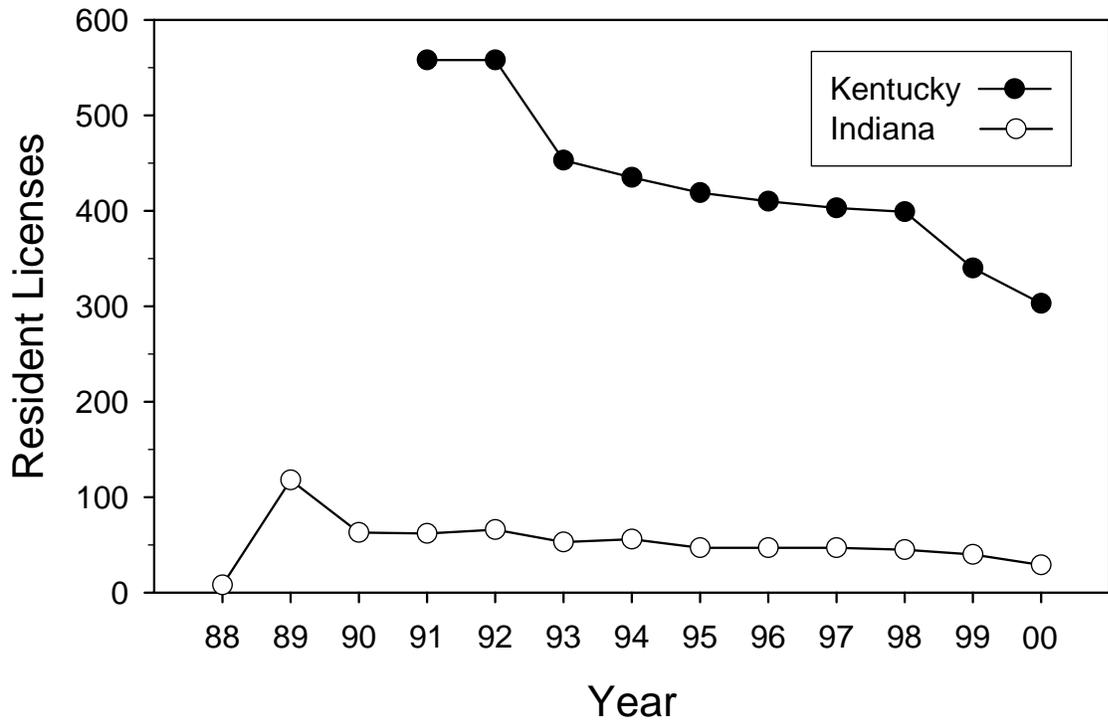
Commercial harvest was not monitored again until 1999 when 301 KAR 1:155 Section 6 required commercial fishers to report their catches from Kentucky waters. Current commercial fishery regulations are provided in Appendix F.

Indiana began selling Ohio River commercial fishing licenses to residents in 1988, but does not sell commercial fishing licenses to non-residents. Licensed Indiana commercial fishers may harvest an unlimited number of paddlefish with hoop nets, wing nets, straight-lead nets, heart-lead nets, gill nets, trammel nets, trotlines, seines, and slat traps. Commercial fishing is limited to the Ohio River mainstem and prohibited in embayments, backwaters, or tributary streams. In addition, commercial gear cannot be used within 45 m (150 ft) of the mouth of a stream and no gear except for slat traps may be used upstream of the outer lock wall of a dam. Baited hoop nets and slat traps may not be left unattended for more than 72 h. All other gear types must be tended not less frequently than once every 24 h (Appendix G).

The Illinois portion of the Ohio River was fully opened to commercial fishing in 1995 by an agreement between the KDFWR and ILDNR. Ohio River commercial fishers must keep daily records and report their harvest monthly. Paddlefish may be harvested from the Illinois portion of the Ohio River by hoop nets, trotlines, seines, and trammel or gill nets (102-mm (4-inch) bar mesh) as specified by the ILDNR (Appendix H).

Sales of commercial fishing licenses have declined in Kentucky and Indiana during the past decade (Figure 2). Resident license sales in Kentucky declined from 558 in 1991 to 303 in 2000, whereas Indiana sales declined from 118 in 1989 to 29 in 2000. Non-resident licenses sold by Kentucky have ranged from 25-75 during the past decade. Commercial license sales may have declined because of: 1) lack of recruitment of new participants; 2) fish consumption advisories; 3) competition from aquaculture products; 4) competition with the job market; and, 5) the increased difficulty in making a living

Figure 2. Annual sales of resident commercial fishing licences in Indiana (legalized in 1988) and Kentucky (data available since 1991) and non-resident licenses in Kentucky, 1988-2000, Ohio River Sub-basin.



as a commercial fisher. Prices of annual commercial fishing licenses vary by state. Kentucky charges residents US\$125 for a license with a block of ten gear tags and an additional US\$15 for each block of 10 gear tags, and non-residents US\$600 for a license with a block of 10 year tags and US\$90 for each additional block of gear tags. Indiana charges US\$72 for a resident commercial license and does not sell non-resident licenses. Illinois charges residents US\$35 for a commercial license and an additional US\$18.50 for each 100 m of net, and charges non-residents US\$150 for a commercial license and US\$36.50 for each 100 m of net.

Indiana currently has five to seven crews that target paddlefish during the October to May egg harvest season. Each crew consists of two to four licensed commercial fishers that operate one or two boats. Approximately 10 to 20 (25 to 69%) of Indiana licensees target paddlefish, but less than half of them fish for alternative species such as buffalo or catfish during the remainder of the year.

Methods

Primary and secondary data pertaining to the Ohio River Sub-basin were collected and compiled to provide a contemporary assessment of paddlefish. Primary sources of data included state stocking records, sport and commercial harvest records, and sampling data collected by state agencies. Most field data were the result of participation of six Ohio River Sub-basin states in the MICRA Paddlefish and Sturgeon Sub-committee and the paddlefish research developed by the Sub-committee. Contaminant data were provided through secondary sources as referenced.

Paddlefish were collected and marked according to protocols developed by the MICRA Paddlefish and Sturgeon Sub-committee. These procedures, which describe methods for tagging both hatchery and wild paddlefish, were provided in the 1995 MICRA Interim Report (Oven and Fiss 1996). Recaptures were obtained by biologist during sampling and voluntarily by sport and commercial fishers that harvested paddlefish. Fishers were offered an incentive to return paddlefish rostrums, the area of the paddlefish tagged, through a reward program that offered a hat and a raffle ticket for a prize drawing for each rostrum returned. Rostrums sent to biologist were scanned to test for the presence of a tag. Data were submitted to a central processing center and later returned to project biologists in a master database.

Biologists within the Ohio River Sub-basin collected paddlefish with electrofishing and entanglement gear, and obtained additional information from participants in the sport snag fishery. Entanglement gear was predominately 102-mm (4-inch) or 127-mm (5-inch) mesh square measure, although mesh ranged from 76 mm (3 inch) to 152 mm (6 inch). Gear and methods of capture were not standardized; therefore, catch-per-effort (CPE) was calculated in a simplified way to provide a coarse estimate of abundance. Estimates of CPE were reported as the number of fish captured per meter of 127-mm (5-inch) mesh entanglement gear herein, similar to the method required of commercial fishers in Kentucky. Additional paddlefish data were obtained from commercial fishers using entanglement gear or sport fishers that snagged paddlefish with rod and reel. Data were analyzed for each of the following locations: 1) entire Ohio River Sub-basin; 2) Ohio River (without Hovey Lake); 3) Wabash River; 4) Hovey Lake (a backwater area of the Ohio River within Myers Pool); and, 5) Cumberland River.

All paddlefish were measured to the nearest 1-mm eye-fork length and weighed to the nearest 0.1 kg. Mean length at capture was reported for each major location during 1995-1999 for fish captured with 102-mm (4-inch) mesh entanglement gear, 127-mm (5-inch) mesh entanglement gear, and electrofishing, and from only 127-mm (5-inch) mesh gillnets in the Ohio River during 2000 and 2001. Relative weight (W_r) was calculated for five length categories of paddlefish <600 mm (24 in), 600-799 mm (24-31 in), 800-999 mm (31-39 in), >999 mm (39 in), and all lengths combined using equations proposed by Brown and Murphy (1993). Mean relative weights among the four major areas were compared with analysis of variance and Tukey's Honest Significant Difference tests to control for Type I error rate (Dowdy and Wearden 1991) at $\alpha=0.05$. Standard and \log_{10} transformed length-weight equations were also developed.

Paddlefish sampled by biologists or stocked in the Ohio River were tagged with coded wire tags following the MICRA protocol. The rostrums of fish captured by biologist were scanned with a wand detector to determine the presence of a coded wire tag (CWT). If a tag was detected, it was removed and replaced with a new tag. If a tag was not present, then a CWT was injected in the rostrum. Once a first-caught or recaptured fish was tagged, it was released near the capture site. Additional fish were sought to test for the presence of tags through commercial and sport fishers. Fishers were encouraged to return all paddlefish rostrums from harvested fish via a reward system. Because CWT were not externally visible, all rostrums were scanned and tags were removed when detected. Paddlefish stocked in the Ohio River Sub-basin during 1995-1999 were tagged with batch coded wire tags. Tagging results were used to estimate gross movement of paddlefish within the Mississippi River Basin and the Ohio River Sub-basin.

The KDFWR and ODNR collected additional data during 1990-2001. Sport fishery information was collected at the Markland Tailwater, where dentary bones used to determine age were sampled from the May 1996 catch and a creel survey was conducted during November 2000 through April 2001. Dentary bones were also collected from random samples of the commercial catch in the McAlpine and Cannelton tailwaters during spring 1996. Dentary bones were removed from paddlefish captured by both biologists and fishers. When possible, the sex and the presence of eggs was determined and fish were

measured and weighed according to procedures previously described. Dentaries were sectioned and the age of each fish was determined by counting annuli with procedures described by Scarnecchia et al. (1996). Age determinations from the sport and commercial fisheries provided insight into the growth of paddlefish and age structure of the catch from each fishery. Paddlefish also were collected from the Greenup, Meldahl, McAlpine and Myers tailwaters during 1990, 1991, 1998, and 1999 for contaminant surveys of the flesh and gonads.

Age data from the sport fishery were used to estimate the age structure of paddlefish sampled by biologists and to estimate total annual mortality of Ohio River paddlefish. A regression of age on length from the sport catch for both sexes of paddlefish combined was developed to estimate the age of each fish sampled by biologists with 127-mm (5-inch) mesh entanglement gear. Age-frequency results were used to develop catch curves based on the regression of the natural logarithm of frequency on age between ages 10-14. Slope of the regression provided an estimate of instantaneous mortality (Z), survival (S) was estimated from $S=e^{-Zt}$, and total annual mortality (A) was estimated from $A= 1-S$, expressed as a percentage (Ricker 1975).

Results and Discussion

Sport Fisheries

The 1996 sample of the sport fishery harvest from the Markland Tailwaters, Ohio River provided a preliminary description of the snagging-fishery catch. The sample was comprised of 29 female and 28 male paddlefish, of which 5 females contained eggs. Mean length of the catch was 776 ± 9 mm (31 in) and mean length at age differed little among males and females (Table 4). Most females were in the 80 and 85-cm (31-33 in) length classes and most males were in the 70 and 75-cm (28-30 in) length classes (Figure 3). Ages ranged from 5 to 13 years and ages 8-11 were most common (Figure 4). The equation $AGE = 0.0178(\text{LENGTH}) - 4.085$ ($R^2 = 0.65$, $P < 0.0001$, $F = 99.99$, $N = 57$), where LENGTH = eye-fork length (mm) and AGE = age in years provided estimates of ages for known-length fish.

Indiana has a substantial sport paddlefish snagging fishery below Markland Dam at which 504 paddlefish were harvested in 1997. In addition, a few paddlefish are sport harvested annually from the Falls of the Ohio fossil bed area below McApline Dam.

The 2000-2001 Markland Tailwater creel surveys quantified the importance of the sport paddlefish fishery. Paddlefish anglers made 246 trips, or 16% of all angler trips even though the paddlefish season was only open during three of the six creel-survey months. By comparison, 50% of all trips were made anglers seeking *Stizostedion* spp. and those seeking *Morone* spp made 19% of all trips. Paddlefish anglers harvested 323 fish with a mean length of 772 mm, and a length range of 590 to 900 mm. Peak harvest was during March (53%), followed by February (31%), and April (16%).

Table 4. Mean length-at-age (mm) of paddlefish sampled from the sport snagging fishery Markland Tailwater, Ohio River, 1996.

Age	Length (mm) \pm SE					
	Female	N	Male	N	Combined	N
5	579	1			579	1
7	674 \pm 25	2	699	1	682 \pm 17	3
8	672 \pm 17	2	707 \pm 9	5	697 \pm 10	7
9	748 \pm 4	2	738 \pm 4	8	740 \pm 4	10
10	821 \pm 11	9	778 \pm 10	7	802 \pm 9	16
11	792 \pm 16	10	792 \pm 16	5	820 \pm 13	15
12	835 \pm 55	2	838 \pm 66	2	836 \pm 35	4
13	831	1			831	1

Figure 3. Length-frequency distributions of a sub-sample sport-snagged paddlefish, Markland Tailwater, Ohio River, May 1996.

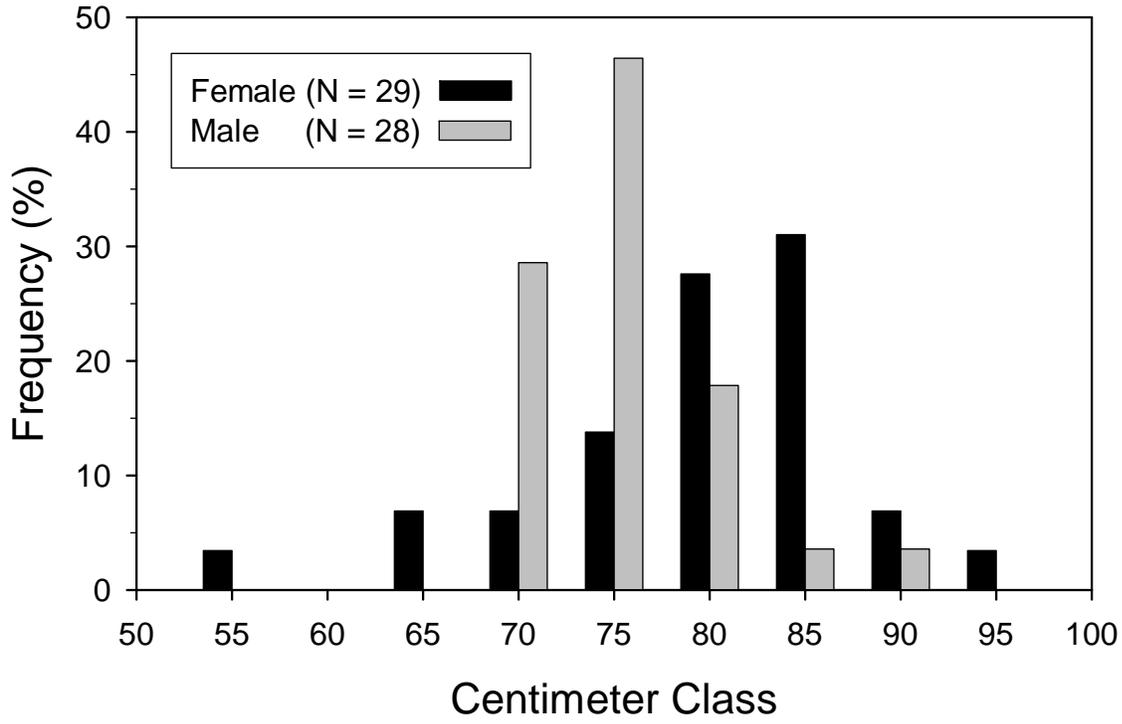
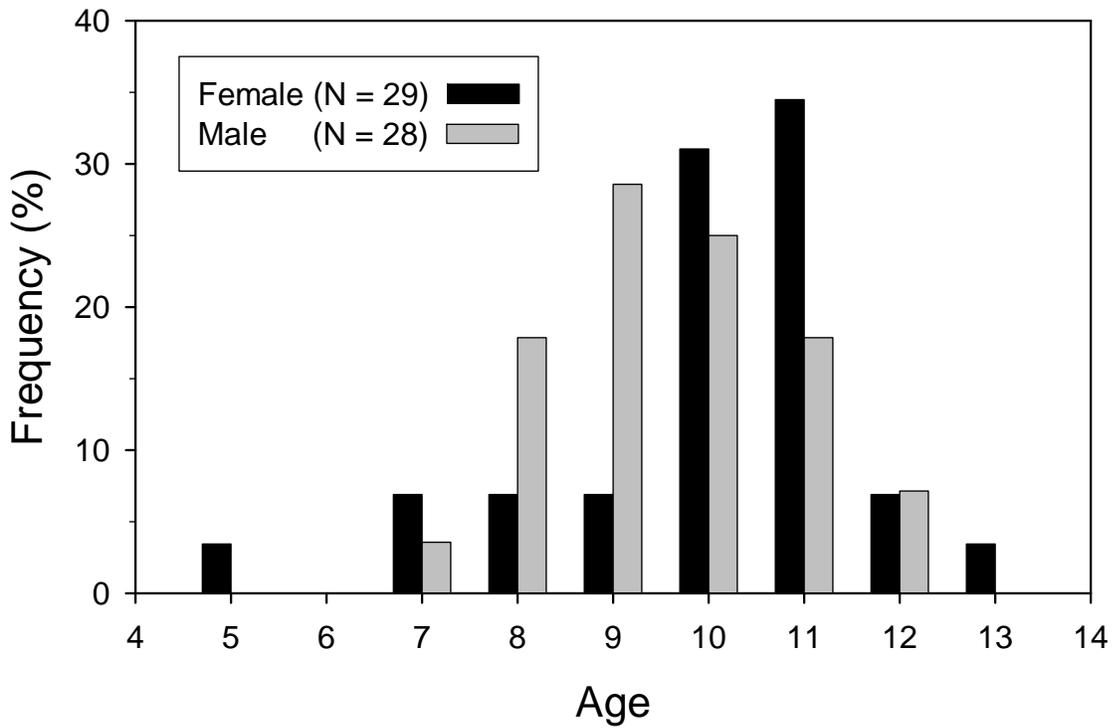


Figure 4. Age-frequency distributions of a sub-sample of sport-snagged paddlefish, Markland Tailwater, Ohio River, May 1996.



Commercial Fisheries

Commercial fishers in Kentucky, Indiana, and Illinois have been required to report harvest of paddlefish flesh and eggs since 1999. Prior to 1999, only fishers in Illinois reported harvest. However, Illinois fishers reported no egg harvest during any year of reporting, which suggested problems with their reporting or recording procedures because fishers are unlikely to discard paddlefish eggs. Licensed Kentucky commercial fishers, both residents and non-residents, accounted for 89% of the flesh and 80% of the eggs reported in the 1999 catch, and 90% of the flesh and 72% of the eggs reported in the 2000 catch. Some fishers licensed by Kentucky were residents of Indiana and Illinois (Table 5).

Total combined commercial harvest of flesh and eggs (Kentucky, Indiana, and Illinois) was greater during 2000 than 1999. Flesh harvest increased from 63,827 kg (140,419 lbs) in 1999 to 159,109 kg (350,040 lbs) in 2000, and egg harvest increased from 2,733 kg (6,013 lbs) 1999 to 10,071 kg (22,156 lbs) in 2000. Indiana data from 1999 and 2000, which provided the only estimate of the number of fish harvested in addition to the weight of the harvest, suggested that the mean size at harvest was 5.45 kg (12.11 lbs), or 710 mm (28 in), and mean age at harvest was 8.5 years. Based on this estimate, approximately 11,711 paddlefish were harvested in 1999 and 29,194 paddlefish were harvested in 2000. One Indiana crew of two fishers licensed through Kentucky reported a harvest 15,707 kg (34,904 lbs) of flesh and 2,812 kg (6,248 lbs) of eggs during 2000, which represented 28% of the egg harvest during that year.

Table 5. Annual harvest (January-December) of paddlefish flesh and eggs reported by commercial fishers, Ohio River Sub-basin, 1995-2000.

Year	<u>Kentucky (kg)</u>		<u>Indiana (kg)</u>		<u>Illinois (kg)</u>		<u>Total (kg)</u>	
	Flesh	Eggs	Flesh	Eggs	Flesh	Eggs	Flesh	Eggs
1999	56,535	2,177	6,168	556	1,124	0	63,827	2,733
2000	143,175	7,255	14,113	2,816	1,821	0	159,109	10,071

*Kentucky records include harvest from the Ohio River, Kentucky Lake, and Lake Barkley.

The elevated harvest during 2000 was a reflection of increased effort and river conditions that were more conducive to harvest compared to the previous year. Ohio River fishers licensed by the KDFWR harvested approximately 0.03 fish/m in 313,323 m (1,044,411 ft) of gillnets during 1999 and 0.06 fish/m in 419,750 m (1,399,167 ft) of gillnets during 2000. The Ohio River mainstem represented 38% (1999) and 37% (2000) of the reported fishing effort in the Ohio River Sub-basin (excluding Tennessee), but provided the majority of flesh harvest in 1999 (84%) and 2000 (91%), as well as nearly all of the egg harvest. Catch rates of fishers in the Ohio River mainstem (0.03 fish/m of net) were also considerably greater than those in Kentucky Lake and Lake Barkley, which were less than 0.005 fish/m during both years in each reservoir. Lower catch rates in these reservoirs may have been a result of fishers targeting other species such as buffalo fishes *Ictiobus spp.* rather than paddlefish.

The paddlefish fishery in the Ohio River Sub-basin is a unique artisanal fishery because economic value of the fishery is derived primarily from paddlefish eggs as a source of caviar, rather than the value of paddlefish flesh. The flesh harvest was valued at US\$69,616 in 1999 and US\$175,020 in 2000 based on a current price of US\$1.10/kg (US\$0.50 per lb) paid to commercial fishers for whole fish. Retail price varies significantly depending upon processing and the market. For example, smoked paddlefish may sell for three to four times that of raw paddlefish fillets or steaks.

The estimated wholesale value of the total egg harvest ranged from US\$273,300- US\$546,600 in 1999 and US\$1,007,100-US\$2,014,200 in 2000 based on a historical price range of US\$100-200 per kg (US\$45-91 per lb) paid to fishers. Current retail price of paddlefish caviar (smallest quantity of order) is approximately US\$423/kg (US\$192/lb) (www.aristoff-cavair.com/price.htm; www.caviarstar.com/paddlefish.htm; www.northstarcaviar.com/northstar/orderform.htm), which suggested that the market value of the reported harvest from the Ohio River was US\$1.2 million in 1999 and US\$4.3 million in 2000.

Monthly harvest records from Kentucky and Indiana indicated that March-April were the period of greatest harvest, although significant harvest also occurred during October, November, and December (Figure 5). In 2000, a much greater percentage of flesh (45%) and eggs (67%) were taken during March - April than in the fall and winter months compared to 1999.

Paddlefish generally recruited to the fishery as they began to reach sexual maturity. A minimum of nine age groups was represented in the age structure estimated from a random sample of 76 commercially-caught fish from the McAlpine and Cannelton tailwaters. Full recruitment to the fishery likely occurs between ages 8 and 9 (Figure 6), but no lengths were associated with these data to provide additional details.

Figure 5. Monthly harvest of paddlefish eggs and flesh by commercial fishers in Kentucky and Indiana, 1999 and 2000, Ohio River Sub-basin.

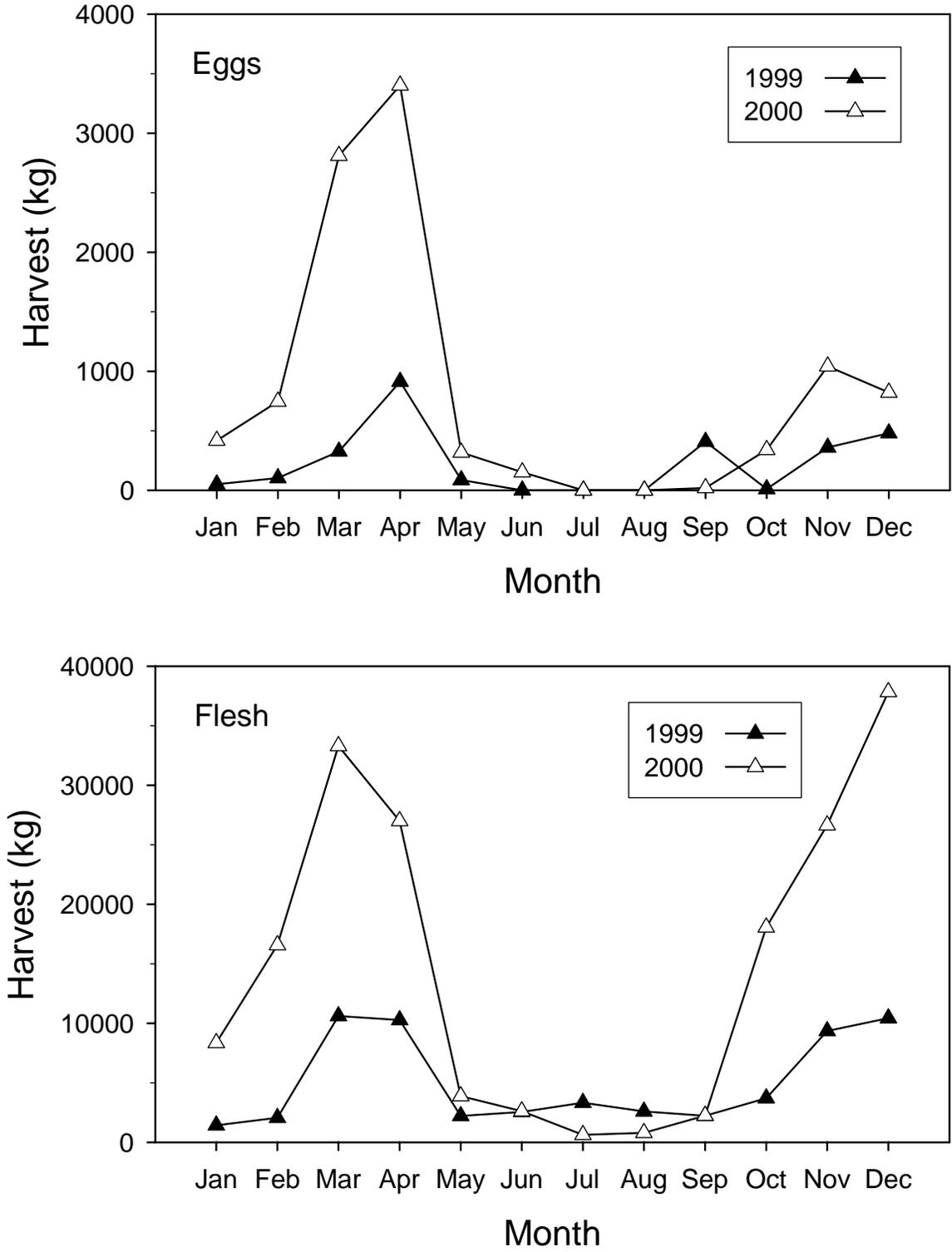
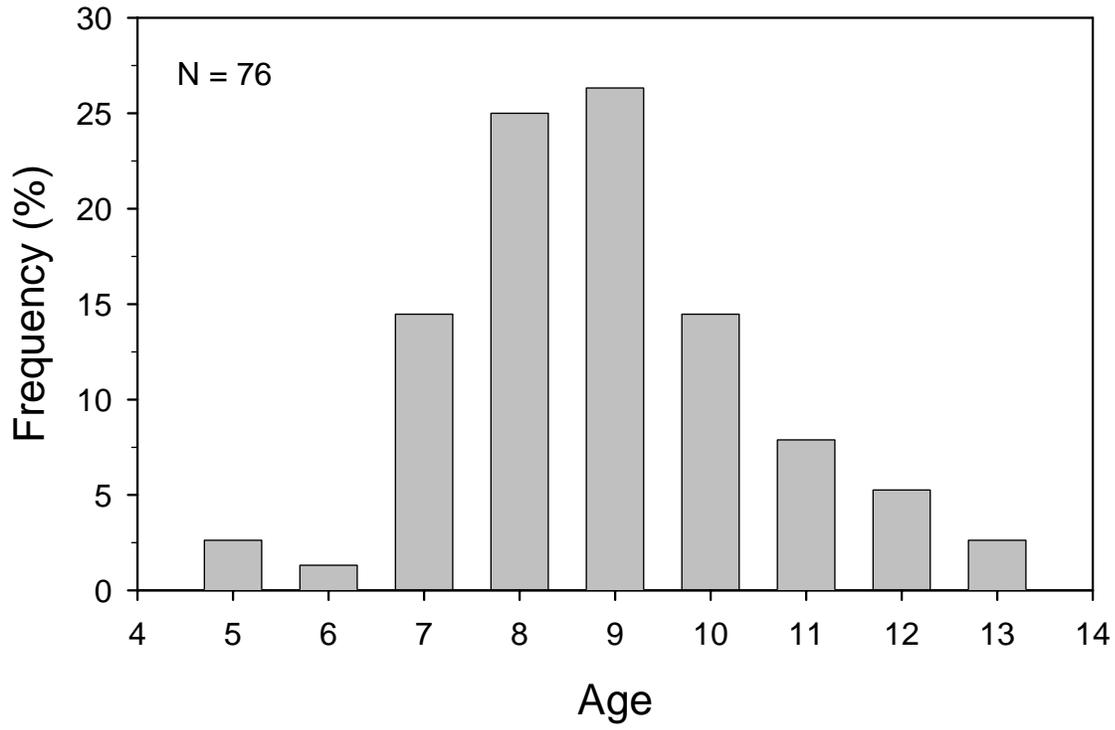


Figure 6. Age-frequency distribution of a random sample of commercially harvested paddlefish from the McAlpine and Cannelton tailwaters, Ohio River, 1996.



Field Sampling

Biologists in the Ohio River Sub-basin tagged 4,191 wild paddlefish with CWT during 1995-1999. Forty percent of these fish were tagged in pools of the Ohio River, 27% were tagged in Hovey Lake, 24% were tagged in the Wabash River, and 7% were tagged in the Cumberland River. Overall recapture rate during the five-year period was 5%, and was greatest in Hovey Lake (8%), followed by the Wabash River (7%), the Cumberland River (6%), and the Ohio River (3%). The majority of recovered paddlefish were captured within two years of the initial tagging. Twenty percent of these fish were recaptured one year after tagging, 44% were recaptured two years after tagging, and 23% were captured three years after tagging.

All CWT recaptures were initially captured and tagged in the Ohio River Sub-basin and no CWT-tagged Ohio River Sub-basin paddlefish have been reported from either the Mississippi River or the Missouri River systems. However, a few paddlefish tagged in other studies were recently reported to have moved great distances and traveled to and from the Ohio River Sub-basin. On July 17, 2001, a Kentucky angler captured a paddlefish in the Lake Barkley Tailwater that had been jaw-tagged in Lake Francis Case, South Dakota (Missouri River) in 1995. This fish passed through the dam of Lake Francis Case and the dam at Lewis and Clark Lake (Gavins Point, South Dakota) before reaching the Missouri River. Inter-basin movement was also documented by Timmons and Hughbanks (2000), who reported recaptures of paddlefish they tagged in the Kentucky Dam Tailwater in the Missouri River, near Jefferson City, Missouri (649 km (295 miles)) and another in the St. Francis River, Arkansas (584 km (265 miles)). One paddlefish they tagged in a Cumberland River sub-impoundment was also recaptured in the Osage River, Missouri, 902 km (410 miles) from the original tagging site.

Among paddlefish tagged by ORFMT states, wild paddlefish accounted for 192 of 197 CWT tag returns, and five recaptured hatchery fish were collected by biologists in West Virginia (Table 6). Seventy percent of recaptures were made by biologists sampling for the MICRA project and 30% were from rostrums turned in by commercial fishers. The greatest percentage of wild recaptures (41%) were collected during 1999 when the most tagged fish were at large, but 38% of all recaptures were from fish tagged during 1996 (Table 7). All recaptured hatchery-reared fish were originally stocked by WVDNR

Table 6. Recapture by state of wild tagged and hatchery tagged (stocked) paddlefish implanted with coded wire tags, Ohio River Sub-basin, 1995-1999.

State	Wild tagged		Hatchery tagged		Recapture source		
	Number	Percent	Number	Percent	Biologist	Commercial	Other
Illinois	25	13	0	0	25	0	0
Indiana	103	54	0	0	72	31	0
Kentucky	26	13	0	0	2	24	0
Ohio	29	15	0	0	29	0	0
West Virginia	0	0	5	100	3	1	1
Tennessee	9	5	0	0	6	3	0
Total	192		5		137	59	1

Table 7. Recapture by year of paddlefish implanted with coded wire tags, Ohio River Sub-basin, 1995-1999.

Year tagged	Year recaptured					Total
	1995	1996	1997	1998	1999	
Unknown	0	0	0	0	1	1
1995	3	8	8	4	8	31
1996		8	36	15	14	73
1997			5	17	21	43
1998				10	23	33
1999					11	11
Total	3	16	49	46	78	192

and recaptured near the stocking sites. Two of these fish were captured within 30 days of release and one was captured five months after release. The remaining two fish were captured 1.5 and 2.5 years after release within the same river reach.

Major upstream movement was more common among tagged paddlefish than major downstream movement. Twenty-six percent of paddlefish recaptures with known points of release and recapture were collected from major locations which differed from the original point of tagging (Table 8). Seventy percent of these fish moved upstream and thirty percent moved downstream, and some movement was extensive. One paddlefish tagged in the Smithland Pool was recovered five pools upstream in the Markland Pool, and had traveled a minimum of 483 km (290 miles) upstream passing through five high-lift navigation dams. Another paddlefish, tagged in the Greenup Pool, was recaptured five pools downstream in the Cannelton Pool, and had traveled a minimum of 526 km (316 miles). However, no paddlefish tagged downstream of Greenup Pool were recaptured upstream. Of 81 paddlefish originally tagged in Hovey Lake that were recaptured, 56 were recaptured in Hovey Lake, but 20 moved upstream, two moved downstream, and two were recaptured directly downstream in the Wabash River.

Paddlefish were captured primarily in 102-mm (4-inch) mesh (18%), 127-mm (5-inch mesh) (59%), and 152-mm (6-inch) mesh (>1%) entanglement gear and by electrofishing (17%) (Table 9). The 127-mm (5-inch) mesh entanglement gear was used to capture the greatest number of fish. Length-frequency distributions of the catch were gear-dependent (Figure 7) and mean lengths of paddlefish differed significantly among gears (ANOVA: $P < 0.0001$, $F = 257.09$, $df = 3,923$; Duncan's Multiple Range Test, $\alpha = 0.05$). The greatest mean length of paddlefish captured with the primary gears was obtained with 127-mm (5-inch mesh) nets, followed by 102-mm (4-inch) mesh nets, and electrofishing. Differences in length distributions among gears precluded combining results from the three major gear types.

Paddlefish sampled in all three primary gear types tended to be larger than average in Hovey Lake and smaller than average in the Wabash River (Tables 10-12). Combined length-frequency distributions from 1995-1999 for each major location suggested that paddlefish size structure was not severely truncated after recruitment to the gear, but few larger fish were apparent in the Wabash River (Figure 8). However, annual length-frequency distributions of paddlefish captured with 127-mm (5-inch)

Table 8. General origin of tagging and point of recapture of 192 wild paddlefish collected from the Ohio River Sub-basin, 1995-1999.

Recapture location	Tagging locations										
	Ohio River pools						Tributary rivers				Total
	Smithland	Newburgh	Cannelton	Markland	Greenup	Hovey Lake	Wabash	Cumberland	Unknown		
<u>Ohio River</u>											
Smithland	0	0	0	0	0	2	0	0	0	2	
Newburgh	2	7	1	0	0	17	0	0	0	27	
Cannelton	0	3	5	2	1	3	0	0	0	14	
Markland	1	0	3	36	0	0	0	0	1	41	
<u>Hovey Lake</u>	2	1	2	3	0	56	1	0	0	65	
<u>Tributaries</u>											
Wabash	0	0	0	0	0	2	24	0	0	26	
Cumberland	0	0	0	0	0	0	0	5	0	5	
Unknown	1	0	3	3	0	1	0	4	0	12	
<u>Total</u>	6	11	14	44	1	81	25	9	1	192	
<u>Net movement</u>											
Upstream	5	3	3	0	0	20	1	0		32	
Downstream	0	1	3	5	1	4	0	0		14	
No interchange	0	7	5	36	0	56	24	5		133	

Table 9. Mean (\pm SE), minimum, and maximum lengths (mm) of paddlefish sampled by different types of gear, Ohio River Sub-basin, 1995-1999.

Gear Type	N	Length (mm)		
		Mean (\pm SE)	Minimum	Maximum
Entanglement gear				
76-mm (3-inch) mesh	9	788 \pm 71	420	976
89-mm (3.5 inch) mesh	1	698	698	698
94-mm (3.7 inch) mesh	1	870	870	870
102-mm (4-inch) mesh	746	763 \pm 4	271	1,150
107-mm (4.2 inch) mesh	1	910	910	910
117-mm (4.6 inch) mesh	1	940	940	940
127-mm (5-inch) mesh	2,508	803 \pm 2	270	1,240
132-mm (5.2-inch) mesh	1	690	690	690
140-mm (5.5 inch) mesh	1	780	780	780
152-mm (6-inch) mesh	38	869 \pm 23	526	1,092
Electrofishing	728	673 \pm 7	168	1,311
Snagging	55	664 \pm 12	420	791
Missing gear data	140			

Figure 7. Length-frequency distributions of paddlefish sampled with 102-mm (4-inch) mesh gillnets, 127-mm (5-inch) mesh gillnets, and electrofishing, Ohio River Sub-basin, 1995-1999.

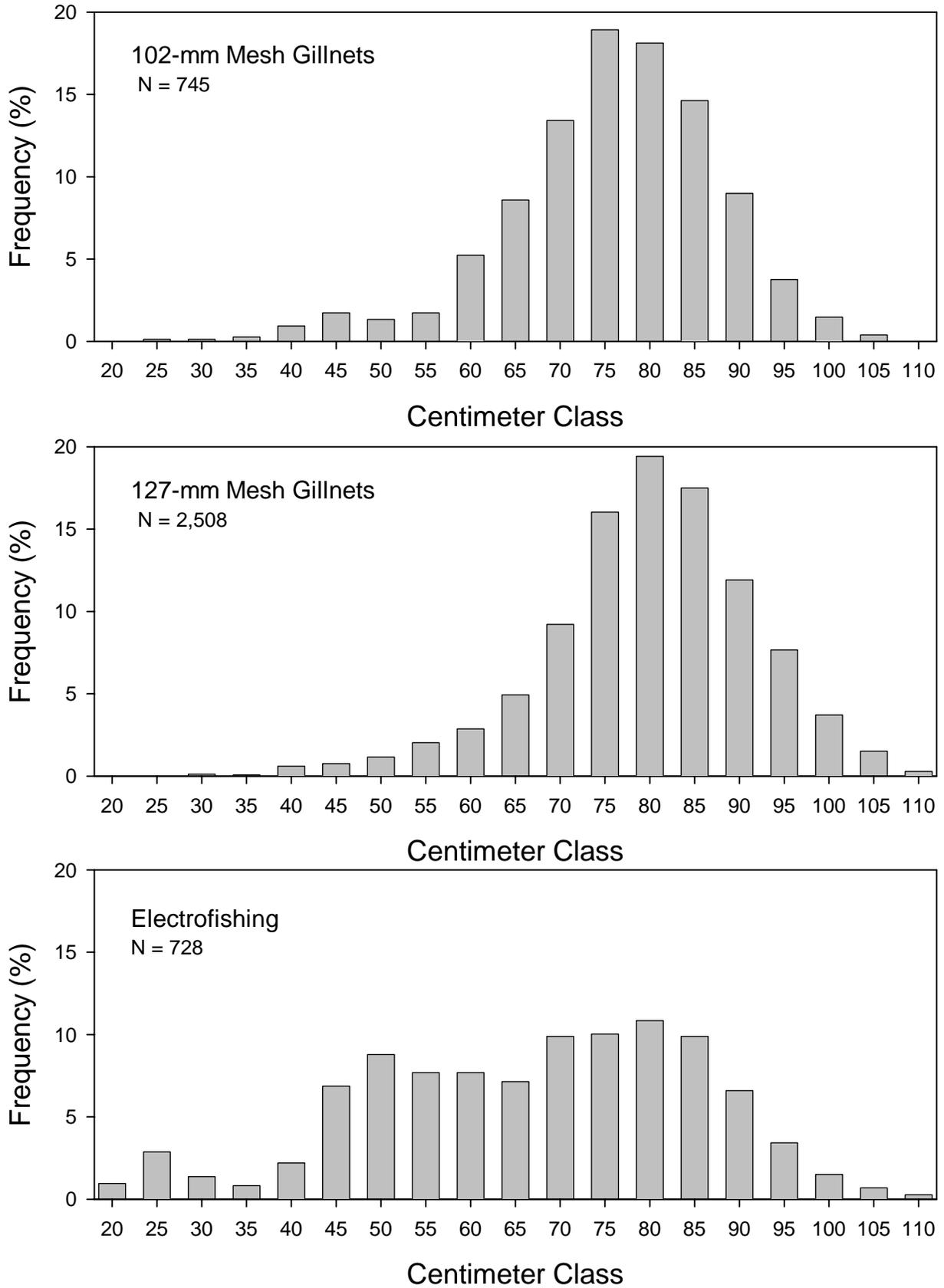


Table 10. Mean length (mm) \pm SE and sample size (below) of paddlefish captured with 102-mm (4-inch) mesh gillnets by biologists, Ohio River Sub-basin, 1995-1999.

Location	Year					All years
	1995	1996	1997	1998	1999	
Ohio River		747 \pm 40 12	514 \pm 96 7		753 \pm 26 20	708 \pm 28 39
Hovey Lake	808 \pm 35 9		827 \pm 15 41	847 \pm 13 64	838 \pm 17 34	837 \pm 8 148
Wabash River	694 \pm 23 4	705 \pm 39 3	770 \pm 7 168	712 \pm 8 217	778 \pm 9 153	748 \pm 5 545
Cumberland River						
Ohio River Sub-basin	773 \pm 29 13	738 \pm 32 15	772 \pm 8 216	742 \pm 7 294	786 \pm 8 207	763 \pm 4 745

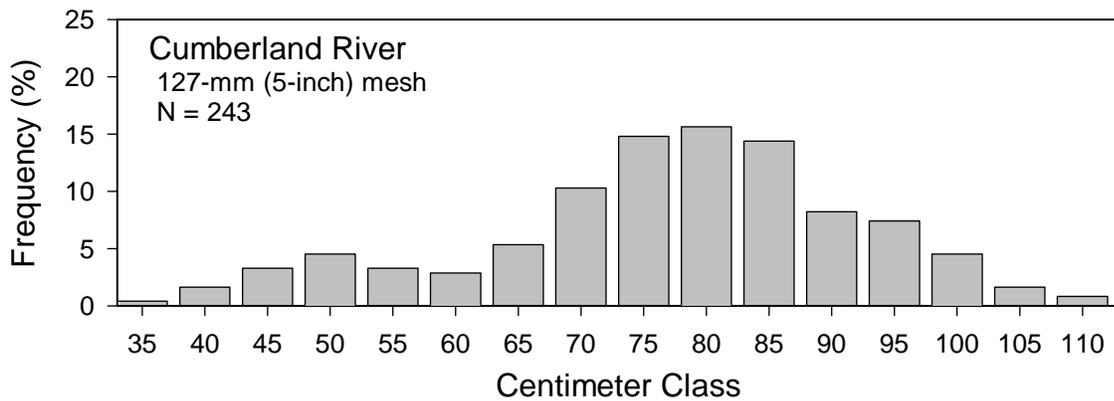
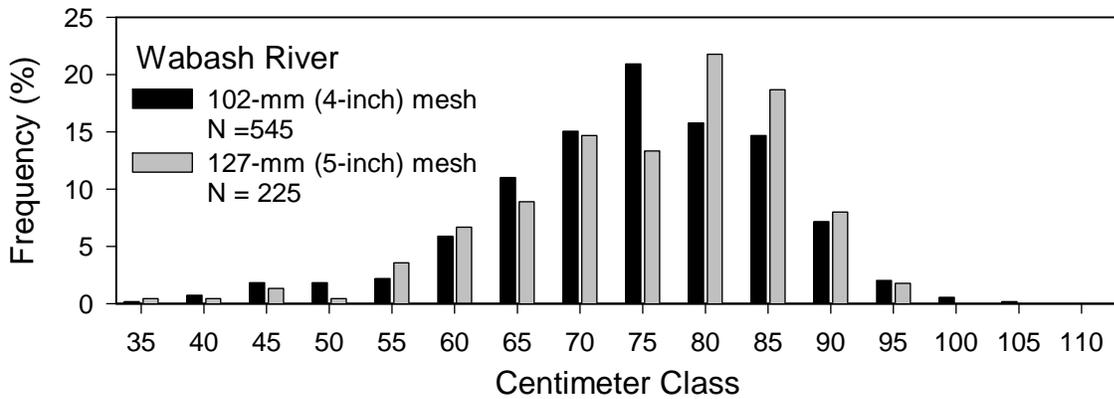
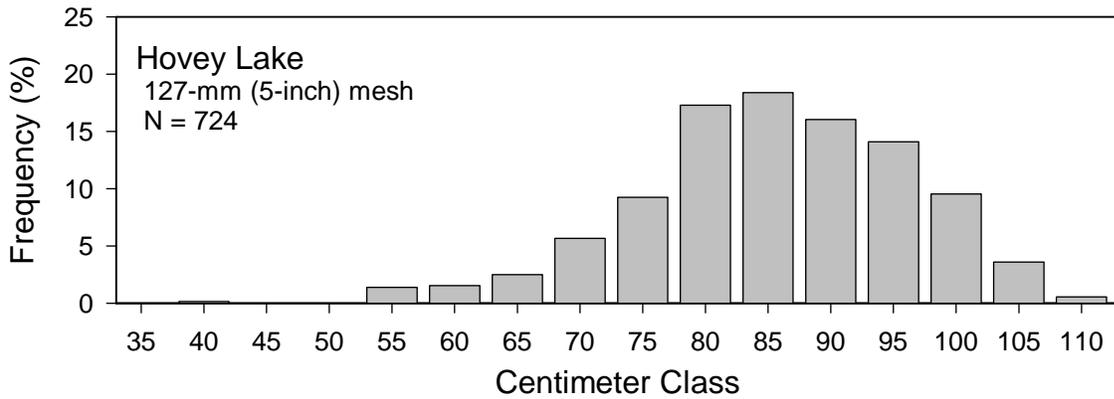
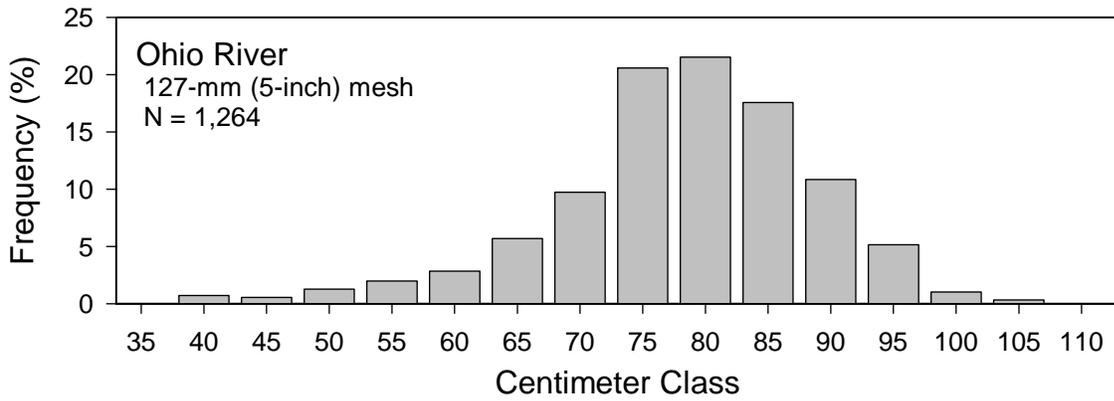
Table 11. Mean length (mm) \pm SE and sample size (below) of paddlefish captured with 127-mm (5-inch) mesh gillnets by biologists, Ohio River Sub-basin, 1995-1999.

Location	Year					All years
	1995	1996	1997	1998	1999	
Ohio River	747 \pm 15 91	776 \pm 7 286	810 \pm 6 276	798 \pm 6 269	772 \pm 5 342	785 \pm 3 1,263
Hovey Lake	885 \pm 13 74	863 \pm 7 226	848 \pm 9 156	857 \pm 9 173	850 \pm 11 95	859 \pm 4 724
Wabash River	740 \pm 36 3	741 \pm 20 42		715 \pm 14 66	789 \pm 8 114	758 \pm 7 225
Cumberland River	740 \pm 21 82	817 \pm 16 47	805 \pm 48 10	762 \pm 14 104		767 \pm 10 243
Ohio River Sub-basin	796 \pm 10 265	809 \pm 5 612	824 \pm 5 442	798 \pm 5 618	789 \pm 4 571	803 \pm 2 2,508

Table 12. Mean length (mm) \pm SE and sample size (below) of paddlefish captured by electrofishing, Ohio River Sub-basin, 1995-1999.

Location	Year					All years
	1995	1996	1997	1998	1999	
Ohio River	737 \pm 16 100	291 \pm 23 35	822 \pm 17 57	795 \pm 31 7	629 \pm 45 10	682 \pm 16 209
Hovey Lake	714 \pm 18 44	771 \pm 18 59	803 \pm 18 57	754 \pm 17 89		762 \pm 9 249
Wabash River	632 \pm 11 111	484 \pm 64 13	496 \pm 96 3	611 \pm 31 31	540 \pm 11 93	586 \pm 8 251
Cumberland River	493 \pm 43 5					493 \pm 43 5
Ohio River Sub-basin	683 \pm 9 263	582 \pm 26 108	804 \pm 13 117	708 \pm 15 137	549 \pm 11 103	673 \pm 7 728

Figure 8. Length-frequency distributions of paddlefish sampled with gillnets in the Ohio River, Hovey Lake, Wabash River, and Cumberland River, Ohio River Sub-basin, 1995-1999.



mesh within the entire Ohio River Sub-basin (Figure 9) became progressively more truncated at larger sizes from 1995 to 1999. The frequency of large fish captured was lowest during 1999. Likewise, the size structure of paddlefish captured with 127-mm (5-inch) mesh within the Ohio River (Figure 10), and the sub-set of Ohio River data that included only Hovey Lake (Figure 11), indicated similar patterns. Sufficient data were not available from the Wabash or Cumberland rivers for similar comparisons.

Total catch-per-effort of all paddlefish captured with 127-mm (5-inch) mesh entanglement gear was 0.03 fish/m of net for the entire Sub-basin during 1995-1999, similar to that reported by commercial fishers. The greatest catch rates were in Hovey Lake (0.10 fish/m of net) and the Wabash River (0.06 fish/m of net). Lower rates of capture were in the Ohio River (0.03 fish/m of net) and the Cumberland River (0.02 fish/m of net).

The Ohio River sample was comprised of progressively fewer age-10 and older paddlefish from 1997 through 2001 (Figure 12). The percentage of age 10-14 paddlefish sampled by biologists with 127-mm (5-inch mesh) entanglement gear peaked at 71% in 1997 and progressively decreased by 2-12% annually to a low of 46% in 2001. Total annual mortality (ages 10-14) ranged from 47-68% during 1995-2001, with a mean of 55% (SE=3). Hoffnagle and Timmons (1989) observed 69% total annual mortality in the Tennessee River following heavy fishing pressure and high egg prices and considered that rate indicative of overharvest. Total annual mortality of an unexploited population of paddlefish in the upper Mississippi River was 27% (Runstrom et al. 2001) and of a lightly exploited population in Keystone Reservoir, Oklahoma ranged from 27-34% (Paukert and Fisher 2001). Results of these studies suggested that within the Ohio River Sub-basin, paddlefish exploitation from sport and commercial fisheries significantly contributed to total annual mortality during 1995-2001.

Our mortality estimates suggested that current exploitation rates may be a concern, but these data must be interpreted with caution for two primary reasons. First, the age estimates were based upon predictions of age at length from a small sample of the sport fishery catch in one location during 1996. And second, the estimates did not separate male and female paddlefish, for which there is clearly discriminate harvest and likely differential mortality. The intent of these analyses was to provide a glance

Figure 9. Length-frequency distributions of paddlefish sampled with 127-mm (5-inch) mesh gillnets, Ohio River Sub-basin, 1995-1999.

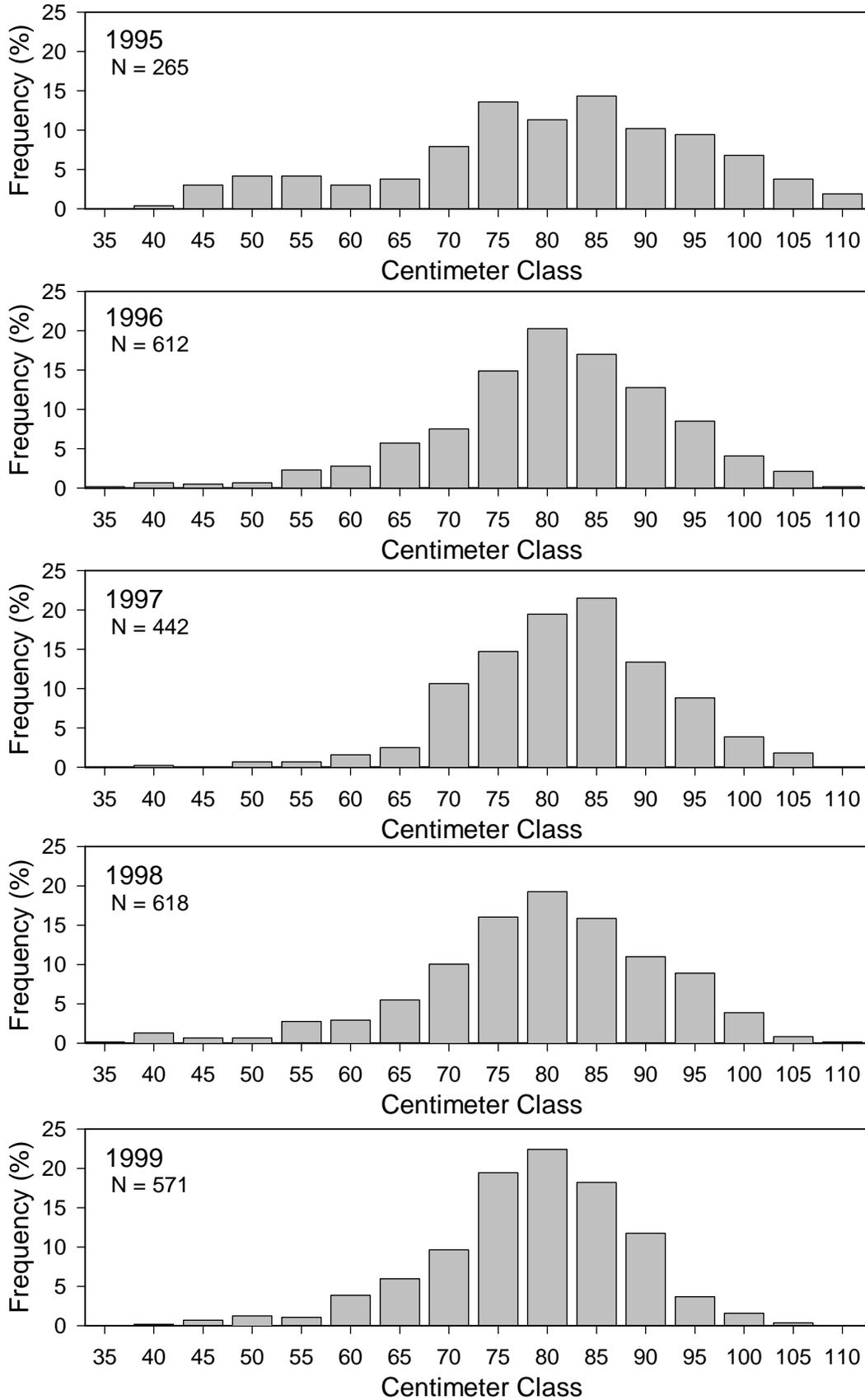


Figure 10. Length-frequency distributions of paddlefish sampled with 127-mm (5-inch) mesh gillnets, Ohio River, 1995-2001.

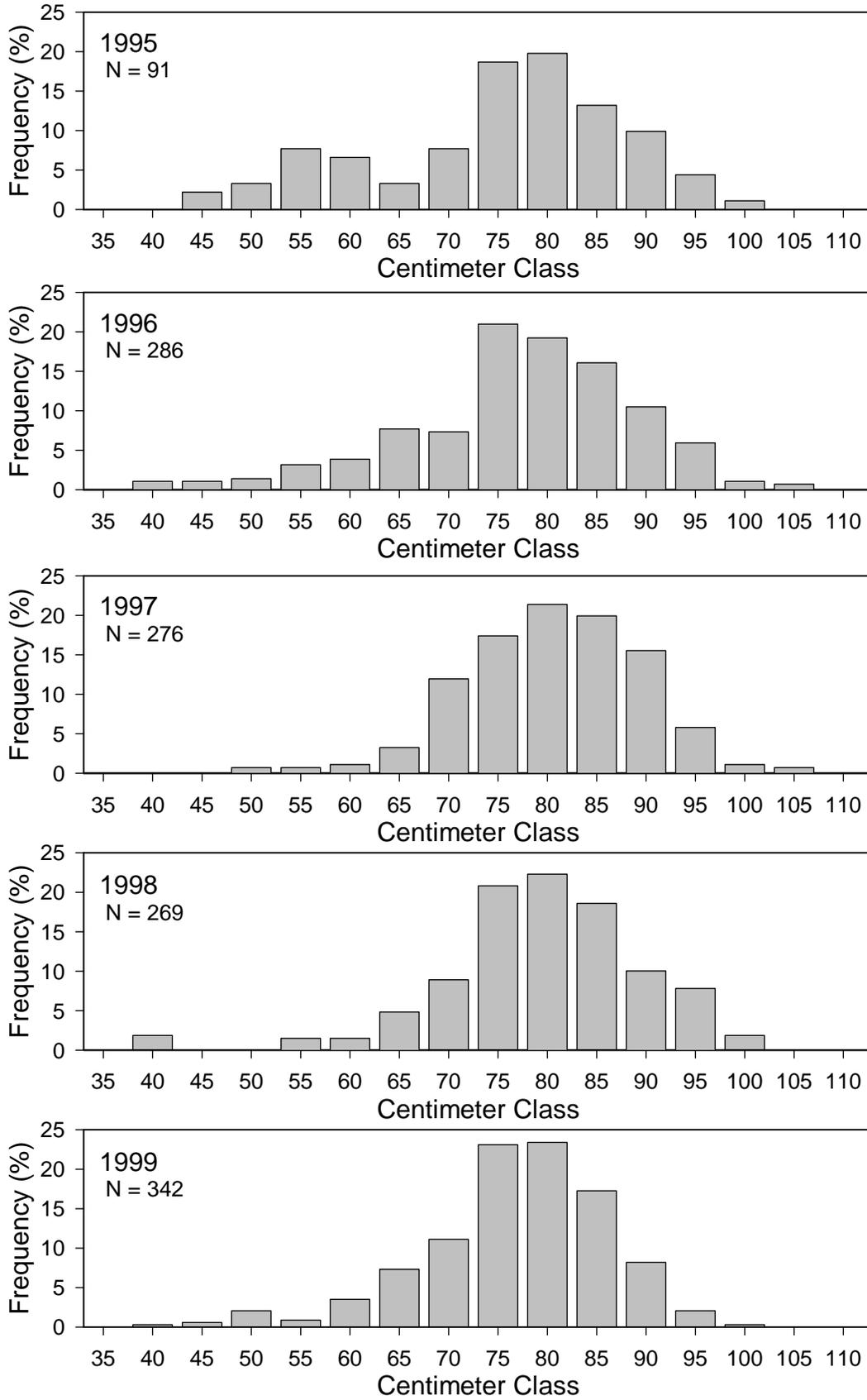


Figure 10 (continued). Length-frequency distributions of paddlefish sampled with 127-mm (5-inch) mesh gillnets, Ohio River, 1995-2001.

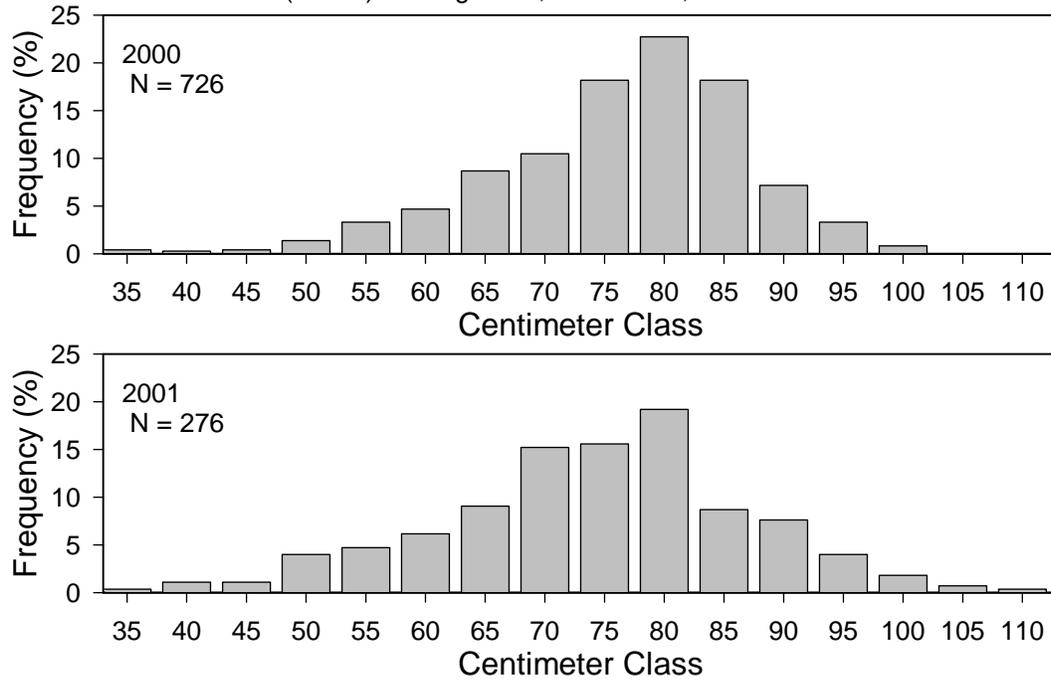


Figure 11. Length-frequency distributions of paddlefish sampled with 127-mm (5-inch) mesh gillnets, Hovey Lake (Myers Pool, Ohio River), Ohio River Sub-basin, 1995-1999.

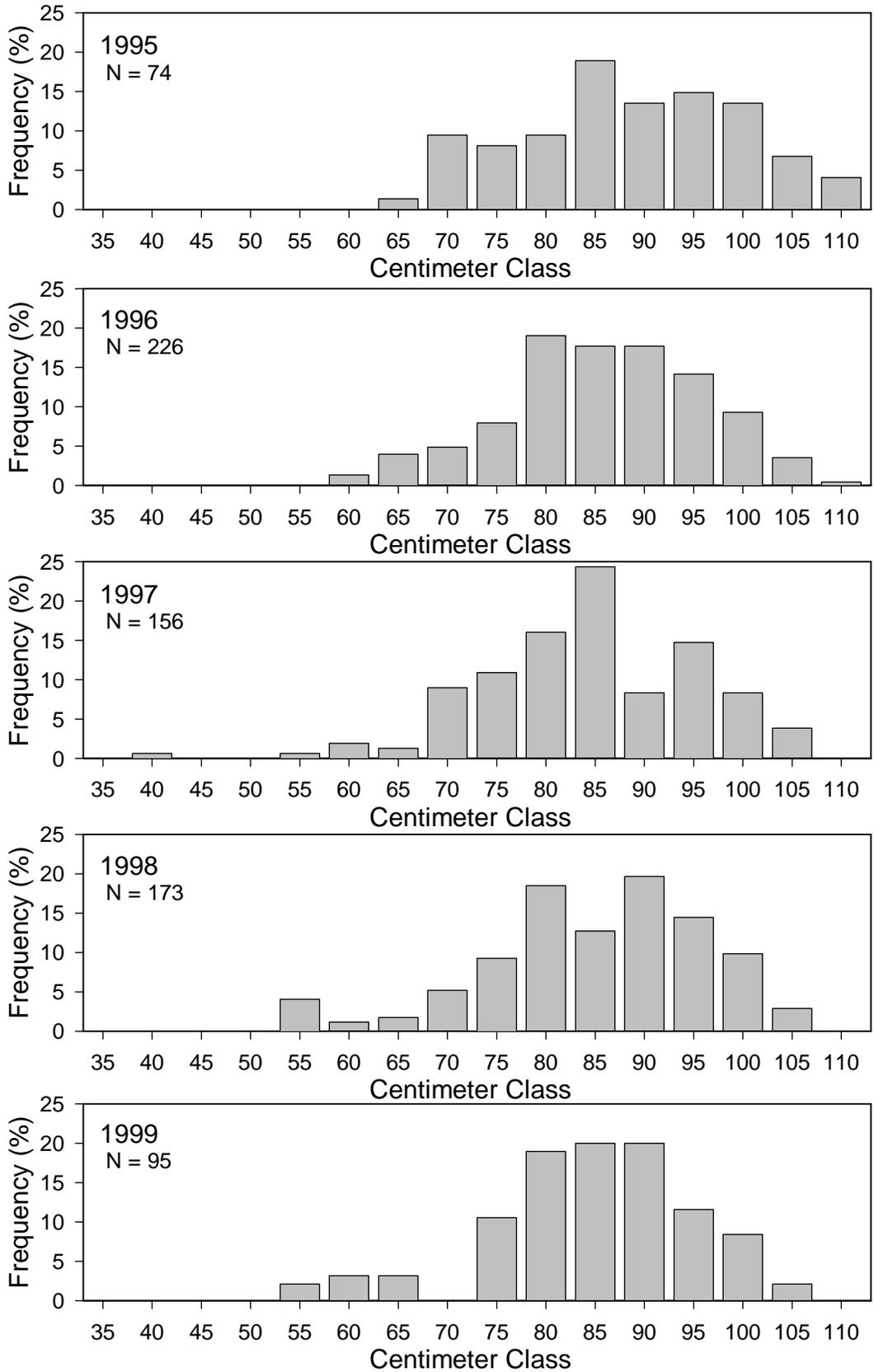


Figure 12. Estimated age-frequency distributions of paddlefish sampled with 127-mm (5-inch) mesh gillnets and estimated instantaneous mortality (Z) and total annual mortality (A), Ohio River, 1995-2001.

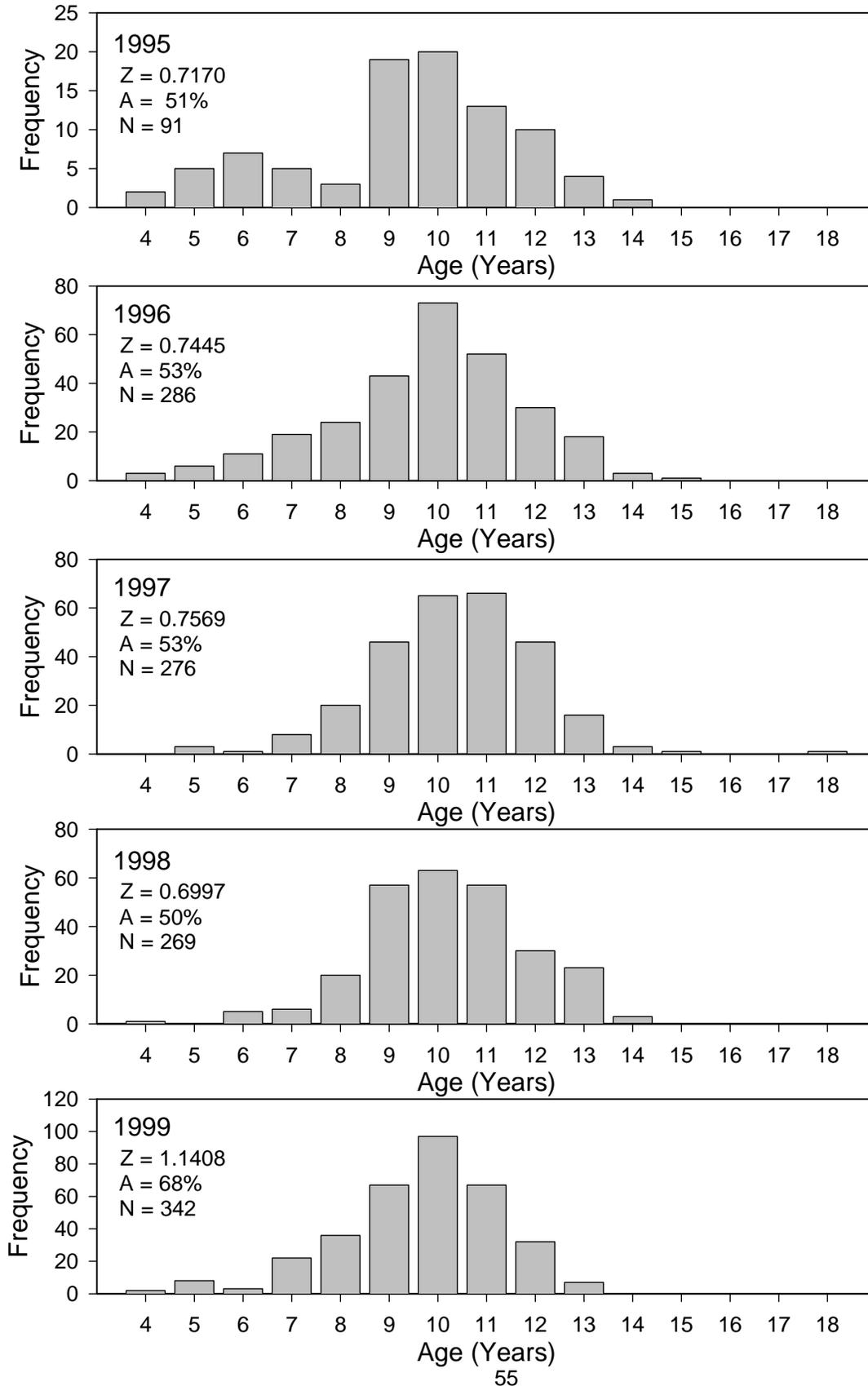
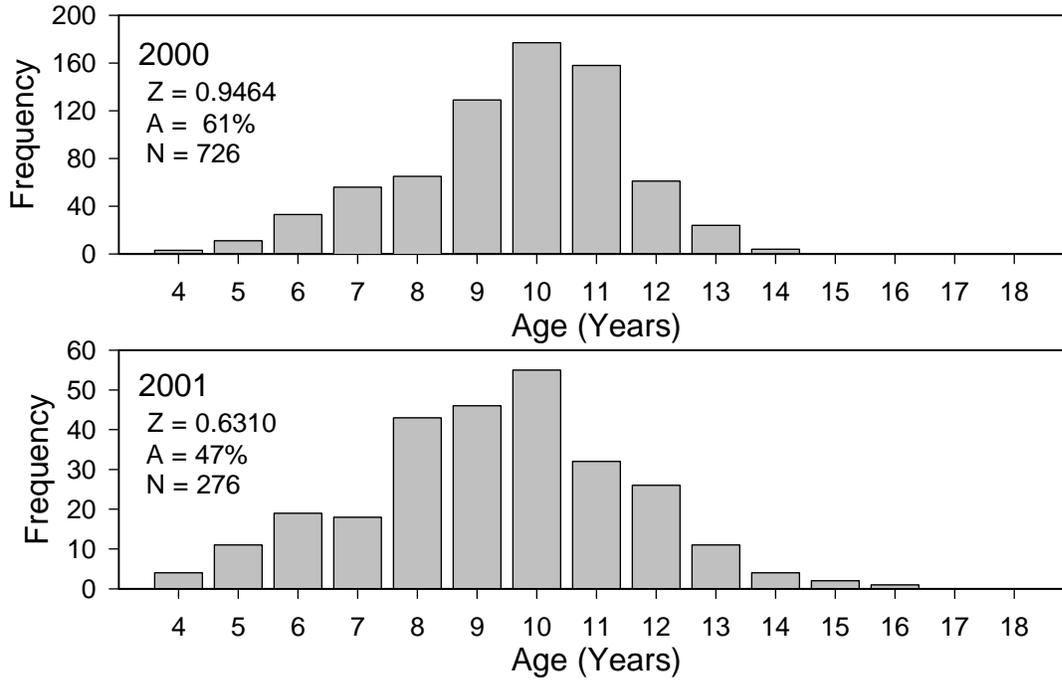


Figure 12 (continued). Estimated age-frequency distributions of paddlefish sampled with 127-mm (5-inch) mesh gillnets and estimated instantaneous mortality (Z) and total annual mortality (A), Ohio River, 1995-2001.



at mortality through a standardized approach using the only available data. We do so with a clear understanding of the shortcomings of these estimates of age structure and annual mortality.

The paucity of large paddlefish sampled, limited number of older fish estimated in the samples, and high total annual mortality were indicative of a population exposed to excessive harvest. These data suggested that the current level of harvest is pushing the limit of sustainable harvest for optimal sustainable yield.

Body condition of paddlefish, expressed as relative weight (W_r), ranged from 95-99 among all size categories and locations indicating good condition of paddlefish within the Ohio River Sub-basin (Table 13). Relative weight for paddlefish of all lengths combined was significantly greater in Hovey Lake than the Ohio River, Cumberland River, or Wabash River, similar between the Ohio River and Cumberland River, and lowest in the Wabash River (ANOVA: $P < 0.001$, $F = 37.53$ $df = 3, 835$; Tukey's procedure $P < 0.05$). Paddlefish less than 600 mm had similar relative weights in Hovey Lake, the Wabash River and the Ohio River; but, those in Hovey Lake and the Wabash River were greater than those in the Cumberland River (ANOVA: $P = 0.01$, $F = 3.82$, $DF = 404$; Tukey's procedure $P = 0.05$). Other differences among length classes of the four locations were minimal.

Length-weight relations of fish in each location were described by polynomial and \log_{10} transformed equations (Table 14). Plots of the polynomial equations demonstrated the slight differences in length-weight relations among locations (Figure 13). Differences detected in relative weights among paddlefish were minimal from Hovey Lake, Ohio River, Cumberland River, and Wabash River, so investigators could justify the use of one length-weight equation for the entire Sub-basin, or separate equations for each habitat, to estimate weight of individual fish. Tables were provide as quick references for estimating paddlefish weight based on length for 400-1,300 mm (16-51 in) fish in each location and the entire sub-basin (Appendix I and Appendix J).

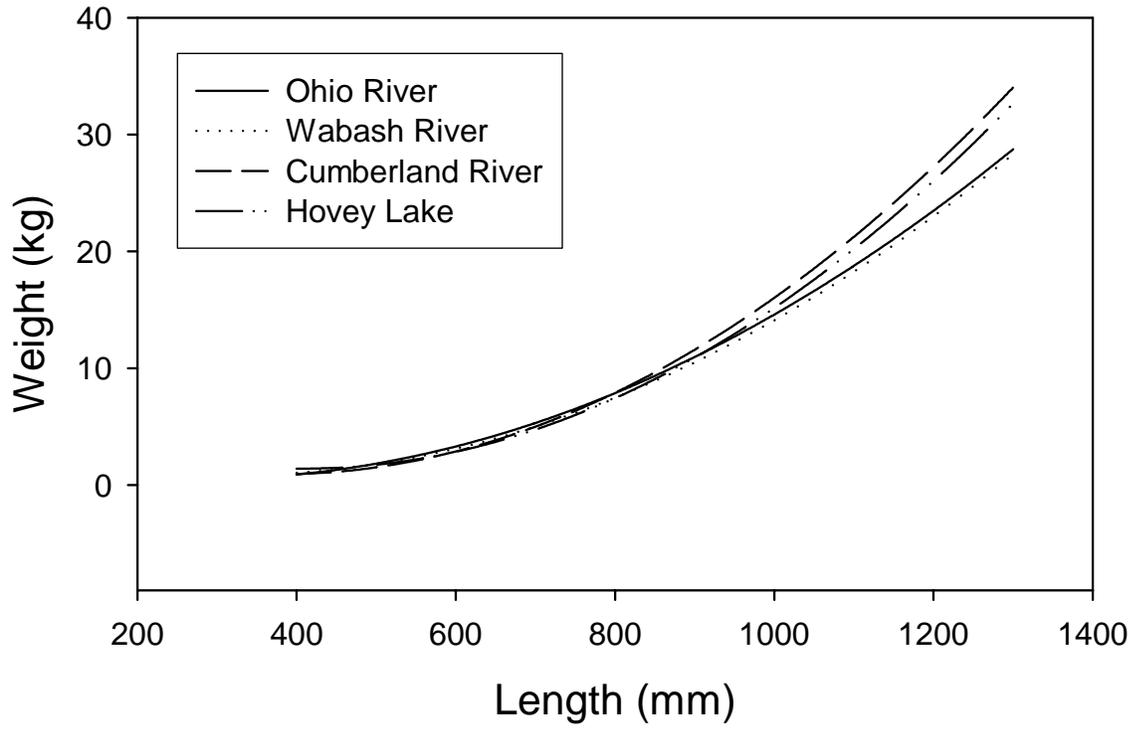
Table 13. Relative weight (Wr) \pm SE and sample size (below) of paddlefish in the Ohio River Sub-basin, 1995-1999.

Location	Relative weight \pm SE (sample size below)				
	< 600 mm	600-799 mm	800-999 mm	>999 mm	All Lengths
Ohio River	98 \pm 0.4 122	98 \pm 0.1 707	98 \pm 0.1 654	98 \pm 0.5 9	98 \pm 0.1 1,492
Hovey Lake	98 \pm 0.3 53	98 \pm 0.1 322	98 \pm 0.1 682	99 \pm 0.1 84	98 \pm 0.0 1,141
Wabash River	98 \pm 0.2 214	97 \pm 0.1 504	98 \pm 0.1 307	95 \pm 0.1 2	97 \pm 0.1 1,027
Cumberland River	96 \pm 0.8 16	98 \pm 0.3 69	98 \pm 0.3 79	99 \pm 0.5 12	98 \pm 0.2 176
Ohio River Sub-Basin	98 \pm 0.2 420	98 \pm 0.1 1,638	98 \pm 0.0 1,745	99 \pm 0.1 112	98 \pm 0.0 3,915

Table 14. Polynomial and \log_{10} transformed length-weight equations for paddlefish, Ohio River Sub-basin (L=length, mm; LSQ= length (mm) squared; W=weight, kg).

Location	Equation	N	R ²
Ohio River	$W = 2.587 - 0.015L + 2.701 \times 10^{-5}LSQ$	1,492	0.82
	$\log_{10}W = -7.790 + 2.983\log_{10}L$	1,492	0.93
Hovey Lake	$W = 7.932 - 0.032L + 3.923 \times 10^{-5}LSQ$	1,141	0.90
	$\log_{10}W = -8.193 + 3.126\log_{10}L$	1,141	0.93
Wabash River	$W = 3.695 - 0.018L + 2.840 \times 10^{-5}LSQ$	1,027	0.87
	$\log_{10}W = -7.823 + 2.986\log_{10}L$	1,027	0.94
Cumberland River	$W = 6.357 - 0.029L + 3.867 \times 10^{-5}LSQ$	283	0.85
	$\log_{10}W = -8.929 + 3.376\log_{10}L$	283	0.91
Ohio River Sub-basin	$W = 5.288 - 0.025L + 3.470 \times 10^{-5}LSQ$	3,915	0.87
	$\log_{10}W = -8.055 + 3.074\log_{10}L$	3,915	0.94

Figure 13. Length-weight relations for paddlefish in four locations of the Ohio River Sub-basin, 1995-1999.



Contaminant Monitoring

Organic chemical and heavy metal contamination of fish flesh from the Ohio River has been suspected since the early 1960s. Fish flesh from the upper two-thirds of the river was anecdotally reported to have objectionable tastes that were described as oily, muddy, or gasoline flavors (Pearson and Krumholz 1984). By 1977, ORSANCO began preliminary examination of fish flesh for polychlorinated biphenyl (PCB) and chlordane, and found contaminant levels in some fishes that warranted more extensive analysis, particularly in the upper reaches of the river (ORSANCO 1977).

In the late 1980s, the U.S. Food and Drug Administration (FDA) established the action levels of 2.0 ug/g for PCB and 0.3 ug/g for chlordane in fish tissue. Contaminant concentrations at or greater than these levels were considered unsafe for human consumption. State agencies in the Ohio River Sub-basin, in conjunction with ORSANCO, began collecting fish flesh and reporting contaminant level advisories to the public in 1987, although paddlefish were not initially included in these advisories. Researchers began to test paddlefish flesh and eggs in the Kentucky portion of the Ohio River as market demand for these fishery products increased. Gundersen and Pearson (1992) found PCB in paddlefish white and red muscle, and gonads (Table 15). They determined that red muscle concentrations of PCB (1.98-6.30 ug/g) were greater than white muscle concentrations (0.05-3.35 ug/g) because lipid concentrations were greater in red muscle, and found the FDA action limit exceeded in white muscle of only one sample. Gundersen and Pearson (1992) also theorized that the high lipid content in ovaries and testes made gonads strong concentrators of these lipophilic contaminants. Upon evaluation, they found considerably greater concentrations of PCB in testes (5.63-23.00 ug/g) than ovaries (0.05-18.70 ug/g). The elevated levels of PCB in paddlefish reproductive tissue became a concern for both human health reasons, because fishery products are consumed, and paddlefish population reasons, because contamination may affect paddlefish reproductive success.

The KDFWR, Kentucky Division of Water (KDW), and Kentucky Cabinet for Health Services (KCHS) responded to the preliminary findings of Gundersen and Pearson (1992) by implementing more extensive tests of paddlefish tissue. The KDFWR sampled paddlefish flesh and eggs from the Ohio River for contaminant analysis and the KCH, Division of Laboratory Services tested samples for Chlordane and

Table 15. Polychlorinated biphenyl (PCB) contaminant levels (ug/g) in paddlefish tissue, McAlpine Tailwaters, Ohio River, 1988-1989 (Gunderson and Pearson 1992).

Tissue	Sex	N	PCB (ug/g)
Eggs	F	12	0.05-18.70
Testes	M	5	5.63-23.00
Red muscle	F	4	1.98-6.30
White muscle	F	13	0.05-1.03
White muscle	M	19	0.05-3.35

PCB in 1990 (36 fish) and 1991 (18 fish). Egg samples from both years exceeded the action levels for chlordane with levels that ranged from 0.03 ug/g to 1.07 ug/g (Table 16), but PCB concentrations remained under the action level, despite elevated levels in some samples. Paddlefish were listed on the river-wide consumption advisory as not recommended for consumption in 1991 because of these results.

In 1998-1999, the KDFWR, KDW, and KCHS continued cooperative evaluation of contaminant levels (Table 17). Sampling methods and sites were similar to those of the 1990-1991 study. In 1998, the FDA relaxed chlordane action levels to 18.9 ug/g, whereas the PCB action level remained at 2.0 ug/g. Paddlefish contaminant levels (flesh and eggs) were considerably lower in the 1998-1999 study than the 1990-1991 study. Egg chlordane levels were below the action level and ranged from 0.02 to 0.51 ug/g. Polychlorinated biphenyl levels, although not exceeding the action level of 2.0 ug/g, remained elevated (range in eggs, 0.10-1.78 ug/g; range in fillets (0.10-1.72 ug/g) and remained the primary source of organochlorine contaminant advisories.

The consumption status of paddlefish products was modified in 2000. After being listed as "do not eat" for 10 years, paddlefish flesh and egg consumption advisories were relaxed to 6 meals per year in the lower two thirds of the Ohio River. Paddlefish eggs still contain elevated levels of PCB and should

Table 16. Contaminant levels (ug/g) of chlordane and polychlorinated biphenyl (PCB) in paddlefish eggs and fillets (flesh) from Ohio River tailwaters, 1990-1991 (Kentucky Cabinet for Health Services, Division of Laboratory Services).

Location (Tailwater)	Year	Sex	N	Mean length (mm)	Mean weight (kg)	Eggs (ug/g)		Fillets (flesh, ug/g)	
						Chlordane	PCB	Chlordane	PCB
Meldahl ^a	1990	F	10	953	11.520	0.27-1.07	0.33-1.44	0.06-0.55	Tr*-0.99
McAlpine ^a	1990	F	4	892	9.855	0.11-0.60	Tr*-1.5	0.11-0.27	0.24-0.40
Cannelton ^b	1990	F	2	897	11.070	0.51	0.73	0.22	0.23
Newburgh ^b	1990	F	10	965	13.815	0.03	0.56	0.11	0.12
Smithland ^b	1990	F	10	945	12.825	0.04	Tr	0.17	0.17
Greenup ^a	1991	F	1	978	12.150	0.45	1.20	0.11	^c
Greenup ^a	1991	M	2	864	8.550			0.19-0.20	^c
Markland ^a	1991	F	2	914	11.250	0.49-0.65	1.14-1.60	0.16-0.31	0.17-0.42
Markland ^a	1991	M	5	836	6.525			0.13-0.36	0.17-0.65
Cannelton ^a	1991	F	3	960	15.300	0.06-0.30	0.48	0.12-0.24	0.47-0.53
Newburgh ^a	1991	F	1	919	13.050	0.54	^c	0.13	^c
Newburgh ^b	1991	M	4	737	5.220			0.03-0.06	^c

*reported as "trace" with no value given

^a samples not composited

^b samples composited

^c not reported

Table 17. Contaminant levels (ug/g) of chlordane and polychlorinated biphenyl (PCB) in paddlefish eggs and fillets (flesh) from Ohio River tailwaters, 1998-1999 (Kentucky Cabinet for Health Services, Division of Laboratory Services¹).

Location (Tailwater)	Year	Sex	N	Mean length (mm)	Mean weight (kg)	Eggs (ug/g)		Fillets (flesh, ug/g)	
						Chlordane	PCB	Chlordane	PCB
Greenup ^a	1998	F	5	947	11.790	0.17-0.26	0.10	0.05-0.15	0.10
Meldahl ^a	1998	F	2	907	10.260	0.18-0.19	0.10	0.05-0.19	0.10
Markland	1998	F	1	932	11.700	0.05	0.10	0.12	0.10
McAlpine	1998	F	1	820	8.550	0.13	0.10	0.09	0.10
Myers	1998	F	4	912	13.275	0.05-0.09	0.10	0.05-0.13	0.10
Smithland ^a	1998	F	2	884	10.890	0.05	0.10	0.05	0.10
Myers ^b	1998	M	3	701	4.995			0.06	0.10
Smithland ^b	1998	M	3	742	4.770			0.02	0.10
Meldahl ^a	1999	F	5	897	9.900	0.13-0.21	0.70-1.68	0.08-0.22	0.15-1.53
McAlpine ^a	1999	F	42	897	10.710	0.21-0.32	0.59-1.78	0.10-0.22	0.25-1.72
Myers ^a	1999	F	5	904	12.375	0.10-0.51	0.45-0.82	0.06-0.26	0.28-1.50

¹ Male paddlefish samples were collected at the same time as the female samples, but analysis of the fillets was performed by the Illinois Environmental Protection Agency.

^a samples not composited

^b samples composited

be consumed with caution. News releases from state agencies along the Ohio River currently recommend that pregnant women, nursing mothers and their infants, and children do not eat paddlefish eggs or flesh, and women who may be, or plan to become, pregnant are also advised to avoid similar consumption.

Concentrations of contaminants in Ohio River paddlefish may pose physiological problems for paddlefish. The contaminant levels observed in paddlefish gonads during 1989 and 1990 were much greater than those found in flesh samples (Gundersen and Pearson 1992), suggesting reproductive implications of contamination. Likewise, recent findings by Gundersen et al. (1998) confirmed high PCB concentrations in gonadal tissue (Table 18). Although they could not identify a significant reduction in hatch related to organochlorine contamination in spawning experiments, the greatest percent hatch was observed in eggs that had the lowest PCB and chlordane concentrations. Gundersen et al. (2000) also found that PCB and chlordane concentrations in paddlefish gonads were greater in the Ohio River than the Cumberland River, a less industrialized river, and suggested that organochlorine (PCB and chlordane) exposure may jeopardize the long-term health of Ohio River paddlefish.

Table 18. Contaminant levels (ug/g) of chlordane and polychlorinated biphenyl (PCB) in paddlefish eggs, immature ovaries, and testes, Ohio River, 1996 (Gunderson et al. 1998).

Location	Sex	N	Eggs (ug/g)		Immature ovary (ug/g)		Testes (ug/g)	
			Chlordane	PCB	Chlordane	PCB	Chlordane	PCB
Markland Pool	F	3	0.69	1.10	0.26	3.85		
Markland Pool	M	3					0.22	4.43
Meldahl Tailwater	F	3			0.29	3.80		
Meldahl Tailwater	M	1					0.26	2.40
McAlpine Tailwater	F	3	0.46	0.59				
Myers Tailwater	F	2	0.27	0.28				

Recommendations of the ORFMT Technical Committee

Paddlefish have persisted in the Ohio River Sub-basin despite severe habitat degradation over the past two centuries. Deforestation of watersheds, dewatering of backwater habitats, dam construction, contamination of water with industrial effluents and septic waste, and destruction of gravel bars have challenged the continued viability of paddlefish populations. As water quality in the Ohio River and its major tributaries has improved and habitat alterations have slowed, environmental conditions are no longer the greatest threat to paddlefish. The most significant current threat to paddlefish is excessive exploitation, both legal and illegal, and coordinated management and improved commercial fishery monitoring are necessary to reduce this threat.

Exploitation of paddlefish increases quickly in response to market demand for caviar, because incentives for profit are great and barriers to fishery entry are minimal. Current market prices provide substantial incentive for legal or illegal entry into the fishery. A 9-kg (20-lb) female paddlefish may be worth as much as US\$400 wholesale, and US\$768 retail. By contrast, a resident commercial fishing license costs US\$35-125, a gillnet suitable for harvesting paddlefish costs slightly more than US\$100, and minimal equipment is required for a fisher with a small boat. Given adequate market incentive and river conditions that facilitate fish capture, harvest of flesh and eggs can triple from one year to the next, as indicated by the commercial harvest reported in 1999 and 2000.

Paddlefish egg prices are projected to increase in response to a dwindling global supply of sturgeon caviar. The supply of the highest grades of sturgeon caviar from the Caspian Sea will decrease if Russia, Azerbaijan, Kazakhstan, and Turkmenistan conform to a harvest freeze and reduce illegal harvest, as desired by the United Nations CITES Committee. Supply of Caspian Sea sturgeon caviar has declined precipitously during the past two decades because of stock collapse, and rapid stock recovery is unlikely; therefore, increased demand for paddlefish eggs as a substitute product will not be a short-term phenomenon.

Current harvest levels of paddlefish in the Ohio River Sub-basin are not well quantified, but estimates of total annual mortality from fish sampled by biologist are a “red flag”, warning against increases in exploitation. Total annual mortality rates that ranged from 47-68% during 1995-2001 were

indicative of a population exposed to extensive harvest. Annual mortality rates higher than these would not be compatible with a sustainable fishery for paddlefish because these fish require 6-10 year to reach sexual maturity, lived up to 30 years, and require more than one year to develop mature ova. Our estimates of mortality were twice as high as recent estimates from populations without strong sport or commercial harvest components (Paukert and Fisher 2001; Runstrom et al. 2001). Therefore, despite the decline in commercial license sales observed in Kentucky and Indiana during the past decade, current levels of fishing activity impact the population.

Paddlefish move both upstream and downstream in the Ohio River, and interchange of pools is not uncommon. During our five-year tagging study, one-fourth of recaptured paddlefish were collected from a pool upstream or downstream of the original point of tagging, and some fish passed through multiple lock and dam structures. These results confirm that paddlefish are a shared fishery resource throughout much of the Ohio River Sub-basin. In addition, movement of paddlefish to the Missouri and Mississippi rivers from the Ohio River Sub-basin, and movement in the opposite direction, has been documented.

Paddlefish are an inter-jurisdictional resource in the Ohio River, yet are managed differently by border-states. States in the upper reaches of the Ohio River have historically lower paddlefish abundance coupled with more dam construction, leading to protection and restoration efforts. Kentucky, with its large shoreline and long history of commercial fishing, has historically supported the most extensive Ohio River paddlefish fishery. Therefore, state management perspectives evolved along a longitudinal gradient of the river and current management practices range from “stock and protect” in the upper reach, to “protect” and “harvest” in the middle reach, and “harvest” in the lower reach.

We recommend the following based upon this report:

- Establish full participation of all Ohio River Sub-basin states in cooperative management of paddlefish.
- Continue paddlefish management as directed by the 2002-2010 strategic plan.
- Encourage states stocking paddlefish in the Ohio River Sub-basin to use only Ohio River broodstock to promote a conservative approach to protection of genetic integrity of the stock.
- Improve procedures for oversight and assessment of commercial fisheries.

- Continue to work closely with law enforcement officials to monitor and curtail illegal activities.
- Align sport fishery regulations for paddlefish among Ohio River states permitting fisheries.
- Monitor retail and wholesale prices of eggs and caviar and CITES exporting permits for sturgeon and paddlefish.
- Continue participation in the MICRA Paddlefish/Sturgeon Sub-committee and national paddlefish study through 2010, but modify sampling protocols.
- Annual review of strategic and operational plans.
- Annual reporting of results from operational plans, commercial and sport harvest, and stocking activities.
- Beginning in 2002, implement these operational plans to monitor and manage paddlefish:
 1. Monitor abundance. Implement standardized surveys in the Byrd, Greenup, McAlpine, Newburgh, and Myers pools of the Ohio River using gillnetting and fisheries acoustics.
 2. Movement and exploitation. Augment the MICRA tagging protocol with use of external tags to better quantify paddlefish movement among Ohio River pools and aid estimation of exploitation.
 3. Commercial-catch characteristics. Conduct onboard monitoring of a limited number of commercial catches in the Cannelton, Markland, and McAlpine pools to estimate age and size structure and sex ratio of the commercial catch.
 4. Monitor sport fisheries. Use existing creel surveys in tailwaters of the Ohio River to obtain harvest, tag return, catch-per-effort, and age and size structure data.
 5. Data management. Develop a shared database for ORFMT paddlefish management.
 6. Public information. Write an article to summarize paddlefish issues in the Ohio River Sub-basin.

SWOT ANALYSIS (May 16-17, 2001)

Mission Statements of Participating Agencies

Wildlife Resources Section, West Virginia Division of Natural Resources. It is declared to be the public policy of the State of West Virginia that the wildlife resources of the State shall be protected for the use and enjoyment of all citizens of this State. All species of wildlife shall be maintained for values which may be either intrinsic or ecological or of benefit to man. Such benefits shall include (1) hunting, fishing, and other diversified recreational uses; (2) economic contributions in the best interest of the people of the State; and (3) scientific and educational uses.

Division of Wildlife, Ohio Department of Natural Resources. We are dedicated to preserving and improving the fish and wildlife resources and their habitats, and promoting their use and appreciation by the people so that these resources continue to enhance the quality of life for all Ohioans.

Kentucky Department of Fish and Wildlife Resources. We are stewards of Kentucky's fish and wildlife resources and their habitats. We manage for the perpetuation of these resources and their use by present and future generations. Through partnerships, we will enhance wildlife diversity and promote sustainable use, including hunting, fishing, boating and other nature-related recreation.

Indiana Department of Natural Resources. To professionally manage Indiana's fish and wildlife for present and future generations, balancing ecological, recreational, and economic benefits.

Illinois Department of Natural Resources. Provide leadership to manage, protect, sustain, and promote Illinois' natural and cultural resources.

Paddlefish Technical Committee Scope

To provide current information and management recommendations to agency leadership for sound inter-jurisdictional management of paddlefish in the Ohio River Sub-basin.

Internal Considerations: Strengths and Weaknesses

Strengths

ORFMT agency commitment
MICRA participation of ORFMT states
Knowledge of the Ohio River
Financial resources
Current data (7 years of recent data)
ORFMT organizational structure
MICRA study methods (somewhat standardized)
Joint interest in paddlefish (shared values)

Weaknesses

MICRA participation
Incomplete knowledge of the Ohio River
Data storage and access (MICRA database)
MICRA study protocols
MICRA study designs
Lack of fundamental management data

External Considerations: Opportunities and Threats

Opportunities

MICRA participation
MICRA Paddlefish-sturgeon Sub-committee leadership
Public interest
Sport fishery potential
Commercial value of eggs
Lock and dam structure (concentrates fish for fishery use)
USFWS (info;CITES; SAR trust species listing)
MICRA Paddlefish-sturgeon Sub-committee
Sustainable commercial harvest
Habitat restoration
USFWS

Threats

MICRA leadership
MICRA Paddlefish-sturgeon Sub-committee leadership
Participation outside of ORFMT in management
Lack of all participation in joint paddlefish management of all Ohio River Sub-basin states
Stocking strategies and philosophies
Public interest
Commercial fishery regulation (lack thereof)
Exploitation (sport and commercial)
Commercial value of paddlefish eggs
Political interests (many Potentially Affected Interests)
Habitat loss (and water quality)
Navigational barriers (lock and dam structures)
Large management area (Ohio River Sub-basin)

Opportunities

Threats

Differential management strategies for one stock
USFWS
Exotic species
Paddlefish life history
Poaching
Law enforcement interest (or lack thereof)
Aquaculture
Genetic engineering (gynogens)
Declining sturgeon stocks
Caviar trade (local and international)
Commercial fishers (as a political unit)
MICRA stability (and Paddlefish-sturgeon Sub-committee)
MOU specifications among states for river use
Non-compliance of reporting commercial harvest
Status discrepancies among Ohio River states

Strategic Plan: 2002-2010

Goal

Restore, enhance, and protect the paddlefish population in the Ohio River Sub-basin to ensure sustainable use and increase public awareness of paddlefish issues.

Objectives

- 1) Abundance. Maintain or restore paddlefish abundance at catch rates of 0.03 fish per meter of net per 2 hour set determined by standardized gillnet surveys in five pools of the Ohio River.
- 2) Total Annual Mortality. Limit total annual mortality of paddlefish to less than 50% (both sexes combined).
- 3) Exploitation. Limit annual exploitation to less than 20% (both sexes combined) in areas of the Ohio River where sport and commercial harvest are permitted.
- 4) Movement. Quantify paddlefish movement among Ohio River pools over a five-year period.
- 5) Restoration. Restore paddlefish in the upper Ohio River reaches by stocking age-0 fish that are produced from Ohio River broodstock and developed without genetic alteration.
- 6) Harvest. Monitor annual sport and commercial harvest.
- 7) Data Management. Develop and maintain an ORFMT paddlefish database.
- 8) Public Information. Condense the background and situation analysis into a popular article for distribution to the public.

Problems and Strategies

Objective 1. Abundance

Problem: Abundance of paddlefish is low in the upper Ohio River.

Strategy: Annually stock paddlefish in the PA and WV portions of the Ohio River with broodstock derived from the Ohio River.

Problem: Abundance of paddlefish is not well quantified in specific pools of the Ohio River.

Strategy: Use annual standardized gillnetting and fisheries acoustics surveys to estimate abundance of paddlefish at fixed sites within five pools.

Problem: Aquatic Nuisance Species (ANS) are invading the Ohio River and may have a negative impact on paddlefish.

Strategy: Record data from non-target species captured in standardized surveys and during onboard commercial catch monitoring.

Objective 2. Total Annual Mortality

Problem: The ORFMT currently lacks male and female age structure of the catch from 127-mm (5-inch) mesh gillnets to obtain sex-specific growth rates, age structure, and catch curves.

Strategy: Collect sex-specific age data from commercial catch samples from 5" mesh nets.

Problem: The sex of paddlefish cannot be externally determined.

Strategy: Explore the use of gonad biopsy as a method for external sex determination.

Problem: Total annual mortality of paddlefish may exceed 50%.

Strategy: Implement fishery management regulations to reduce harvest.

Objective 3. Exploitation

Problem: Rates of sport and commercial exploitation are currently unknown.

Strategy: Determine sport and commercial exploitation via external tagging of Ohio River paddlefish.

Problem: Non-reporting of tags may bias estimates of exploitation from tagging studies.

Strategy: Evaluate non-reporting bias through design of the tagging study.

Problem: Combined commercial and sport fishery exploitation may exceed 20%.

Strategy: Implement fishery management regulations to reduce harvest.

Objective 4. Movement

Problem: Current tagging methodology (internal tags) does not provide the necessary resolution to best quantify paddlefish movement among pools of the Ohio River.

Strategy: Supplement MICRA methodology with external tagging methods throughout the Ohio River.

Objective 5. Restoration

Problem: Genetic integrity of the native paddlefish population may be compromised by stocking paddlefish derived from broodstock sources outside of the Ohio River Sub-basin.

Strategy: Encourage all Ohio River Sub-basin states to only stock paddlefish that are produced from Ohio River Sub-basin broodstock.

Objective 6. Harvest

Problem: Reporting of commercial fishery harvest is incomplete and not uniform.

Strategy: Implement standardized reporting of paddlefish catches by commercial fishers in Kentucky, Indiana, and Illinois that includes reporting the numbers of fish harvested.

Strategy: Use onboard monitoring of commercial fishers to record harvest, sex ratio, size and age structure of the harvest, tag returns and bycatch.

Problem: Sport fishery harvest is not monitored in all tailwaters with paddlefish fisheries.

Strategy: Use the existing creel surveys to monitor the sport fishery harvest of paddlefish.

Objective 7. Data Management

Problem: The current MICRA database is cumbersome to use and insufficient for ORFMT needs.

Strategy: Develop an ORFMT database to house and share field sampling, tagging, commercial fishery, sport fishery, and contaminant data.

Objective 8. Public Information

Problem: An ORFMT publication does not currently address paddlefish issues for the general public.

Strategy: Develop a popular article or publication to summarize findings and implications of the ORFMT sub-basin report.

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Appendix A. Letter from Susan Lieberman, Chief, Division of Scientific Authority, USFWS to Willem Wijnstekers, Secretary General, CITES Secretariat describing how the USFWS implements Article IV of the CITES treaty concerning exports of Acipenseriformes species in the Review of Significant Trade.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

In Reply Refer To:
FWS/AIA/DSA/DMA

JAN 26 2001

Willem Wijnstekers, Secretary General
CITES Secretariat
15, chemin des Anémones
Case postale 456
CH-129 Châtelaine
Geneve, Switzerland

Dear Mr. Wijnstekers:

This letter is in response to your telefax transmission to us of November 24, 2000, requesting that we provide information on our "... implementation of Article IV of CITES concerning exports of Acipenseriformes species in the Review of Significant Trade." Specifically, you asked us to provide you with the scientific basis on which we issued permits for the exports of native specimens of Acipenseriformes from 1997 to 2000. As you know, we requested, in a December 22, 2000, fax to the Secretariat (addressed to Dr. Lindeque) a three-week extension to January 28, 2001, to send this information (due to the workload of hosting the Animals and Plants Committee meetings). We appreciate your understanding in that regard.

We are providing this information in two forms. First, we have express-mailed copies of our actual non-detriment findings for three of the nine species of Acipenseriformes native to the United States: paddlefish (*Polyodon spathula*) from 1992 to 2000, white sturgeon (*Acipenser transmontanus*) from 1998 to 2000, and shovelnose sturgeon (*Scaphirhynchus platorhynchus*) from 1998 to 2000. The paddlefish listing came into effect in 1992 and the other species listings in 1998. These findings will include those where we found no detriment or detriment, or were unable to make a finding because of insufficient information. These are the only species of Acipenseriformes native to the United States for which there is commercial international trade in any parts or products. For more details, please refer to our letter to you of January 16, 2001, in which we responded in detail to Decision 11.58 ("Regarding Trade in Sturgeons and Paddlefish") and the attached table. The table lists all Acipenseriformes native to the United States, and whether or not there is commercial trade from the wild or aquaculture in each species.

The following is a summary of our non-detriment finding process for native sturgeon and paddlefish exports:

Whenever an exporter (individual, company, institution, etc.) applies for a CITES export permit from the Service, a finding of non-detriment pursuant to CITES is required. For every permit issued, therefore, a non-detriment finding from the U.S. CITES Scientific Authority will be on file. We track the permits that are issued, and the exports from the United States, in order to implement the treaty effectively. For Appendix II species, this monitoring contributes to effective implementation of Article IV, especially paragraph 3.

In general cases, the status of the species in the wild is the primary factor that the Scientific Authority takes into consideration in making a non-detriment finding. We endeavor to consider all of the factors that pertain to the degree of risk to the species, and afford an increased level of scientific scrutiny to those permit requests with increased risk to species and populations in the wild. As with all species, we try to ensure that our sturgeon and paddlefish non-detriment findings are based on the best available biological information, are scientifically grounded, and consider whether the species in the wild is common, abundant, managed, stable, declining, threatened, or endangered. However, in some cases, there is insufficient information to definitively determine that the requested activity would not be detrimental to the species. In those cases, we act in a precautionary manner, noting that there is insufficient information on which to base the required finding of non-detriment; the requested export or import is not approved in such a case. You will note that some sturgeon and paddlefish findings that we sent to you indicate insufficient information (and therefore a permit was not issued).

In the case of sturgeon and paddlefish, based on our ongoing consultations with our States, we particularly consider: (1) the current year's harvest levels; (2) input from State biologists and managers on recent activities with the species; (3) the robustness of the State's management program; (4) the current market situation for the commodity in question; (5) the magnitude of individual catches to ascertain if spawning shoals are being targeted; and (6) all other available biological information. Our non-detriment findings for sturgeon and paddlefish have either been case-by-case findings, State-based general findings, or facility-based (aquaculture) findings.

Species-based general findings, another method we use in some cases, have not been used for sturgeon and paddlefish. We have decided to make case-by-case findings for wild harvests of sturgeon and paddlefish, for a variety of reasons, including: low volumes of trade from native species; few States allowing or requesting exports; and increased risk to the species necessitating increased case-by-case scrutiny. We approve the programs of our States based on information provided to us by them. We do not issue quotas to our States, or national quotas, but rather approve exports from individual States, based upon our satisfaction that the State's harvest or export program is not detrimental to the survival of the species. Please refer to the general non-detriment findings for Montana and North Dakota (the Glendive and North Star operations) in the express-mail package we sent you.

Facility-based non-detriment findings are issued for sturgeon or paddlefish aquaculture facilities with which we are very familiar, whose work usually either benefits species conservation or recovery, where adequate controls are in place as regards augmentation from the wild, and/or where the facility is working with species that we are familiar with. In several cases, we have physically inspected the aquaculture facility. Alternatively, we rely on State agencies that have regulatory mechanisms for monitoring and control of aquaculture facilities.

If your office has any questions about the information provided, please don't hesitate to contact the Chief of the Division of Scientific Authority, Dr. Susan Lieberman, at telephone: (703) 358-1708 or Fax: (703) 358-2276.

Sincerely,



Teiko Saito
Chief, Division of Management Authority



Susan Lieberman, Ph.D.
Chief, Division of Scientific Authority

Attachment

Table 1. Exports of native Acipenseriformes from the United States

Species	Commercial trade permitted?	Product	Source
Shortnose sturgeon <i>Acipenser brevirostrum</i>	No		
Atlantic and Gulf sturgeon <i>Acipenser oxyrinchus</i>	No		
Lake sturgeon <i>Acipenser fulvescens</i>	No		
Pallid sturgeon <i>Scaphirhynchus albus</i>	No		
Alabama sturgeon <i>Scaphirhynchus suttkusi</i>	No		
Shovelnose sturgeon <i>Scaphirhynchus platorhynchus</i>	Yes	Meat	Wild
		Caviar	Wild
Green sturgeon <i>Acipenser medirostris</i>	Yes ¹	No documented international trade	
White sturgeon <i>Acipenser transmontanus</i>	Yes	Meat	Wild
			Captive propagation
		Caviar	Captive propagation
Paddlefish <i>Polyodon spathula</i>	Yes	Caviar	Wild
			Captive propagation
		Meat	Captive propagation
			Wild
		Live eggs	Captive propagation

¹No specimens exported from United States since taxon was listed in 1998.

Appendix B. CITES exporting permits reviewed by the USFWS for export of paddlefish products from the Ohio River Sub-basin, 1997-2000.

MEMORANDUM

To: Chief. Branch of Permits,
Office of Management Authority

From: Chief. Branch of Consultation and Monitoring,
Office of Scientific Authority

Subject: Convention Permit Application

MAR 30 2000

Please be advised that, after examining the available information, we are unable to find that all portions of this export will not be detrimental to the survival of the species, except the shovelnose sturgeon roe supplied by The Fish Market. We find that allowing the export of The Fish Market's shovelnose sturgeon roe will not be detrimental to the survival of the species.

Application number	Applicant	Species	Specimens
18899	Caspian Star Caviar, Inc. Jamaica, NY	Paddlefish (<i>Polyodon spathula</i>) Shovelnose sturgeon (<i>Scaphirhynchus platorynchus</i>)	undetermined amount of processed roe

BASIS FOR ADVICE:

1. The applicant requests a permit to export an undetermined amount of caviar processed from the roe of paddlefish (*Polyodon spathula*) and shovelnose sturgeon (*Scaphirhynchus platorynchus*) to various consignees.
2. The applicant has provided invoices from Royaloff Caviar Company of Chattanooga, Tennessee, indicating the purchase of caviar processed from paddlefish and shovelnose sturgeon (or hackleback, the local common name for *S. platorynchus*), and paddlefish meat. Documentation was not provided to indicate the river and location of harvest of the paddlefish and shovelnose products, nor the names and license numbers of the fishers that harvested the paddlefish and shovelnose sturgeon.

Invoices from The Fish Market of West Union, Illinois, were also included in the application: all invoices are affixed with a stamp that states: "This ROE and or FISH taken from legal waters RIVER." Of the 39 invoices provided, three list the river of origin as the Wabash River in

Illinois: the remaining 36 do not specify a distinct river as the source for the paddlefish and shovelnose roe. In a fax dated January 8, 2000, the owner of The Fish Market furnished a list of the commercial fishers that sold the roe to him along with a statement that all roe was taken from the Wabash River in Illinois.

In a fax dated January 10, 2000, a fishing license for a Mr. Ron Hall of Missouri was submitted by the applicant's attorney. Mr. Hall was identified as another dealer that supplied roe to Caspian Star Caviar, Inc. However, no information was available to indicate the species harvested, the amount of roe taken, or the geographic location where the fish were harvested.

3. Discussions with biologists from the State of Illinois indicate that shovelnose sturgeon populations are considered fairly healthy and there is an open fishery with no limits for this species on the Wabash River. There is no specific information regarding shovelnose abundance on the Wabash River, as there were no indications of a market for shovelnose roe prior to 1999, and shovelnose were not considered a species of concern. However, a recent review of 1999 harvest reports submitted to the State by commercial fishers indicates that Mr. Radloff of the Fish Market reported harvest of shovelnose roe in excess of 2,500 lbs in 1999, and total harvest (all fishers) for the Wabash River exceeded 4,000 lbs.. The state biologists are unable, at this time, to determine that this level of harvest is detrimental, due to a lack of current sampling studies for this species.

The diminutive size of this species (in comparison to other sturgeon species) limits the amount of roe that may be harvested from a single female to less than one pound, and generally averages 0.5 pound. In addition, the sex ratio for shovelnose sturgeon is skewed toward males: there are four males for each female. The sexes are morphometrically similar, and it is impossible to determine a male from a female through a visual inspection. Calculations show that more than 8,000 mature fish (no estimate is available for juvenile fish taken as bycatch) may have been harvested to produce the amount of roe claimed by The Fish Market. Although the State of Illinois does not have a definitive answer to the question of detriment to the wild population of shovelnose sturgeon on the Wabash River, it is our belief that continued harvest at these levels may rapidly result in a fishery that is unsustainable in the future.

Paddlefish are currently regulated by State fisheries agencies. At the present time, six states allow commercial harvest, including Tennessee, Arkansas, Illinois, Kentucky, Mississippi, and Missouri. Paddlefish population declines can be attributed to several factors, including over-exploitation as a result of fishing, habitat modifications, and declining water quality throughout its historic range. Wildlife biologists and resource managers share deep concerns regarding the increasing evidence of over-exploitation of paddlefish for its roe, particularly since the 1998 CITES listing of all previously unlisted Acipensiformes species. Therefore, as a result of population declines, and the current increase in the harvest of paddlefish roe, the Office of Scientific Authority must have information regarding the specific source of all paddlefish roe to determine if allowing an export the roe is detrimental to the survival of the species.

4. The applicant states that all of The Fish Market's roe (paddlefish and shovelnose sturgeon) originated in the Wabash River in Illinois. However, in a press release dated May 22, 1997, the Illinois Department of Natural Resources stated that "[d]ue to concern about the paddlefish population, commercial harvest of paddlefish is banned in all Illinois waters with the exception of

SCIENTIFIC AUTHORITY EXPORT ADVICE - NATIVE SPECIES

APP. NO.: 777027

APPLICANT: Caspian Star Caviar, Incorporated
Jamaica, NEW YORK

SPECIES and SPECIMENS:
3,900 lb. paddlefish (*Polyodon spathula*) caviar

RECIPIENTS: American Airlines, Incorporated

ADVICE

This export will not be detrimental to the survival of the species.

BASIS FOR ADVICE:

Species managed by the State of Kentucky; take from the wild is regulated so that wild populations will remain self-sustaining.

COMMENTS:

Caviar originated from wild specimens taken in the Ohio River commercial fishery. The 3,900 lb. of caviar represents a loss of 490 - 560 mature females from the Ohio River, but this fishery is managed by the State of Kentucky. Currently, there are no seasons, quotas, or creel limits imposed by the state, but Ted Crowell (KY Department of Fisheries and Wildlife Resources, pers. comm.) has said that 25 years of survey data show no decline in local paddlefish populations.

Applicant obtained unprocessed paddlefish roe from Clarksville Fish, Inc. of Clarksville, Indiana, and provided copies of valid KY commercial fishing licenses, FDA HACCP permit, sales receipts, and specific harvest locations used by Clarksville Fish.

BIOLOGIST: _____ CONCUR: _____

ADVICE ISSUED: _____ via copy of advice OMA BIOLOGIST: A. Coppola
OSA:JField 10/23/00; 026440

the Illinois portion of the Ohio River, the Mississippi River south of Lock and Dam 19 near Hamilton, and the Illinois River south of Illinois Route 89 near Spring Valley." On March 24, 2000, Bob Williamson of the Illinois Department of Natural Resources verified that the Wabash River was closed to commercial harvest of paddlefish due to concerns about the population's status. **Therefore, we are unable to find that the export of The Fish Market's paddlefish roe will not be detrimental to the survival of the species in the wild, due to the state's closure of the Wabash River to protect the declining paddlefish population.**

Likewise, the lack of information regarding the actual amount of roe to be exported by the applicant, and no indication of the sources of Royaloff Caviar Co. and Mr. Ron Hall's paddlefish and shovelnose roe, renders us **unable to make a finding that allowing the export of shovelnose sturgeon and paddlefish roe from either Royaloff Caviar Co. or Mr. Ron Hall will not be detrimental to the survival of the species**, for these portions of the application. For any paddlefish export, we must be able to determine the impact on the population from which the specimens being exported (e.g., roe, meat, or live fish) were harvested. For shovelnose sturgeon, since it is listed for purposes of similarity of appearance, the origin of the fish is required for us to determine whether there would be any adverse impacts on either paddlefish or other sturgeon species by allowing this export.

However, due to the open and unlimited nature of the shovelnose fishery on the Wabash River in the State of Illinois, and the lack of substantial information indicating that the export of this shovelnose roe would be detrimental, **we find that allowing the export of The Fish Market's supply of shovelnose sturgeon roe will not be detrimental to the survival of the species on the Wabash River.** We are concerned, however, about whether the number of shovelnose sturgeon derived from this fishery will be sustainable if current harvest levels remain unchecked.

Therefore, we are unable to find that allowing the export of the following will not be detrimental to the survival of the species:

1. All paddlefish and shovelnose sturgeon roe supplied by Royaloff Caviar Co., Chattanooga, Tennessee;
2. All paddlefish and shovelnose sturgeon roe supplied by Mr. Ron Hall of Missouri;
3. Paddlefish roe supplied by The Fish Market, West Union, Illinois.

We find that allowing the export of shovelnose sturgeon roe supplied by The Fish Market, West Union Illinois, will not be detrimental to the survival of the species.

MEMORANDUM

To: Chief, Office of Management Authority
From: Biologist, Office of Scientific Authority
Subject: Convention Permit Application

Please be advised that, after examining the available information, we are unable to find that this export will not be detrimental to the survival of the species.

Application number	Applicant	Species	Specimens
827428	Steve Kinder Perry Park, KY	Paddlefish (<i>Polyodon spathula</i>)	roe (caviar and raw); up to 3 metric tons

BASIS FOR ADVICE:

1. The applicant requests to export up to 3 metric tons (6,600 pounds) of paddlefish roe collected from Kentucky waters, to Transpac Fisheries, Ltd., Tokyo, Japan. This amount of roe represents the production from an estimated 1,000 average-size female paddlefish.
2. The paddlefish were historically abundant in most of the large rivers of the Mississippi River drainage, particularly the Missouri, Ohio, Tennessee, Cumberland, White, Arkansas, and Red Rivers. They also were considered abundant in many of the Gulf Slope river drainages in Texas, Louisiana, Mississippi, and Alabama. Relict populations occurred in Lake Erie and other Great Lakes around the turn of the century, and were known to exist in Ontario, Canada. They have been extirpated from the Great Lakes and Canada, and from some of the peripheral range states such as Pennsylvania, New York, Maryland, and North Carolina. The peripheral range of the paddlefish has continued to decline since the turn of the century. Today, even though paddlefish still occur in 22 States, only remnant populations remain in many of the major river systems and their tributaries where they once were considered to be abundant.
3. Paddlefish are highly mobile and a long-lived fish, grow relatively rapidly, and reach large sizes. In established populations, 15- to 20-year-old fish are common, and some individuals may live 30 years. Individuals between 50 and 100 pounds also are common in older populations, but this size is unusual today throughout most of its present range. Males reach sexual maturity at 7 to 9 years of age and females at 10 to 12 years, but this can vary depending upon the geographical location of the populations. Because paddlefish are highly mobile and long-lived, cumulative adverse impacts associated with environmental alterations of habitat (such as dams,

channelization, gravel mining, and irrigation), overexploitation (especially illegal harvest), and contaminant effects often are not immediately recognized. Its mobility, large size, and tendency to live in large rivers makes it a difficult species to obtain specific population status information on.

4. The State of Kentucky has laws and regulations established regarding the harvest of paddlefish. Although a license is required to commercially harvest paddlefish, there does not appear to be any control over the level of harvest or season of harvest. Although there has been very little research into the population status in Kentucky, according to Edwin Crowell, Assistant Director of Fisheries, Commonwealth of Kentucky, the population is "healthy."

5. In the application, while purportedly taken from Kentucky waters, the specific origin of the roe was not given. When this information was requested from the applicant, Mrs. Kinder stated that, given the competitive nature of paddlefish harvesting and because the applicant want to maintain a high level of confidential operation, the exact origin could not be provided. Given the large but localized range of paddlefish, the exact origin of the paddlefish being collected to harvest the roe is important to determining what impact the harvest will have on the wild population, particularly with such a large volume of roe requested for export.

6. Therefore, since the applicant is not willing to state the origin of the roe, we are unable to determine the origin of the paddlefish and we are concerned that the harvest of such a large number of paddlefish could have a substantial impact on the wild population. Furthermore, even if the roe all originated from paddlefish harvested from Kentucky waters, specific population information is lacking for paddlefish in Kentucky, making the impact of the removal of such a large number of fish difficult to assess. Therefore, we cannot determine that this export would not be detrimental to the survival of the species.

for the Scientific Authority

OSA:TVanNorman:6/2/97:827428x.fsh

SCIENTIFIC AUTHORITY EXPORT ADVICE - NATIVE SPECIES

APP. NO.: 032078

DATE OSA: 9/14/00

APPLICANT: Great Atlantic Trading Co.
Portland, Maine

SPECIES and SPECIMENS: Paddlefish meat (*Polyodon spathula*); 100 lbs.

RECIPIENT: Chosin Suisan Boeki Co.
Tokyo, Japan

BASIS FOR ADVICE:

XXX Species managed by the State of Tennessee, and take from the wild is regulated so that wild populations will remain self-sustaining.

THEREFORE, this export will not be detrimental to the survival of the species.

COMMENTS: All paddlefish meat included in this application was harvested by Mike Kelley, dba Kelley's Katch Caviar, located in Savannah, Tennessee. Mr. Kelley is a licensed fisherman in the State of Tennessee and harvested the paddlefish from Kentucky Lake, Tennessee.

BIOLOGIST: Marie J. Maltese ^{9/21/00} CONCUR: Robert P. Habel ^{9/21/00}

ADVICE ISSUED: SEP 21 2000 OMA BIOLOGIST: C. Hamilton

OSA:Maltese:032078cex

SCIENTIFIC AUTHORITY EXPORT ADVICE - NATIVE SPECIES

APP. NO.: 021457

DATE OSA: 1/5/00

APPLICANT: Great Atlantic Trading Co.
Portland, Maine

SPECIES and SPECIMENS: 700 lbs. of paddlefish roe (*Polyodon spathula*)

RECIPIENT: Daikyu Bussan Ltd.
Osaka, Japan

BASIS FOR ADVICE:

XXX Species managed by the State of Tennessee and take from the wild is regulated so that wild populations will remain self-sustaining.

XXX We are not aware of any reintroduction programs for this species in Tennessee.

THEREFORE, this export will not be detrimental to the survival of the species.

COMMENTS: This paddlefish roe was harvested by Mike Kelley and Ricky Scott, licensed commercial fishers in the State of Tennessee, and sold by Mike Kelley dba Kelley's Catch Caviar. Harvest took place on Kentucky Lake, near New Johnsonville, TN. This area is open for commercial take of paddlefish, and the population can sustain this volume of take without detriment to the wild population, per Jerry Strom, Assistant Regional Manager of Fisheries for West Tennessee.

BIOLOGIST: M. Maltese CONCUR: _____

ADVICE ISSUED: _____ OMA BIOLOGIST: A. Coppola

OSA:Maltese:1/19/00:021457cex

SCIENTIFIC AUTHORITY EXPORT ADVICE - NATIVE SPECIES

APP. NO.: 22662

DATE OSA: 5/2/00

APPLICANT: Great Atlantic Trading Inc.
Portland, Maine

SPECIES and SPECIMENS: Paddlefish (*Polyodon spathula*) roe, 2260 lbs.

RECIPIENT: Universal Traders Ltd.
Osaka, Japan

BASIS FOR ADVICE:

XXX Species managed by the State of Tennessee and take from the wild is regulated so that wild populations will remain self-sustaining.

XXX We are not aware of any reintroduction programs for this species within the State of Tennessee.

THEREFORE, this export will not be detrimental to the survival of the species.

COMMENTS: The largest percentage of paddlefish roe taken for this application was harvested in January and February, 2000; catch dropped off suddenly after February. Jerry Strom, Assistant Regional Manager for western Tennessee fisheries, verified that the State noted very high catch reports for those months, due to drought conditions that resulted in extremely low water levels. Paddlefish congregated in pools and were easily and rapidly harvested during the low water conditions.

BIOLOGIST: Manu J. Maltes ^{5/8/00} CONCUR: Robert P. Gabel ^{5/9/00}

ADVICE ISSUED: MAY 10 2000 OMA BIOLOGIST: A. Coppola
OSA: Maltes:5/8/00:22662cex

MEMORANDUM

To: Chief, Branch of Permits,
Office of Management Authority

From: Chief, Branch of Consultation and Monitoring,
Office of Scientific Authority

Subject: Convention Permit Application

Please be advised that, for the following application, we find that allowing the export of up to 100.17 pounds of paddlefish roe will not be detrimental to the survival of the species, but we are unable to find that the export of the remaining 99.83 pounds will not be detrimental to the survival of the species.

Application number	Applicant	Species	Specimens
021760	Hansen Caviar Co., Inc. Bergenfield, New Jersey	Paddlefish (<i>Polyodon spathula</i>)	200 pounds of processed roe

BASIS FOR ADVICE:

The applicant requests a permit to export 200 lbs. of caviar processed from the roe of paddlefish (*Polyodon spathula*) to Altonaer Kaviar Import Haus in Hamburg, Germany.

No-detriment finding for 100.17 pounds of caviar

1. To document the origin of 100.17 pounds of paddlefish caviar covered by this application, the applicant has provided invoices for their purchase of this amount from Royaloff Caviar Company of Chattanooga, Tennessee. Additional documentation provided by the applicant includes information on the location of harvest, a copy of a valid fishing license issued by the State of Tennessee, and invoices confirming the sale of roe by the fisherman, Anthony Melson, to Royaloff Caviar Co.
2. The documentation provided indicates that this roe was harvested in accordance with regulation promulgated by the State of Tennessee that are designed to support management of the species for long-term sustainability, both within the State and as part of a coordinated effort among range States of the species. The Wildlife Resources Agency of Tennessee is a member of MICRA, an organization of 28 state natural resource departments, instituted in 1991, as a

SCIENTIFIC AUTHORITY EXPORT ADVICE - NATIVE SPECIES

17

APP. NO.: 777027 DATE OSA: 4/2/99
(multiple permits to be issued)

APPLICANT: River of Life Hatchery,
David Mueller, President/Owner
Vadnais Heights, MN 55127

SPECIES and SPECIMENS: Paddlefish (*Polyodon spathula*) eggs, fry, and
fingerlings

RECIPIENTS: Forever Enterprises, Hong Kong; Fortune Wide Asia, Kowloon
City, Hong Kong; Rainbow Aquarium Farm, China; Wun Fat Aquarium, New
Territory, Hong Kong; Chinese Foodstuffs Co. Ltd., Tokyo, Japan; Water World,
Higashi-Osaka, Japan

BASIS FOR ADVICE:

XXX Species managed by the State of Kentucky; take from the wild is
regulated so that wild populations will remain self-sustaining.

THEREFORE, this export will not be detrimental to the survival of the
species.

COMMENTS: Captive-bred stock originated from the paddlefish fishery
managed and regulated by the State of Kentucky and Kentucky State
University Aquaculture Research Center. Wild-caught stock exported
under this permit originated from the paddlefish fishery managed and
regulated by the State of Kentucky.

BIOLOGIST: _____ CONCUR: _____

ADVICE ISSUED: _____ OMA BIOLOGIST: W. Weber

OSA:MMaltese:5/7/99:777027

SCIENTIFIC AUTHORITY EXPORT ADVICE - NATIVE SPECIES

APP. NO.: 024388

APPLICANT: Royaloff Caviar Co.
Savannah, TENNESSEE

SPECIES and SPECIMENS:
American paddlefish (*Polyodon spathula*); one (1) lb. caviar

RECIPIENT: W.G. White LTD.
Middx, TAIWAN

ADVICE

This export will not be detrimental to the survival of the species.

BASIS FOR ADVICE:

Species managed by the State of Tennessee; take from the wild is regulated so that wild populations will remain self-sustaining.

COMMENTS:

Caviar originated from wild specimens taken in the Tennessee River commercial fishery. The applicant provided copies of the fisherman's valid TN commercial fishing license and an invoice showing the sale of a larger 23.6 pound lot of roe from the fisherman to the applicant. The date of sale coincides with the open season for the Tennessee fishery, and the state manages the fishery through a combination of seasons and minimum sizes. In addition, Tennessee requires permitted fishermen to report numbers harvested, fish lengths, and product weights (meat and roe) (Rober Todd, Tenn. Wildlife Resources Agency, pers. comm.). The one (1) pound of caviar represents a negligible loss to the wild population of paddlefish in the Tennessee River.

BIOLOGIST: John Field 1/17/01 CONCUR: Robert P. Habel 1/17/01

ADVICE ISSUED: JAN 17 2001 via copy of advice OMA BIOLOGIST: A. Coppola
OSA:JField 1/17/01; 024388.wpd

Appendix C. Primary tributaries (drainage areas 2,600 km² (1,000 mile²) or more) of the Ohio River. These tributaries account for 89 percent of the entire watershed.

Tributary	Enters Ohio River at river km	Enters Ohio River at river mile	Stream length (km)	Stream length (mile)	Drainage (km ²)	Drainage (mile ²)
Allegheny River (PA)	0.0	0.0	520	325	30,420	11,700
Monongahela River (PA)	0.0	0.0	205	128	19,240	7,400
Chartiers Creek (PA)	4.0	2.5			720	277
Beaver River (PA)	40.6	25.4	34	21	8,138	3,130
Raccoon Creek (PA)	47.4	29.6			520	200
Little Beaver River (PA)	63.2	39.5	82	51	1,326	510
Yellow Creek (OH)	80.6	50.4	54	34	624	240
Cross Creek (OH)	114.6	71.6	43	27	333	128
Buffalo Creek (WV)	119.5	74.7			416	160
Short Creek (OH)	130.2	81.4	46	29	382	147
Wheeling Creek (OH)	145.6	91.0	48	30	281	108
Wheeling Creek (WV)	145.6	91.0			780	300
McMahon Creek (OH)	151.5	94.7	45	28	237	91
Grave Creek (WV)	164.0	102.5			195	75
Captina Creek (OH)	175.4	109.6	62	39	471	181
Fish Creek (WV)	182.1	113.8			650	250
Sunfish Creek (OH)	188.8	118.0	50	31	296	114
Fishing Creek (WV)	205.3	128.3			572	220
Middle Island Creek (WV)	246.4	154.0			1,456	560
Little Muskingum River (OH)	269.3	168.3	112	70	819	315
Duck Creek (OH)	273.1	170.7	83	52	593	228
Muskingum River (OH)	275.5	172.2	179	112	20,904	8,040
Little Kanawha River (WV)	295.4	184.6	256	160	6,032	2,320
Little Hocking River (OH)	306.9	191.8	29	18	268	103
Hocking River (OH)	318.9	199.3	160	100	3,094	1,190
Shade River (OH)	337.0	210.6			575	221
Shady Creek (WV)	353.0	220.6			299	115
Mill Creek (WV)	370.4	231.5			598	230
Leading Creek (OH)	406.7	254.2	48	30	393	151
Kanawha River (WV)	425.1	265.7	155	97	31,720	12,200
Raccoon Creek (OH)	441.6	276.0	174	109	1,778	684
Guyandotte River (WV)	488.3	305.2	106	66	4,342	1,670
Symmes Creek (OH)	493.9	308.7	112	70	926	356
Twelvepole Creek (WV)	501.1	313.2			1,144	440
Big Sandy River (WV-KY)	507.4	317.1	43	27	11,128	4,280
Little Sandy River (KY)	538.2	336.4			1,882	724
Pine Creek (OH)	555.0	346.9	77	48	481	185
Little Scioto River (OH)	558.4	349.0	66	41	606	233
Tygarts Creek (KY)	565.3	353.3			874	336
Scioto River (OH)	570.4	356.5	379	237	16,926	6,510
Kinniconnic Creek (KY)	589.0	368.1			658	253

Appendix C. (continued). Primary tributaries (drainage areas 2,600 km² (1,000 mile²) or more) of the Ohio River. These tributaries account for 89 percent of the entire watershed.

Tributary	Enters Ohio River at river km	Enters Ohio River at river mile	Stream length (km)	Stream length (mile)	Drainage (km ²)	Drainage (mile ²)
Ohio Brush Creek (OH)	620.8	388.0	91	57	1,131	435
Eagle Creek (OH)	665.1	415.7	50	31	400	154
Whiteoak Creek (OH)	678.2	423.9	78	49	608	234
Little Miami River (OH)	741.6	463.5	144	90	4,342	1,670
Licking River (KY)	752.3	470.2	512	320	9,542	3,670
Mill Creek (OH)	756.0	472.5	45	28	432	166
Great Miami River (OH)	785.8	491.1	258	161	14,040	5,400
Tanners Creek (IN)	791.7	494.8			354	136
Laughery Creek (IN)	797.9	498.7	62	39	910	350
Kentucky River (KY)	873.3	545.8	408	255	18,122	6,970
Little Kentucky River (KY)	874.4	546.5	56	35	382	147
Indian Kentucky River (IN)	880.8	550.5			390	150
Silver Creek (IN)	970.4	606.5			585	225
Salt River (KY)	1007.8	629.9	200	125	7,514	2,890
Big Indiana Creek (IN)	1051.2	657.0			658	253
Blue River (IN)	1060.8	663.0			1,131	435
Sinking Creek (KY)	1121.4	700.9			400	154
Anderson Creek (IN)	1170.4	731.5			608	234
Blackford Creek (KY)	1187.5	742.2			322	124
Little Pigeon Creek (IN)	1236.8	773.0			1,079	415
Green River (KY)	1254.7	784.2	592	370	23,998	9,230
Pigeon Creek (IN)	1268.6	792.9			975	375
Wabash River (IN-IL)	1356.8	848.0	758	474	86,060	33,100
Saline River (IL)	1387.7	867.3	43	27	3,042	1,170
Tradewater River (KY)	1397.6	873.5	176	110	2,600	1,000
Cumberland River (KY)	1472.6	920.4	1109	693	46,592	17,920
Tennessee River (KY)	1495.2	934.5	1043	652	106,366	40,910
Cache River (IL)	1561.1	975.7			1,872	720

Data provided by www.orsanco.org.

Appendix D. Current navigational dams of the Ohio River.

Name	River km	River mile	Normal Pool (m)*	Normal Pool (ft)*	Year place in operation**
Emsworth	9.9	6.2	213	710	1921
Dashields	21.1	13.2	208	692	1929
Montgomery	50.7	31.7	205	682	1936
New Cumberland	87.0	54.4	199	664.5	1959
Pike Island	134.7	84.2	193	644	1963
Hannibal (h)	202.2	126.4	187	623	1972
Willow Island	258.7	161.7	181	602	1972
Belleville	326.2	203.9	175	582	1965
Racine (h)	380.0	237.5	168	560	1967
Robert C. Byrd	446.7	279.2	161	538	1937
Greenup (h)	545.6	341	155	515	1962
Meldahl	697.9	436.2	146	485	1964
Markland (h)	850.4	531.5	137	455	1963
McAlpine (h)	970.9	606.8	126	420	1961
Cannelton	1153.1	720.7	115	383	1972
Newburgh	1241.8	776.1	107	358	1975
Myers (Uniontown)	1353.6	846	103	342	1975
Smithland	1469.6	918.5	97	324	1980
Lock and Dam 52	1502.2	938.9	91	302	1928
Lock and Dam 53	1540.2	962.6	87	290	1929

*Height of water surface above mean sea level (National Geodetic Vertical Data).

**Year place in operation defined as when the pool was raised.

(h) Means that the project has hydropower facilities.

Data provided by www.orsanco.org.

Appendix E. Ohio Revised Code 1533.54, a pre-1953 statute, specified the bounds of inland commercial fishing in Ohio.

1533.54. Three hooks per line allowed; angling is the only device permitted; exception:

No person shall draw, set, place, locate, maintain, or possess a pound net, crib net, trammel net, fyke net, set net, seine, bar net, or fish trap, or any part thereof, or throw or hand line with more than three hooks attached thereto, or any other device for catching fish, except a line with not more than three hooks attached thereto or lure with not more than three sets of three hooks each, in the inland fishing district of the state, except for taking carp, mullet, sheephead and grass pike as provided in section 1533.62 of the Revised Code, and except as provided in section 1533.60 of the Revised Code, or as otherwise provided for by division rule. No person shall catch or kill a fish in that fishing district with what are known as bob lines, trotlines, or float lines, or by grabbing with the hands, or by spearing or shooting, or with any other device other than by angling. In the waters of the inland fishing district, except those lakes, harbors, and reservoirs controlled by the state, a trotline may be used with not more than fifty hooks, and no two hooks less than three feet apart, by the owner or person having the owner's consent in that part of the stream bordering on or running through that owner's lands.

Notwithstanding this section, any resident who is licensed to fish with nets in the Ohio River may possess fish nets for the sole purpose of storage, repair, drying, and tarring in the area between United States route fifty and the Ohio River from the Indiana state line to Cincinnati, Ohio, and in the area between United States route fifty-two and the Ohio River from Cincinnati, Ohio to Chesapeake, Ohio, and in the area between state route seven and the Ohio River from Chesapeake, Ohio to East Liverpool, Ohio.

Any person possessing a net in this reserve district shall have an Ohio permit for each net in his possession. The permit shall be issued annually by the chief of the division of wildlife upon application of the owner of the net and submission of evidence by him of his possession of a valid fishing license permitting him to fish with nets in the Ohio River, and the payment of ten dollars for each net for which an application is made and a permit is issued. The permit shall expire at twelve midnight on the fifteenth day of March of each year.

Appendix F. Kentucky commercial fishing regulations, effective 2001.

Kentucky Administrative Regulations
TITLE 301
TOURISM DEVELOPMENT CABINET DEPARTMENT OF FISH AND WILDLIFE RESOURCES

Chapter 1 Fish

301 KAR 1:060. Sport and rough fish.

RELATES TO: KRS 150.010

STATUTORY AUTHORITY: KRS 13A.350, 150.015

NECESSITY, FUNCTION, AND CONFORMITY: The purpose of this administrative regulation is to limit the taking of certain fishes to angling. It is necessary to protect the fish population. This amendment is necessary to clarify the prohibition against using sport fish as bait.

Section 1. The following fishes are designated sport fishes and may be taken only by angling:

Largemouth Bass	Rockfish (Striped Bass)
Smallmouth Bass	White Bass
Kentucky Bass	Yellow Bass
Coosa Bass	Musky
Rock Bass	Northern Pike
White Crappie	Chain Pickerel
Black Crappie	Trout
Walleye	Hybrids of any of the above
Sauger	

Section 2. All species of fishes, except those listed in Section 1 of this regulation, are hereby designated as rough fish and may be harvested by the methods prescribed by any section of KRS Chapter 150 or by any regulation adopted by the department, including angling.

301 KAR 1:140. Special commercial fishing permit.

RELATES TO: KRS 150.450(2)

STATUTORY AUTHORITY: KRS 150.025(1)

NECESSITY, FUNCTION, AND CONFORMITY: KRS 150.025(1) authorizes the department to regulate the size or type of devices and methods used to take wildlife, including rough fish and the places where they may be taken. This administrative regulation is necessary to specify the waters open to, and other restrictions on the use of, gill and trammel nets.

Section 1. Definitions.

- (1) "Bar mesh size" means the distance between two (2) knots on a line of a net.
- (2) "Permit" means a special commercial fishing permit.
- (3) "Rough fish" is defined by KRS 150.010(32).
- (4) "Whip set" means a gill net or a trammel net rigged so it is free-floating.

Section 2. A person who has in his possession a valid special commercial fishing permit and a commercial fishing license may use a gill net or a trammel net to take rough fish:

- (1) From November 1 through:
 - (a) March 31 in Kentucky Lake; and
 - (b) The last day of February in Barkley Lake.
- (2) In the portions of Kentucky and Barkley lakes open to commercial fishing as specified in 301 KAR 1:150.

Section 3. A person using a gill net or a trammel net in the waters specified in Section 2 of this administrative regulation shall:

- (1) Before fishing, apply for a permit by providing on a form provided by the department his:
 - (a) Name;
 - (b) Address;
 - (c) Telephone number; and
 - (d) Fish markets he intends to use;
- (2) Have the permit in his possession while:
 - (a) Fishing with a gill net or a trammel net;
 - (b) Transporting a gill net or a trammel net; or
 - (c) Selling fish taken with a gill net or a trammel net;
- (3) Tag a gill net or a trammel net as specified in KRS 150.175(1)(d);
- (4) Not use a gill net or a trammel net with a bar mesh size smaller than three and one-half (3-1/2) inches or larger than four and one-half (4-1/2) inches, except that a whip set may have a minimum bar mesh size of three (3) inches;
- (5) Not fish a stationary set net with the top of the net or float line shallower than three (3) feet below the surface;
- (6) Tend each net, except whip sets, at least once every twenty-four (24) hours;
- (7) Not leave whip sets unattended;
- (8) Affix a decal supplied by the department to each side of the boat or motor he uses for fishing under the special commercial fishing permit so that the decal is clearly visible while the boat is used for fishing with a gill net or a trammel net;
- (9) Not release a rough fish; and
- (10) Fish a minimum of 800 yards of net for at least one-fourth (1/4) of the season.

Section 4. The permit holder may be accompanied by one (1) unlicensed helper, who shall be:

- (1) In the same boat with the permit holder while fishing with a gill net or a trammel net; or
- (2) Accompanied by the permit holder while transporting or selling fish taken under the permit.

Section 5. The permit holder shall:

- (1) Maintain an accurate record of daily fishing activity and fish sales; and
- (2) Submit a weekly report to the department:
 - (a) On a form provided by the department, providing information on:
 1. The number of each species of rough fish taken;
 2. How the fish were disposed of; and
 3. The average total length of nets fished each day, with separate entries for:
 - a. Gill nets;
 - b. Trammel nets; and
 - c. Whip sets.
 - (b) Duplicate receipts for fish sold.

Section 6. The department shall:

- (1) Not renew the permit of a person who does not submit a report as specified in Section 5 of this administrative regulation.
- (2) Revoke the permit of a person found guilty of violating a statute or administrative regulation pertaining to commercial fishing for three (3) years.

Section 7. Incorporation by Reference.

- (1) The following material is incorporated by reference:
 - (a) Application for a Special Commercial Fishing Permit, 1998.
 - (b) Permit Fisherman's Daily Catch Report, 1998.
- (2) This material may be inspected, copied or obtained at the Department of Fish and Wildlife Resources, #1 Game Farm Road, Frankfort, Kentucky 40601, Monday through Friday, 8 a.m. to 4:30 p.m.

301 KAR 1:146. Commercial fishing gear.

RELATES TO: KRS 150.010, 150.025, 150.120, 150.170, 150.175, 150.445, 150.450, 150.990

STATUTORY AUTHORITY: KRS 13A.350, 150.025

NECESSITY, FUNCTION, AND CONFORMITY: It is necessary to accurately describe the gear allowed in commercial fishing so that the proper size and species of fish can be harvested, the sport fish populations are not adversely affected and perpetuation of the fishery resource is assured. This amendment is necessary to readjust the hoop net mesh size on the Ohio River for a two (2) year transition period.

Section 1. The functions of the various commercial fishing tags authorized under KRS 150.175 are consolidated into one (1) tag called "commercial gear tag" which shall serve as they each were designated in KRS 150.175, subsections (5), (6), (7) and (8).

Section 2. All lines and mesh shall be made of linen, cotton or flexible synthetic fiber only. All mesh shall be measured by bar measure. This measure is the length of one (1) side of the square, or as measured between two (2) knots on the same line.

Section 3. The following gear is the only commercial gear that shall be used in commercial waters designated in 301 KAR 1:150 and under conditions described in 301 KAR 1:155 by appropriately licensed commercial fishermen:

(1) Hoop net, wing net, straight lead net, heart lead net.

(a) Shall have a minimum mesh size of three (3) inches, except in the Ohio River, the Mississippi River, those portions of the Cumberland River below Barkley Dam and the Tennessee River below Kentucky Dam that are open to commercial fishing where the minimum mesh size shall be one (1) inch.

(b) Hoops may be any size or shape or material.

(c) Maximum length of each lead or wing shall be sixty (60) feet.

(d) Wings and leads must be constructed of multifilament natural or synthetic material only.

(e) Netting used for wings and leads shall be constructed of twine no smaller than number six (#6) nylon or equivalent, having a breaking strength of fifty-five (55) pounds or greater.

(f) Wings and leads may be of knotted or knotless construction and shall have a mesh size no larger than one (1) inch.

(g) Hoop nets, wing nets, straight lead nets or heart lead nets shall be fished as individual nets. Wings or leads shall not be tied together so as to become continuous multiple net units.

(h) Wings and leads shall be used only to lead fish into the hoop net.

(i) One (1) commercial gear tag shall be attached to the first hoop of each net.

(2) Gill net or trammel net.

(a) May be used only in Ohio and Mississippi Rivers and overflow lakes directly connected with each river or as specified in 301 KAR 1:140. Minimum mesh size is three (3) inches in the Mississippi and its overflow lakes and four (4) inches in the Ohio River and its overflow lakes.

(b) May be fished weighted or as a flag net.

(c) Shall have one (1) commercial gear tag attached to each 100 feet or part thereof.

(3) Commercial trotline.

(a) Shall have more than fifty (50) hooks placed no closer than eighteen (18) inches apart.

(b) Shall have one (1) commercial gear tag attached.

(c) Shall be no longer than 3,000 feet, including staging, and shall be fished separately, not tied together in a continuous line.

(4) Seine.

(a) Shall have a maximum mesh size of one (1) inch and may be of knotted or knotless construction. Knotted netting shall be constructed of twine no smaller than number 6 (#6) nylon or equivalent having a breaking strength of fifty-five (55) pounds or greater, and knotless netting shall be constructed of twine no smaller than #147 nylon or equivalent having a breaking strength of fifty (50) pounds or greater.

(b) Shall be constructed of multifilament natural or synthetic material only.

(c) Shall have both float and lead lines.

(d) Shall have wood, fiberglass, or metal poles or brails attached at each end.

(e) Shall be attended by persons pulling the seine by hand through the water for the entrapment of fish.

(f) Shall have one (1) commercial gear tag attached to each 100 feet or part thereof.

(5) Slat trap basket.

(a) Shall have no wire or other mesh added to any part of trap.

(b) Shall have at least two (2) openings left between slats no smaller than one and one-fourth (1 1/4) inches wide in the catch portion of the trap. These openings shall not be restricted by cross-bracings to a length shorter than eight (8) inches.

(c) Shall be no larger than two (2) feet in diameter or square-end measure.

(d) Shall have one (1) commercial gear tag attached to opening ring or square.

301 KAR 1:150. Waters open to commercial fishing.

RELATES TO: KRS 150.010, 150.025, 150.120, 150.170, 150.175, 150.445, 150.450, 150.990

STATUTORY AUTHORITY: KRS 13A.350, 150.025

NECESSITY, FUNCTION, AND CONFORMITY: It is necessary to regulate the places where commercial fishing is permitted to insure that the size of the water and fish population is large enough for this type of activity to better utilize and conserve those populations concerned. This amendment is necessary to close commercial fishing in Mud River and the tailwater areas below the highlift dams on the Ohio River.

Section 1. Appropriately licensed commercial fishermen may fish with commercial fishing gear in the following designated waters subject to requirements as set forth in administrative regulations designating commercial gear and manner of taking. Commercial gear shall be used in no other waters of the commonwealth except under specific permit.

Section 2. Commercial Fishing Waters.

(1) Streams and rivers.

(a) Barren River from its junction with Green River upstream to Greencastle, Kentucky;

(b) Big Sandy River from its junction with Ohio River upstream to junction of Levisa and Tug Forks;

(c) Levisa Fork from its junction with Big Sandy River upstream to 200 yards below mouth of Paint Creek in Johnson County;

(d) Cumberland River from its junction with Ohio River upstream to Highway 62 bridge;

(e) Eagle Creek from its junction with Kentucky River upstream to Highway 22 bridge in Grant County;

(f) Green River from its junction with Ohio River upstream to 200 yards below Lock and Dam 6;

(g) Highland Creek from its junction with Ohio River upstream to Rock Ford Bridge in Union County;

(h) Kentucky River from its junction with Ohio River upstream to junction of North and Middle Forks of Kentucky River;

(i) North Fork of Kentucky River from its junction with Kentucky River upstream to mouth of Walker's Creek;

(j) South Fork of Kentucky River from its junction with Kentucky River upstream to mouth of Cow Creek;

(k) Licking River from its junction with Ohio River upstream to a point directly adjacent to Highway 111 on the Bath and Fleming Counties line;

(l) Mississippi River from the mouth of Ohio River downstream to the Tennessee line;

(m) Ohio River from its junction with Mississippi River upstream to West Virginia state line except those segments of the river that extend below the following locks and dams wherein slat baskets are the only piece of commercial gear allowed:

1. Smithland Dam downstream to the end of the outer lock wall.

2. Uniontown Dam downstream to the end of the outer lock wall and that portion of the split channel around the southern part of Wabash Island from the fixed weir dam to the first dike.

3. Newburgh Dam downstream to the end of the outer lock wall.

4. Cannelton Dam downstream to the end of the outer lock wall.
5. McAlpine Dam downstream to the K&I railroad bridge.
6. Markland Dam downstream to the end of the outer lock wall.
7. Meldahl Dam downstream to the end of the outer lock wall.
8. Greenup Dam downstream to the end of the outer lock wall.

- (n) Pond River from its junction with Green River upstream to Highway 62 bridge;
- (o) Panther Creek from its junction with Green River upstream to head of creek;
- (p) Rough River from its junction with Green River upstream to Highway 69 bridge at Dundee, Kentucky;
- (q) Tennessee River from its junction with Ohio River upstream to River Mile 17.8;
- (r) Tradewater River from its junction with Ohio River upstream to bridge; and
- (s) Salt River from its junction with the Ohio River upstream to the northwestern boundary of Ft. Knox.

(2) Lakes. The following lakes are open to commercial fishing, but not above the first shoal or riffle upstream from the impounded or standing pool of the lake in any main or tributary stream except as noted below:

- (a) Barkley;
- (b) Cumberland Lake is closed above the confluence of Koger Creek on the Big South Fork Tributary;
- (c) Herrington;
- (d) Kentucky;
- (e) Nolin;
- (f) Rough River;
- (g) Overflow lakes directly connected to the Mississippi and Ohio Rivers;
- (h) Dewey Lake is open uplake to Buffalo Bridge; and
- (i) Barren Lake

301 KAR 1:155. Commercial fishing requirements.

RELATES TO: KRS 150.010, 150.120, 150.170, 150.175, 150.445, 150.450(2), (3), 150.990

STATUTORY AUTHORITY: KRS 150.025(1)

NECESSITY, FUNCTION, AND CONFORMITY: KRS 150.025(1) authorizes the department to prescribe by administrative regulation the methods and devices used to take wildlife, as well as the buying and selling of wildlife. The function of this administrative regulation is to regulate taking fish for commercial use, to avoid conflicts with other interests, and to utilize and conserve the populations of these fishes.

Section 1. Definitions.

- (1) "Commercial fisherman" means a person holding a valid resident or nonresident commercial fishing license.
- (2) "Commercial fishing gear" means the equipment described in 301 KAR 1:146.
- (3) "Overflow lake" means a permanent or temporary body of water that receives overflow flood waters from an adjacent stream.
- (4) "Sport fish" means those species so designated by 301 KAR 1:060.
- (5) "Unlicensed helper" means a person without a commercial fishing license who is assisting a commercial fisherman.

Section 2. Unlicensed Helpers.

- (1) A commercial fisherman shall not utilize more than one (1) unlicensed helper.
- (2) An unlicensed helper shall not use commercial fishing gear or sell fish unless he is accompanied by a licensed commercial fisherman.

Section 3. Tagging And Using Commercial Gear. A person shall:

- (1) Tag commercial gear so that a law enforcement officer can find and read the tag without undue difficulty.
- (2) Not use commercial gear:

- (a) Within fifty (50) yards of the outlet or inlet of an overflow lake.
- (b) Within fifty (50) yards of the mouth of a stream except the mouth of the Ohio River.
- (3) Not use commercial nets from April 1 through October 31:
 - (a) In bays and inlets of Kentucky or Barkley Lakes; and
 - (b) For a distance of 200 yards from the mouth of bays or inlets in Kentucky or Barkley Lakes.

Section 4. Sport Fish and Endangered Species. A person taking a sport fish or an endangered species by commercial gear shall immediately return the fish, without undue injury, to the waters from which it was taken.

Section 5. Tending Gear and Removing Fish. A person shall:

- (1) Tend and remove the fish from:
 - (a) Baited hoop nets or slat traps at least every seventy-two (72) hours.
 - (b) Other commercial fishing gear at least every twenty-four (24) hours.
- (2) Remove commercial fishing gear from the water when he has finished fishing.

Section 6. Reporting. Beginning March 1, 1999:

- (1) A commercial fisherman shall report his catch monthly to the department:
 - (a) By the tenth day of each month;
 - (b) On forms provided by the department.
- (2) The department shall not renew the license of a commercial fisherman who does not submit:
 - (a) A report for each month of the license year, including a month during which he did not fish; or
 - (b) The information required on the report form.
- (3) The report form shall include the following information, if applicable:
 - (a) Days of month fished;
 - (b) Water body fished;
 - (c) Kind of gear used, including:
 - 1. Gill net;
 - 2. Trammel net;
 - 3. Hoop net;
 - 4. Fishing pole;
 - 5. Trot line;
 - 6. Slat trap;
 - 7. Seine; and
 - 8. Dip net; and
 - (d) Weight of the catch by species.

Section 7. Incorporation by Reference.

- (1) The Monthly Report of Commercial Fish Harvest in Kentucky, 1998 edition, is incorporated by reference.
- (2) It may be obtained or copied at the Department of Fish and Wildlife Resources, #1 Game Farm Road, Frankfort, Kentucky 40601, between 8 a.m. and 4:30 p.m. on normal business days.

Appendix G. Indiana fishery regulations pertaining paddlefish, effective May 1, 2001.

Statewide Paddlefish Regulations

Paddlefish may only be taken from the Ohio River. Any paddlefish caught from public lakes or streams or other rivers in Indiana must be returned.

Ohio River Sport Snagging Regulations

You may not sort or release any lawfully snagged paddlefish. After two paddlefish are taken no more snagging is allowed. Snagging is prohibited within 200 yards of a dam on the Ohio River.

Snagging on the Ohio River for non-sport fish (which includes paddlefish) is allowed from February 1 through May 10 using one single or treble hook. Snagging is not allowed from a boat or platform or along a bay or tributary to the Ohio River.

Ohio River Commercial Fishing Regulations

312 IAC 9-8-6 Commercial fishing on the Ohio River

Authority: IC 14-22-2-6; IC 14-22-13

Affected: IC 14-22

Sec. 6

(a) This section applies to commercial fishing on the Ohio River.

(b) No person shall take or sell fish except in accordance with this section and 312 IAC 9-10. A person may take fish with the aid of illumination of a spotlight, searchlight, or artificial light where lawfully engaged in commercial fishing.

(c) A license holder under this section may take and sell all species of fish from the Ohio River except the following: largemouth bass, smallmouth bass, spotted bass, rock bass, white crappie, black crappie, walleye, sauger, saugeye, striped bass, white bass, hybrid striped bass, yellow bass, muskellunge, northern pike, tiger muskellunge, chain pickerel, lake sturgeon, trout, salmon.

(d) A license holder under this section must tag each item of gear so that a conservation officer may determine if the gear is properly licensed and the license holder is complying with the law.

(e) No person shall possess a seine, net, or commercial trotline except as authorized for a commercial fishing license for the Ohio River. This subsection does not apply to a manufacturer, retailer, or wholesale dealer who possesses gear exclusively for sale.

(f) Commercial fishing nets authorized under this section cannot be used on a bay or inlet of the Ohio River. A line drawn from point to point of a bay or inlet denotes the limits of the fishing zone. Commercial gear cannot be used with fifty yards of the mouth of a stream. Commercial gear, except slat traps, cannot be used in the following locations:

(1) Uniontown (Myers) Dam downstream of the outer lock wall and the portion of the split channel around the southern part of Wabash Island from the fixed weir dam to the first dike.

(2) Newburgh Dam downstream to the end of the outer lock wall.

(3) Cannelton Dam downstream to the end of the outer lock wall.

(4) McAlpine Dam downstream to the K and I railroad bridge.

(5) Markland Dam downstream to the end of the outer lock wall.

(g) Each item of fishing gear in use must be tended no less frequently than once every twenty-four hours and all fish taken by the gear removed, except that baited hoop nets or slat traps may be left unattended for not more than seventy-two hours. Each item of gear must be removed from the waters in which the item was fished immediately upon usage.

(h) Gear is authorized only as set forth as follows:

(1) Lines and mesh must be made of linen, cotton, or a flexible synthetic fiber.

(2) The following restrictions apply to a hoop net, wing net, straight lead net, or heart lead net:

(A) Each net described in this subdivision must have a minimum bar mesh size of one inch.

(B) Hoops may be any size, shape, or material.

- (C) The maximum length of the lead or wing is sixty feet.
- (D) One tag must be attached to the front hoop of each net.
- (3) The following restrictions apply to a gill or trammel net:
 - (A) The minimum bar mesh size is four inches.
 - (B) The nets reference in this subdivision may be fished weighed or as a flag net.
 - (C) A tag must be attached to the net at intervals not less than one hundred feet apart.
- (4) The following restrictions apply to a commercial trotline:
 - (A) Each line must have more than fifty hooks placed no closer than eighteen inches apart.
 - (B) One tag must be attached.
 - (C) The trotline must be not longer than three thousand feet, including staging, and must be fished separately rather than tied in a continuous line.
- (5) The following restrictions apply to a seine:
 - (A) A seine must have a minimum bar mesh size of one inch.
 - (B) A seine must have both bloat and lead lines.
 - (C) A seine must have wood, fiberglass, metal poles, or brails attached to each end.
 - (D) A seine in the water must be attended by persons pulling the seine through the water for the entrapment of fish.
 - (E) A seine must have a tag attached at intervals not less than one hundred feet apart.
- (6) The following restrictions apply to a slat trap basket:
 - (A) No wire or other mesh may be added to the trap.
 - (B) At least two openings no less than one and one-fourth inches wide must be located between the slats. These openings shall not be restricted by cross-bracings shorter than eight inches long.
 - (C) The trap shall be no larger than two feet in diameter or square end measure.
 - (D) A tag must be attached to the open ring or square.
- (i) A license holder must keep accurate daily catch records on a departmental form of the following:
 - (1) The pounds and species of fish caught by gear type.
 - (2) The number of paddlefish and shovelnose sturgeon caught by gear type.
 - (3) The pounds of paddlefish, shovelnose sturgeon, sucker, and eggs sold.
 - (4) The location fished by pool, river mile, and county.
- (j) The license holder must submit to the department the completed form required under subsection (i) by the fifteenth day of each month for the preceding month whether the license holder fished or not.
- (k) The license holder must allow on-board and dockside inspection of the gear and catch at any time by the director or the director's representative. (*Natural Resources Commission, 312 IAC 9-8-6; filed May 12, 1997, 10:00 a.m. 20 IR 2725; filed May 28, 1998, 5:14 p.m.: 21 IR 3727*)

Appendix H. Illinois commercial fishing regulations and information, effective May 1, 2001.

This information is taken from the Fish and Aquatic Life Code and Administrative Rules. It does not supersede or modify the Fish and Aquatic Life Code or Administrative Rules and is presented only as a guide, which is subject to change.

Definitions

Resident Commercial Fishermen: An individual who has actually resided in Illinois for one year immediately preceding his application for a Commercial Fishing License and who does not claim residency for a commercial fishing license in another state or country.

Dressed: Means having the head of aquatic life removed.

WATERS OPEN TO COMMERCIAL FISHING (open year round except as noted)

1. Lake Michigan (limited entry). For further information on Lake Michigan, contact the Division of Fisheries, Lake Michigan Program, 9511 Harrison Street, Des Plaines, IL 60016.
2. Mississippi River and backwaters, except Quincy Bay, including Quincy Bay Waterfowl Management Area, and U.S. Fish and Wildlife Service National Wildlife Refuge waters, but includes that portion of the Kaskaskia River below the navigation lock and dam.
3. Illinois River and backwaters from Route 89 highway bridge downstream, except for:
 - a) U.S. Fish and Wildlife Service National Wildlife Refuge waters;
 - b) Donnelly/DePue Fish and Wildlife Area;
 - c) Rice Lake Complex, including all of Big Lake; and
 - d) Meredosia Lake in Cass and Morgan Counties during duck season.
4. Wabash River.
5. Little Wabash River.
6. Skillet Fork (Wayne, Hamilton and White Counties).
7. Embarras River, except from Route 130 in Coles County upstream to Route 16 including Lake Charleston.
8. Sangamon River from Belt Route 48 southwest of Decatur downstream to its mouth in Cass County.
9. Kaskaskia River south of Route U.S. 50 bridge to mouth in Randolph County.
10. Big Muddy River south of State Route 14 Highway bridge in Franklin County to mouth in Jackson County.
11. Cache River from Route 51 downstream to the Mississippi River via Cache Diversion Channel but not including that portion of the Cache River between the Cache Diversion Channel Levee and the Ohio River.
12. Saline River in Gallatin and Saline Counties.
13. Ohio River.

Commercial fishing will not be permitted in any stream, ditch or tributary connected to the backwaters of the aforementioned waters. Other waters (lakes and streams) may be open to commercial fishing by special season or contract with the Illinois Department of Natural Resources.

SIZE LIMITS ON FISH THAT MAY BE TAKEN COMMERCIALY

No channel, flathead, blue, and white catfishes under 15 inches in length undressed, or under 12 inches dressed, or under 10.7 inches dressed with the first vertebrae (T bone) removed may be taken (except in the Ohio River where there is no minimum size). There is no size limit on carp, buffalo, drum, bullhead, shovelnose sturgeon, paddlefish, sucker, gar (except that alligator gar may not be taken), bowfin, eel, mooneye, goldeye, carpsuckers, white amur (grass carp), gizzard shad, redhorses, bighead and silver carp, goldfish and minnows. Any person operating commercial fishing devices shall have no other species of Aquatic Life in his possession.

PADDLEFISH may not be commercially harvested except in the Ohio River, the Illinois River below Route 89, and the Mississippi River below Lock and Dam 19.

GEAR AND USE LIMITATIONS

Hoop nets, basket traps, trot lines and dip nets may be used in all of the aforementioned waters.

Basket Traps: Must be constructed of wood or plastic slats and must have an unobstructed opening or openings in the rear of not less than 1-1/2 inches square. Wire traps are illegal.

Trot lines: Must have hooks spread at intervals of not less than 24 inches. Trot, set, or throw lines may not be drawn through the water to snare or snag fish.

Hoop Nets: Must have a mesh not less than one inch bar measurement and attached wings and leads must not be smaller than number 9 twine.

Dip Nets: Must have a mesh size not less than 1-1/2 inches bar measurement and must not be more than 15 feet square or in diameter.

Trammel and Gill Nets: Trammel nets must have mesh of not less than 2 inches bar measurement (except in the Ohio River where trammel nets must have a mesh of not less than 4 inches bar measurement), gill nets not less than 4 inches. Neither shall be less than 100 feet in length. It is unlawful to use trammel or gill nets except in the Ohio River, Mississippi River and the Illinois River from its mouth up to Illinois highway Route 89, including adjacent backwaters, but not above the mouth of any stream, ditch, or tributary connected to such backwaters. All trammel and gill nets set shall be under immediate supervision of the operator or his employee except from May 1 to September 30, or except when nets are set under ice, or from sunset to sunrise.

Trammel nets and gill nets may be used in additional waters where authorized by contract from the Illinois Department of Natural Resources.

Seines may be used only in the Ohio River, Illinois River, Mississippi River (except seining will not be permitted in Boston Bay and its connected backwaters above the mouth of Boston Bay in Mercer County) and Wabash River, except where authorized by contract from the Illinois Department of Natural Resources. Except for seines, no other devices may be pulled, dragged, hauled or drawn to or near shore or to or against any backstop.

Seines: Seines up to 100 yards in length may have a minimum mesh size of 1-1/2 inches bar measurement; in seines over 100 yards in length, the mesh size shall not be less than 2 inches bar measurement, except that all seines over 100 yards in length may have a section not exceeding 300 feet of 1-1/2 inch bar measurement. No seine shall be more than 1500 yards long. If seines are more than 200 yards long, they must be operated with a backstop of vertical slats not less than 1-1/4 inches apart or with 3 inch bar measurement netting or of chicken wire or metallic cloths with mesh of not less than 1-1/2 inches square and shall be operated in not less than two feet of water.

Commercial devices may not be used within 300 yards above or below any spillway, fishway, lock or dam, or in such a manner as to block more than one-half of the width of any stream or watercourse.

Live boxes and nets: Must be plainly labeled with the owner's name and address.

OPERATION AND DISTURBANCE OF GEAR

It is illegal to loan licenses for operation of commercial fishing gear. One may not disturb the licensed equipment of another person without that person's consent.

DISPLAY OF TAGS: All gear must be tagged with a 2001 Gear tag and the owner's name and address as follows:

Seines: Tag or tags shall be attached to the brail or to the leader line adjoining the brail on either end of the seine.

All nets: Tag shall be attached to the rear hoop, tail line or on the tail pole.

Other devices: Tag shall be in such a position as to be exposed to public view.

CHECKING GEAR

Commercial fishing devices must be checked and emptied of catch at the following time intervals:

1. Hoop nets and basket traps must be attended at least once every 48 hours during open water conditions. During ice cover conditions, hoop nets and traps must be attended at least once every 20 days.

2. Trammel and gill nets must be attended constantly from October 1 to April 30 during open water conditions and daylight hours and at least every 24 hours during May 1 to September 30. Under ice they must be attended at least every 96 hours.
3. Trotlines and other hook and line devices must be checked at least every 24 hours
4. Seines and trammel or gill nets fished by driving or drifting must be constantly attended.
5. Commercial gear containing dead or moribund fish as a result of failure to check gear and empty catch shall be considered an illegal device.

NETTING UNDER THE ICE

Holes shall be marked so as to be clearly visible. Trammel nets shall be set not less than 100 yards from any natural opening in the ice.

IMPORTED FISH

Fishes imported into Illinois must be in containers labeled as to the state and county of origin and must bear the name and address of the transporter.

RECORDS MAINTAINED BY COMMERCIAL FISHERMEN

Commercial Fisherman shall keep an accurate record throughout the year of their catch and commercial fishing activities showing the species and number of pounds taken, type of gear used and location taken. Additional information required includes disposition of fish and eggs harvested and price received for fish and eggs sold. This information shall be open for inspection by the Department of Natural Resources at all times and shall be submitted to DNR on official forms as requested by the Department. Failure to submit such required reports is a violation of Illinois Law and shall be grounds for the Department to refuse to issue a license for the following year.

PROTECTED SPECIES

All aquatic life on the State and Federal Endangered and Threatened Species List cannot be taken or in possession. The list is available from the Division of Natural Heritage, 524 South Second street, Lincoln Tower Plaza, Springfield, Il 62706. The State endangered river otter is occasionally taken in nets of commercial fishermen. Reporting of accidental captures should be made to the Department of Natural Resources County Conservation Police Officer or Endangered Species Program Manager (217/785-8290).

CONSENT OF LANDOWNERS

Commercial fishermen are responsible for obtaining permission to fish from the landowner(s) of the aforementioned waters.

SALE OF AQUATIC LIFE

Licensed commercial fishermen may sell commercial species of fish legally taken by themselves in commercial fishing devices to a **resident** licensed wholesale fish dealer without additional license.

Resident Retail Fish Dealer's License

Illinois resident commercial fishermen operating a retail fish market in Illinois or offering for retail sale their commercial catch, must also possess a Resident Retail Fish Dealers License. A separate license is required for each location and for each vehicle from which aquatic life is sold.

Resident Wholesale Fish Dealer's License

Illinois resident commercial fishermen who operate a wholesale fish market in Illinois or who sell or ship aquatic life to any other wholesaler, retailer, or commercial institution (other than a licensed resident wholesale fish dealer) must possess a Resident Wholesale Fish Dealer's License. A separate license is required for each location and for each vehicle from which aquatic life is sold.

Non-resident Fish Dealer's License

Any non-resident commercial fisherman who sells or ships aquatic life to other wholesalers, retailers, or consumers must possess a non-resident fish dealer's license. A separate license is required for each location and for each vehicle from which aquatic life is sold.

REQUIRED RECORDS FOR FISH DEALERS

Resident and Non-resident Fish Dealers shall maintain records of all aquatic life bought, sold, and shipped. The records shall include the name of the seller, the species, and the poundage. The records shall be made immediately available to authorized employees of the Department of Natural Resources upon request.

REQUIRED RECEIPTS FOR FISH DEALERS

Fish Dealers shall issue a numbered receipt to the person the aquatic life is purchased or received from listing the number of pounds and kinds of aquatic life, the date of purchase, the price paid per pound for each species, the name and address of the person the aquatic life was received from, the appropriate license number of the seller, and the origin of the aquatic life. A duplicate copy of the receipt shall be given to the person the aquatic life was received from. The original copy of the receipt shall be maintained by the fish dealer for a minimum of two years from the date of the transaction. All receipts, reports, and records shall be open for inspection by any law enforcement officer upon request.

SHIPMENT OF AQUATIC LIFE: LABELS AND TAGS

Any person shipping or transporting aquatic life shall attach to every container a tag showing the different varieties of aquatic life contained within, the pounds of each variety, the name and place of business of the consignor and of the consignee, and the number and type of license.

CURRENT LICENSE FEES

All commercial fishermen shall have a Commercial Fishing License. Persons assisting a commercial fisherman must also have a commercial fishing license unless those persons are under direct supervision of and aboard the same water craft as the licensed commercial fisherman.

Initial commercial licenses and device tags are available from:

Commercial Permits

524 South Second St. Room 210

Springfield, IL 62701-1787 Phone 217 -785-3423

Device tags only are available from local license vendors.

All commercial fishing licenses expire on March 31st of each year; all resident and non-resident fish dealer and minnow dealer licenses expire on January 31st of each year. There is a \$.50 issuing fee per license sold by a vendor. The prices listed below include the \$.50 licensing fee.

<u>Type</u>	<u>Resident</u>	<u>Non-Resident</u>
Commercial Fishing License	\$ 35.00	\$ 150.00
Commercial Fishing Type A Device Tag: Hoop net, basket trap, trot line (100 hooks), dip net	3.50	6.50
Commercial Fishing Type B Device Tag: Each 100 yards or fraction thereof, For seine, minnow seine*, trammel net, or gill net	18.50	36.50*
Resident Wholesale Fish Dealer License	50.00	
Non-resident Fish Dealer License		100.00
Resident Retail Fish Dealer License	10.00	
Wholesale Minnow Dealer (intra-state)	25.00	Resident Only
Retail Minnow Dealer (intra-state)	5.00	Resident Only
Minnow Dealer (inter-state)	500.00	Resident Only

* minnow seines are resident only devices

The Illinois Department of Natural Resources receives Federal financial assistance and therefore must comply with federal anti-discrimination laws. In compliance with the Illinois Human Rights Act, the Illinois Constitution, Title VE of the 1964 Civil Rights Act, Section 504 of the Rehabilitation Act of 1973 as amended, and the U.S. Constitution, the Illinois Department of Natural Resources does not discriminate on the basis of race, color, sex, national origin, age or disability. If you believe that you have been discriminated against in any program, activity, or facility, please contact the Equal Opportunity Officer, Department of Natural Resources, 524 S. Second Street, Springfield, IL 62701-1787, (217) 782-7616, or the Office of Human Resources, U.S. Fish and Wildlife Service, Washington, D.C. 20240. Department of Natural Resources information is available to the hearing impaired by calling DNR's Telecommunications Device for the Deaf: (217) 782-9175. The Ameritech Relay Number is (800) 526-0844.

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Appendix I. Estimated weight (kg) of paddlefish at a given length (mm) for five Ohio River Sub-basin locations based on polynomial equations in Table 13.

Estimated weight (kg) at length (mm)					
Length (mm)	Ohio River	Hovey Lake	Wabash River	Cumberland River	Ohio River Sub-Basin
400	0.909	1.409	1.039	0.944	0.840
450	1.307	1.476	1.346	1.138	1.065
500	1.840	1.740	1.795	1.525	1.463
550	2.508	2.199	2.386	2.105	2.035
600	3.311	2.855	3.119	2.878	2.780
650	4.249	3.707	3.994	3.845	3.699
700	5.322	4.755	5.011	5.005	4.791
750	6.530	5.999	6.170	6.359	6.057
800	7.873	7.439	7.471	7.906	7.496
850	9.352	9.076	8.914	9.646	9.109
900	10.965	10.908	10.499	11.580	10.895
950	12.714	12.937	12.226	13.707	12.855
1000	14.597	15.162	14.095	16.027	14.988
1050	16.616	17.583	16.106	18.541	17.295
1100	18.769	20.200	18.259	21.248	19.775
1150	21.058	23.014	20.554	24.148	22.429
1200	23.481	26.023	22.991	27.242	25.256
1250	26.040	29.229	25.570	30.529	28.257
1300	28.734	32.631	28.291	34.009	31.431

Appendix J. Estimated weight (kg) of paddlefish at a given length (mm) for five Ohio River Sub-basin locations based on Log_{10} transformed length-weight equations in Table 13.

Length (mm)	Estimated weight (kg) at length (mm)				
	Ohio River	Hovey Lake	Wabash River	Cumberland River	Ohio River Sub-Basin
400	0.937	0.873	0.885	0.717	0.878
450	1.332	1.262	1.257	1.067	1.262
500	1.824	1.754	1.722	1.523	1.744
550	2.424	2.363	2.289	2.101	2.338
600	3.142	3.101	2.969	2.819	3.055
650	3.990	3.983	3.770	3.693	3.907
700	4.977	5.021	4.704	4.743	4.907
750	6.114	6.229	5.780	5.987	6.067
800	7.412	7.622	7.009	7.444	7.398
850	8.881	9.212	8.399	9.135	8.913
900	10.532	11.014	9.962	11.080	10.625
950	12.375	13.043	11.708	13.298	12.546
1000	14.421	15.311	13.646	15.812	14.689
1050	16.680	17.834	15.786	18.644	17.066
1100	19.163	20.625	18.138	21.814	19.690
1150	21.881	23.700	20.713	25.346	22.573
1200	24.843	27.072	23.520	29.263	25.728
1250	28.060	30.757	26.569	33.587	29.168
1300	31.542	34.769	29.870	38.342	32.905