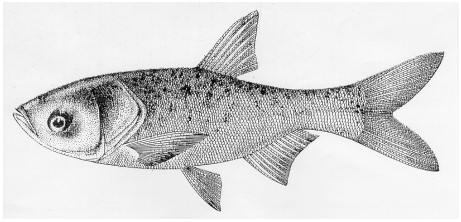
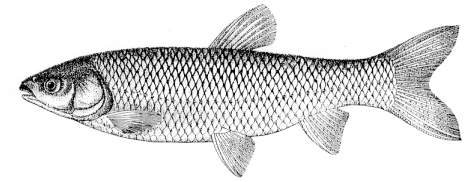
PROCEEDINGS

ASIAN CARP
MANAGEMENT AND CONTROL WORKSHOP





Sponsored by the U.S. Fish and Wildlife Service
Facilitated by Dale Brown & Associates

April 19-20, 2000
St. Louis, Missouri

SUMMARY

The U.S. Fish & Wildlife Service's Columbia Fishery Resources Office and Region 6 Aquatic Nuisance Species Coordinator co-hosted an Asian Carp Workshop in St. Louis, Missouri on April 19-20, 2000 to initiate the process of gathering input for the development of a Mississippi River Basin Asian Carp Management and Control Plan. The goal of the workshop was to review status, distribution, biology; ecological and economic benefits and impacts of four Asian carp species and identify management and control alternatives to reduce or mitigate these impacts.

Fifty-eight participants from state and federal natural resources agencies, universities and research facilities along with aquaculturists and their trade association representatives met to review current information and formulate management and control alternatives for grass, bighead, silver and black carp species. Three of these exotic species have escaped and/or been stocked in the Mississippi River basin. They have become naturalized in many basin rivers and streams and have rapidly expanded their range while producing adverse impacts to many native aquatic species and their habitats through competition and displacement. The fourth species, black carp, is believed to be currently confined to culture facilities, but poses a major threat to already endangered freshwater molluscs and big river ecosystems should they escape or be accidentally introduced.

Workshop participants reviewed current status and biological information on target species and identified economic and environmental impacts and benefits of each species in facilitated breakout sessions. Additional sessions identified alternatives for reducing impacts and optimizing benefits through preventing spread, detection and monitoring and controlling populations. These proceedings will serve as the basis for development of a Mississippi River Basin Management and Control Plan.

The workshop was facilitated by: Dale Brown & Associates, P.O. Box 571, Marion, IL 62959; 618-997-2400; dalebrown01@earthlink.net.

Contact Jim Milligan, Columbia FRO, 573/876-1909 x102 or jim_milligan@fws.gov for additional information.

Cover Photo credit
Lin, Z. 1991. Pond fisheries of China. Pearl River Fisheries Institute of the Chinese Academy of Fisheries Sciences. Pergamon Press. Elmsford, New York.

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STATEMENT OF PURPOSE

Background

Invasive species are becoming a major threat to the health of our Nation's natural resources. Freshwater aquatic animals have been identified as the most threatened group of species in the United States. More than one-third of freshwater fishes, molluscs and amphibians dependent upon aquatic or wetland habitats are at risk. Aquatic niusance species such as zebra mussels, round goby and ruffe are contributing factors in the decline of native aquatic species in some areas. Exotic aquatics such as Asian carps have produced a mix of environmental and economic benefits and impacts. For example, the grass carp is a valuable tool for biological control of undesirable aquatic vegetation which can also adversely affect aquatic communities and habitat. Others such as bighead and silver carp are of value to the aquaculture industry, but are displaceing native species through competition for food and habitat resources in the wild. Black carp are presently confined to culture facilities, but pose a serious threat to native freshwater mussels and invertebrates if they escape into interjurisdictional waterways.

Comprehensive assessment and evaluation of Asian Carp status and impacts will ensure these species are managed and controlled to maintain economic and ecological values. The unique circumstances of these species require that assessment, management and control alternatives be developed by a coalition of private and public sector fisheries professionals, aquaculturists, and aquatic ecologists.

Workshop Goal

To review the status, distribution, biology; ecological and economic benefits and impacts of Asian carp species (silver, black, bighead, and grass carp) and identify management and control alternatives to reduce or mitigate these impacts.

Workshop Objectives

1. Initiate a cooperative effort by private and public sector individuals; including aquaculturists, fisheries professionals and aquatic ecologists to discuss Asian carp issues.

2. Review current information on biology, management, economic and environmental benefits and impacts and identify information needs for Asian carp management and control.

3. Identify management and control alternatives for reducing impacts of Asian carp species through Preventing Spread, Detection and Monitoring and Controlling populations.

4. Identify a workgroup of state, federal and private sector volunteers to assist with developing workshop information into a draft Aquatic Niusance Species Asian Carp Management and Control Plan.

ASIAN CARP MANAGEMENT AND CONTROL
WORKSHOP AGENDA
St. Louis, Missouri

April 19th, 2000

1:00	Announcements and Introductions	Dale Brown
1:10	Welcome	Norm Stucky, MO Dept. of Conservation
1:20	Life History of Selected Asian Carp	Wayne Stancill, USFWS
1:50	Distribution and Impacts of Asian Carp	Leo Nico, USGS
2:10	Big Head Carp in the Missouri River	Sally Shrank, KS State Univ.
2:30	State and Regional Regulations and Policy Governing Introductions	Jay Rendall, MN Dept. Natural Resources
2:50	Federal Regulations and Policy Governing Exotic Species	Hannibal Bolton, USFWS
3:10	Break (15 minutes)	
3:25	Aquaculture and Asian Carp Panel Discussion of Catfish Industry, Diseases and Parasites, Black Carp and Alternatives, Economics and Control of Escapement	Hugh Warren, Catfish Farmers of America Anita Kelly, MS State Univ. Drew Mitchell, USDA Jim Avery, Natl. Warmwater Aquaculture Center Ted McNulty, Arkansas Development and Finance Authority
4:25	Black Carp Risk Assessment	Leo Nico, USGS
4:45	Certification Process for Triploid Asian Carp	Vince Mudrack, USFWS
5:05	Black Carp in Mississippi	Dennis Riecke, MSDWC
5:25	Preview of Tomorrow's Agenda/Activities	Dale Brown
5:30	Adjourn	

ASIAN CARP MANAGEMENT AND CONTROL
WORKSHOP AGENDA
St. Louis, Missouri
April 19-20, 2000

April 20th, 2000

8:00	The Development of a DNA Vaccine Against Digenetic Trematodes	Vince Mudrak, USFWS
8:30	Work Group Break Out Overview and Assignments	Dale Brown
	Identifying Environmental and Economic Impacts and Benefits	
10:00	Break (15 minutes)	
10:15	Reconvene in Breakout Groups to Prepare Summaries	
10:45	Reconvene in Large Plenary Group Group Spokespeople from Work Breakout Groups Report Back to All Open Discussion of Reports	
11:45	Lunch (1 hour, 15 minutes)	
1:00	Overview of Work Group Breakout Sessions on *Reducing Impacts and Optimizing Benefits Through Preventing Spread, Detection and Monitoring and Controlling Populations*	
1:15	Disperse to Breakout Sessions	
3:00	Break (15 minutes)	
3:15	Reconvene in Breakout Groups to Prepare Group Summary	
3:45	Group Spokespeople Report Back to All Open Discussion of Reports	
4:45	Workshop summary and identification of volunteers to assist with developing alternatives into a draft ANS Asian Carp Management and Control Plan. A minimum commitment of 3 days is required to review workshop results, identify information gaps and initiate plan formulation.	
5:00	Adjourn	

ASIAN CARP MANAGEMENT AND CONTROL
WORKSHOP NOTES
St. Louis, Missouri
April 19, 2000

Announcements (Dale Brown)

Welcome to group, timeliness of agenda, announcements, introductions.

Welcome (Norm Stucky – Missouri Department of Conservation)

- Welcomed participants.
- Thanked Jim Milligan and Linda Drees for arranging and coordinating workshop.
- Review of handout regarding workshop purpose.
- Everyone is here to address a common problem concerning our natural resources and taking care of our national aquatic treasures. The major concern is with negative impacts of Asian carps on native species. (Cited news article regarding Devils Lake in North Dakota.) Aquaculture industry has issues with economic and biological uses of these species in fish culture.
- Importation of exotic species and problems caused for native species. Also concerns about diseases and parasites brought in with non-native species.

Challenge: All resolve to be good listeners, good communicators, walk in each other shoes to gain understanding and appreciation for each other's problem – work together, partner together to come up with win/win solution to address concerns all have.

Life History of Selected Asian Carp (Wayne Stancill - USFWS) (refer to handout)

Expertise in Asian carp based on 9 months of sampling in Missouri River. Presented life history and ecology of bighead, silver, grass and black carp species.

Bighead Carp

- Fish with upside down head that only a mother could love.
- Introduce into US in 1972 by fish farm in Arkansas.
- In 1994 several thousand escaped into Osage River (MO). Dispersed downstream in Oklahoma from illegal stockings. Illegally introduced with grass carp.
- Prefer large river systems and associated backwater habitats.
- Spawning is initiated during large rise in water levels.
- Fertilized eggs drift suspended between 20 and 60 hours until they hatch.
- Bighead carp progress through five shifts in feeding oncology from phytoplankton to zooplankton and insect larvae. Are opportunistic feeders. Can detect chemical cues given off by plankton concentrations.

- Based on Missouri River sampling, fish do not stay on mud flats during most of year, only when water warms do they concentrate on mud flats and shallow confluence areas.
- Feeding ecology – similar to paddle fish resulting in diet overlap and competition - important in river systems where zooplankton is limiting factor.

Silver Carp

- First brought to the United States in 1973. By 1980, discovered spawning and recruiting in natural waters. Accidently stocked in Florida and Arizona.
- Similar in appearance and reproductive ecology to bighead carp. Spawning habitats are not as well known.
- Females reach sexual maturity in 3-4 years and males one year earlier. If growing fast, reach sexual maturity more quickly. A three year old can reach 4-5 kg in the wild.
- Primary filter feed on phytoplankton and secondarily zooplankton and invertebrates – utilize available resource and can shift alternative food resources.
- Similar to buffalo (native species important to commercial fisheries).

Grass Carp

- Imported to United States in Alabama and Arkansas during 1963 to control aquatic vegetation in aquaculture facilities.
- First escaped into the wild from a fish farming experimental station in Arkansas.
- Diploid and triploid fish have been intentionally stocked to control aquatic vegetation.
- Migrations have been as long as 1700 km in large riverine systems.
- Feed primarily on vegetation, but can shift to other food resources.
- In adults, the intestine is about 250% of the body length and feed almost exclusively on plants. Digests about ½ of the food they consume.
- Can take an area with good water quality and degrade to poor water quality through nutrient cycling and habitat alterations.

Black Carp

- May be out there but hiding. First brought to the United States in early 1970's mixed in grass carp stocks.
- In 1980, important as food fish and as a biological control agent.
- In 1994, 30 escaped into the wild in Osage River in Missouri when an aquaculture facility flooded.
- Uncertain whether triploids are sterile.
- Are similar in appearance to grass carp and are the largest of Chinese carp.
- Spawn in large rivers during moderate rises or receding waters.
- Males are sexually mature between six and eleven years and females about one year later.

- Utilize benthic habitats partly due to their feeding behavior.
- Between 20 and 30 mm, their pharyngeal teeth are fully developed and they shift from insect larvae to mollusks.
- Adults are primarily mollluskivores. The size of native mollusks they can take is limited by mouth gape size, but larger adults can handle larger mollusks.

What it means:

- Bighead, silver, grass, and black carp utilize similar habitats but have unique feeding ecologies indicating the impacts of each introduction are additive. Because we have one doesn't mean adding another won't be a problem.
- Bighead and silver carp are similar in appearance as are grass and back carp making their accidental introductions into new areas likely.
- Bighead, silver, grass, and black carp each have unique life history requirements that overlap native species at sometime in their life cycle.
- Grass carp feeding ecology greatly alters natural habitats, often to the detriment of native species.
- Black carp have the ability to directly compete with native species as well as prey on already declining species of mollusks.
- They are large river fish that migrate long distances and are capable of moving from one jurisdiction to another. If one state allows and another doesn't, one can't expect they will not move into areas they should not be.
- Habitats and food resources utilized by these introduced carp species are often limited in large riverine systems.

Q & A: Concerning the bighead/paddlefish comparison, has anyone done published food habits studies?

Answer: There is good information on dietary overlap based on fact that their gill rakers are similar. Only work that shows direct comparison is by a Kansas State student that reported that when in they are in the same facilities using similar food paddlefish do poorly.

Additional Work: None shared.

Distribution and Impacts of Asian Carp (Leo Nico - USGS) (refer to handout)

Chinese (Common) Carp, Silver Carp, Bighead Carp, Grass Carp, Black Carp:

Common Carp in US since 1800's. Other four dealing with today (referring to picture of carp on overhead)

Grass Carp

- First imported in 1963 and escaped into the wild.
- Only five states have no records of grass carp.

Bighead Carp

- Brought into the United States in 1972 by a private fish farmer and reported in open waters by early 1980s.
- Recorded to be found in 18 different states.

Silver Carp

- Found in twelve states.
- Evidence of reproducing population in Louisiana and middle and lower Miss River.

Black Carp

- At first only record of existence in Osage River in Missouri.
- Now aware of black carp in research or aquaculture facilities in 9 states.

Common Notes:

- All species native to eastern China.
- Transport: many introductions were legal through trucking.
- Chinese Carp Culture: negative impacts are very difficult. Hard to find cause and effect and getting a handle on the situation is difficult because of habitat disturbances and natural changes.
- Attractiveness to aquaculture: large size and feeding habits cause environmental concerns if these fish get out into natural areas. Multiple Asian carp species used in culture ponds because of their different feeding habits and purposes.
- Impact: if fish get into natural system feed off native plants and invertebrates and by doing that removes forage, nursery areas, and cover for native fish. Fair amount of literature discussing direct/indirect impact of grass carp. Other species information based on what is known about diets.
- Problem is that black carp feeds heavily on mollusks. Individual carp of ½ meter has gape width of about 2 inches.
- Common carp introduced by government in 1800 and pushed as food fish. Although popular in Europe and other areas, never caught on. Transported and released in many places throughout United States.

Q and A: Where did Fish and Wildlife obtain the information on the release of black carp on Osage River and what kind of affect have common carp had since being introduced? Answer: The Fish and Wildlife obtained the information from a fish farmer (corporate operation or another) that reported the release and other documentation not disputed. Affect of common carp impact -- a lot of literature about common carp impacts because they root around and destroy vegetation, eat invertebrates and compete with native fishes. Where populations exploded, clear water lakes became very turbid. Obviously introduced species

may go through population explosion. With common carp their population has stabilized.

Concern: Suggestion to reassess and revisit this information.

Q and A: USGS Invasive Species data base and web site is great resource, how do people report / add to data base?
Answer: If accessing data base through web site, there is a reporting form. Reports need to be double checked. Or, individuals can contact biologist at lab.

Q and A: You don't add record to data base if it can't be confirmed?
Answer: We make all attempts to validate information submitted before adding it to the data base.

Big Head Carp in Missouri River (Sally Shrank – Kansas State University) (refer to handout)

- Understanding of bighead carp is important.
- They aid in water quality in production ponds.
- Bighead carp increasing in harvest in Missouri River.
- Most bighead carp used in study are very large (larger than 600 mm) For reproductive information, looking at female gonads.
- Multiple spawning may be occurring. Appears bighead carp may spawn at multiple times in Missouri River.
- Appears that big head carp in Missouri River are doing well at reproducing.
- Same age bighead carp are found in wide variations of lengths and weight. Speculate that variations may be connected to large scale movement patterns in the Mississippi and Missouri rivers.
- Bighead carp grow very fast until age five then growth levels off.
- Larvae density: upstream of Missouri River to Lexington and also involved Platte River/Missouri River convergence and Kansas River/Missouri River convergence. No convergence at Lexington. Appears reproduction occurring less upstream .
- Calculation of hatch date: hatching takes 24 hours. Discharge of temperature during spawning. Relationship between water temperatures, discharge and spawning. Conditions in the Missouri River adequate for big head spawning.
- Preliminary results: four treatments bighead carp, bighead carp and paddlefish, paddlefish, and no fish. Measure bighead and paddles. Weight data from study: smaller size possible keeping gape size comparable. Initiation weight and final weight of paddlefish and paddlefish-bighead carp. Change in paddlefish bar and bighead carp were significantly different.
- No significance difference in mean weight in just bighead carp.
- Conclusions: big head carp very well established in Missouri River.

- Growing very well and similar to how they do in Asia. Big head carp and paddlefish are apparently competing. Bighead carp are problematic in large rivers and should be used as a model.

Q & A: Comment: The graphs didn't show great population increases.

Answer: The information is voluntary and provided by commercial harvesters.

Q & A: Comment: The Illinois Department of Natural Resources collects information from commercial fisherman and this information is a lot different from that reported from this information. They show large increase in bighead carp.
Answer: Missouri commercial fisherman market is weak and not economically working. Can't fish in certain locations because of staggering number of big head carp. The graph doesn't accurately reflect what is happening. Illinois data is probably more accurate of what is happening. Commercial fisherman in Illinois are topping out.

State and Regional Regulations and Policy (Jay Rendall – Minnesota Department of Natural Resources) (refer to handout)

Regulations are extensive and complicated. Will give overview. Lesson from the Past:

- Introductions are costly for management activities, biological losses, industry, recreational opportunities.
- Once introduced, eradication from the state is unlikely. (sometimes get lucky)
- Often no acceptable controls are available (no chemical control or silver bullets)
- Introductions are forever (population may go away but biological pollution doesn't)
- In the case of harmful exotics, an ounce of prevention is worth more than a pound of cure. (future must prepare to intercept pathways of introduction) "prevention, prevention, prevention (saying for exotic species)

Way to deal with prevention:
Regulations and education. Today deal with regulations. Our laws in this country do not work to prevent new introductions. Need to improve ways to deal with regulations for preventing introductions. Reactive approach is too late and costly. Need to develop good effective preventive regulation rather than wait until they arrive.

OTA Findings

- The current federal framework is a largely uncoordinated patchwork of laws, regulations policies and programs. . . in general they only partially match the problems at hand. (this is a pretty good description)
- State laws governing agriculture pests are relatively comprehensive. However, for non-indigenous species that do not affect agriculture, state laws provide only spotty coverage.
- National Invasive Species Act of 1996: be up for reauthorization during the coming year and will provide a good opportunity to close some gaps.

- Tremendous variations from state to state with regulations and variances of responsibility. Model regulations do exist to serve as toolbox that could be adopted by states.

Intentional Pathways:

- Evaluation of the potential environmental impacts of proposed introductions (introducer should be responsible for escapes – if bring species in be able to assure it will not escape)

  Q and A: Given approach of state regulations, is it time for federal regulation?

  Answer: Good point. Biggest point –very limited regulations of what can bring into the country. On animal side a lot is fair game. Look at what comes into the country. State regulations have role, but need federal regulations that address different things.

Federal Regulations and Policy (Hannibal Bolton - USFWS)

Patchwork, hodgepodge of regulatory authority on introduced species. There is no silver bullet to address invasive species issues. Couple of acts (regulatory acts -- Lacy Act and Endangered Act) that relate. The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 will be addressed today.

Overview of the Act: Objective:

- The Act establishes a federal program to prevent the introduction of, and to control the spread of, introduced aquatic nuisance species and the brown tree snake.
- Established an interagency Task Force
- Establishes a nationwide ANS program to:
  - Reduce the risk of unintentional introductions
  - Detect and monitor existing ANS
  - Control established ANS
- Ballast Water Management

Statutory Responsibilities:

- Ballast Water Programs
- National Ballast Water Management Information
- Establishment of Task Force
- Aquatic Nuisance Special Program (education is key)
- Regional Coordination
- State ANS Management Plans (model plan is available to states)
- Intentional Introductions Policy Review
- Brown Tree Snake Control Program (problem in Guam)
- The ANS Task Force shall develop and implement a program for waters of the US to prevent introduction and dispersal of ANS, to prevent, monitor, control, and study such species, and to disseminate related information.

- Prevention: The Task Force shall establish and implement measures, within the developed program, to minimize risk of introduction of ANS to waters of the US., including: (1) identification of pathways, (2) assessment of the risk that an aquatic organism that may become an aquatic nuisance species, (3) evaluation of whether measures to prevent introductions of ANS are effective and environmentally sound.
- FWS Prevention Activities: Erie Canal Dispersal Barrier; 100th Meridian Initiative; Chicago Waterways NIS Dispersal Barrier; Pathway Analysis-Bait Study; New Zealand Mud Snail Dispersal Pathways Study; Alaska Ballast Water Initiative; and Caulerpa Import Prevention Initiative
- FWS Detection/Monitoring
- Control: The Task Force may develop cooperative efforts to control established ANS to minimize the risk of harm to the environment and pubic health and welfare.
- FWS Activities/Funding: brown tree snake control; mitten crab control (development); Asian swamp Eel control (development); Asian carp control (development); Native Mussel Protection; Rapid Assessment of New Introductions
- Research
- Technical Assistance: to state and local governments to minimize the environmental, public health, and safety risks associated with ANS.
- Intentional Introductions Policy Review. Need discussion about what to do about invasive species. One of the most damaging to natural resources.

In February of 1999, President signed an executive order that sought to bring all invasive species under one coordinated body, established an executive council and an advisory council.

> Q and A: Do you think regulation executives are doing what they should to stop non-indigenous species coming into this country? Are the regulations adequate? Can you point to one instance where regulations have prevented invasion.
>
> Answer: Sufficient ? No.
> One instance? No.

All non-indigenous are not invasive. Need a comprehensive look at regulations of invasive species. Find a way to close our coast and do a better job of keeping unwanted species out. No guarantees. Need work to deal with the problems. This is a good group to start the discussions. Make a comprehensive review of all regulations and identify what is missing and what is needed.

NISA of 1990 is the only Federal legislative and regulatory authority that begins to deal with aquatic nuisance species.

Norm Stucky: World of perspective -- great presentations. Now hearing the other side.

Introduction (Hugh Warren – Catfish Farmers of America) (refer to handout)

- Appreciate invitation as a panel to this workshop.
- Many comments about dangers are shared.
- As an industry, need to be responsive and sensitive to those concerns. Look forward to participating in dialogue.
- Aquaculture industry overview: (NASS handout) important and growing industry when responding to deficit in seafood industry. Bar graph listing aquaculture species in US and in US catfish industry is in lead. Breakdown by state of number of farms and number of acres related to catfish farms.
- Remember: catfish growers are not fisherman but are growers. With depressed price of farm commodities, catfish can show profit and has helped farmer to survive and offers employment opportunities.
- Industry is vertically integrated. Waters mainly come from wells and on average ponds drained only to repair banks and are refilled.
- Industry blessed by regulatory agencies (23 federal agencies) on food and water. To make a profit, must have a good environment.

Introduced Panel: History of Carp in Arkansas. (Ted McNulty)
General Use of Carp in Aquaculture (Jim Avery)
Trematode Issue (Drew Mitchell)
Biological control of snails and catfish (Anita Kelly)

History of Carp in Arkansas (Ted McNulty – Arkansas Development and Finance Authority)

- 1963 grass carp imported by USFWS
- Successful spawning techniques developed
- 1968 first lake in Ark stocked with grass carp (other lakes in next few years)
- 1984 fish farmers developed triploid grass carp
- Triploid Grass Carp Act 1995 – user fee to fund certification program in 37 states
- Other Chinese carp brought in during 1970's
- Black, Silver, Bighead Carp – EPA funded evaluations
- Biological control of snails was purpose of black carp importation
- Today, very few silver carp raised, hard to handle and not popular food fish
- Industry working on better ways to process bighead and grass carp and evaluating consumer market potential.
- Canned bighead carp evaluated against tuna and majority approved its taste
- Good demand for bighead in other counties.

General Use of Carp in Aquaculture (Jim Avery – National Warmwater Aquaculture Center) (refer to handout)

- Species Used: bighead, silver, grass, black: Mostly apply to catfish industry but also see use of carps in with other cultured fish and bass production in southeast.
- Bighead Carp: (Positive Aspects) - filter-feeding omnivore, 100-500/acre when polycultured with catfish (but catfish growers normally don't like to polyculture), reach 3 pounds in single growing season. (Negative Aspects) - actually increase phytoplankton biomass, must be hand sorted, few markets – not an easy market to get into, dockage by processors (if no market, shipped to processor and deducted from payment by processing plant), few farmers produce outside of AR.
- Silver Carp: (Positive Aspects) - filter-feeding omnivores, 100-500/acre when polycultured with catfish, and reach 1 to 3 pounds in single growing season (do not do good at taking out algae, needed to be removed and held in clean water for taste, etc.) (Negative Aspects) - actually increase phytoplankton biomass, must be hand sorted, fewer markets than bighead, injury to workers due to jumping, dockage by processors, extremely few farms outside of AR (this carp used less than bighead carp)
- Grass Carp (Positive Aspects) - control of nuisance aquatic weeds in nursery ponds (5 to 10 per acre), do not compete with small catfish for food, consume large quantities of weeds, prefer *Najas* and *Chara (do good job of taking these out)*, reduced chemical usage. (Negative Aspects) - long time to reduce existing weed problems, 2 – 3 year old fish switch to feed(decreases economic incentive to have them in there), injury to workers, no commercial foodfish value (no market in Mississippi and Louisiana), and few weed problems in foodfish ponds.
- Black Carp: Used by Arkansas game fish producers to control grub problems, No interest by catfish farmers until late 1999, Integral part of control measures for *Bolbophorus Confusus*.

<u>Current NWAC Recommendations for grub control</u>

- Pond margin treatments of hydrated lime or copper sulfate to reduce snail populations
- Aquatic weed control to remove habitat
- Stocking 10 black carp per acre

<u>MSDAC Guidelines for Use of Black Carp</u>

- Cultivation/marketing
- Facility inspection for filtering system
- Stock

<u>Double Screen on Pond Drains (Filtering System)</u>

- Expanded metal mesh or slotted well pipe on inside
- Soft screening devices on outside alfalfa valves and riser pipes
- Soft screens

How many farms affected by trematode problem?

- 396 potential farms in Mississippi as of Jan. 1999
- MS only permitted 6 new farms for black carp
- One permitted research station
- Pending black carp permits: 5 farms and 1 research station
- Number may increase

Black Carp Negatives

- Currently only out-of-state producers, primarily AR
- No economic recovery of costs
- Polyculture adds management problems

Trematode Issue (Drew Mitchell - USDA) (refer to handout)

Involvement with Asian Carp: did first inspection in 1985.

Digenetic Trematode:

- they are often called grubs or flukes
- they are small usually less than ¼ inch.

Catfish Trematodes:

- 30 different digenetic trematodes infect channel catfish
- Trematodes found in cultured fish
- Catfish Trematode: two farms in Arkansas affected, three farms in Louisiana, and twelve farms in Mississippi. This thing seems to be moving and spreading as a problem over time.
- What can it do? Can kill 100% of fish in four days (worst case scenario), can put fish off feed, slows fish growth, affected fish may not be marketable, appears to stress fish and other diseases kill them, and has put at least one catfish producer out of business.
- White pelican is major host – no other bird found. Two species of ram's horn snails that carry this.
- Key characters: lateral pseudosuckers, clear parasite cyst in host cyst, interconnecting.
- Catfish trematode cercariae: survives in water 96 hours, released from snail from April to November and one snail can release over 1000 per day.
- Catfish trematode also found in trout, bluegill, fathead minnows, hybrid striped bass, and channel catfish. This has been around for a while – maybe back to 1953.
- Yellow Grub also causing economic impact: Intermediate snail host. Large grub. Loss of sale due to consumer rejection, price deductions at the processing plants, loss of growth and death.
- Sunshine bass losses have been major.

Gill Trematode

- comes in on exotic snails and several birds as avian host.
- Kills in the environment.
- One of the major fish diseases in the industry.
- Will affect every one of major species.

Need something to control snails.

Brain grub, eye flukes, black grubs, are other types of trematodes.

Management and control targets to break life cycle:

- trematode – not practical or cost effective;
- bird – protected and control measures are ineffective;
- Snail – difficult but best approach

Snail Control:

- Chemical Bayluscide, copper sulfate, lime, hydrothol 191, and salt (takes large doses to kill snails and ends up killing fish)
- Biological – black carp, redear sunfish, and others.

Biological control of snails and catfish (Anita Kelly – Mississippi State University) (refer to handout)

Ways to control snail populations. (handout)

- Trematode does cause economic loss to catfish industry.
- Causes high mortality rate in fingerlings.
- Chemical controls: hydrated lime, potassium permanganate, there is no control once metacercariae are encrusted in the muscle. No legal chemicals approve to kill snails.

Potential biological control species:

- Must be tolerant of warmwater conditions.
- Black carp: do have permit at Mississippi State to have in the facilities.
- Freshwater Drum: known to eat snails but adults veer away from snails. Are not being commercially produced.
- Redear Sunfish: may be to small to eat snails as juveniles and difficult to train to eat commercial feeds.
- Redear sunfish-bluegill hybrid: more aggressive and therefore a better forager.
- Blue Catfish: known to eat zebra muscles, already produced on some fish farms, (this will probably be best option other than sorting through other possibilities). They may prefer feed over snails.
- Freshwater shrimp: may consume small snails, difficult to produce in ponds with catfish (catfish may consume them).

Concerns:

- black carp escaping into the natural environment
- Seining ponds stocked with black carp, freshwater drum, and freshwater shrimp is difficult.
- No marker for redear and sunfish hybrids.
- Don't want test species to consume catfish feed.
- Don't' want test species to reproduce in ponds (take up more space – less for catfish).

Objectives

- Determine which test species will consume ram's horn snails in aquaria.
- Determine effects on snail populations.
- Methods for Aquaria Tests.
- Data Collection.
- Methods for Pond Tests (are using catfish fingerlings stocked at 5000/acre).
- Data Collection (monthly snail sampling and daily feedings).
- Management Implications (find out which is most effective).

Q and A: Have you looked at red swamp crawfish as biological control?
Answer: Can throw that in. Not averse at looking at that. Problem may be with seining of catfish and may cause docking at processing plan. Also some large catfish may consume them. In areas where catfish ponds are next to crawfish pond, there is no mixing, indicating that the two are probably not compatible.

Q and A. Any studies to back up this?
Answer: Some studies have been done on stocking densities of black carp. Ten black carp per acre has worked very effectively. Another paper says 10 to 25 black carp per acre controlled trematode (ramshorn snail). Another found 5 and 10 black carp controlled snail but if aquatic algae are present then needed 10.

Q and A. Some parasites introduced in aquaculture along with exotic fish?
Answer: We are well aware of that and some tapeworms probably brought in with grass carp but only one know for sure. Do not know of any parasites brought in with black carp.

Comment: Norm Stucky – Mississippi River monitoring station at Cape Girardeau has noted absence of zooplankton in side channels along with large increase in silver and bighead carp numbers. Speculate they are taking out zooplankton and causing phytoplankton bloom increase. For the last three years, wild paddlefish collected throughout the Mississippi River basin have shown a decrease in relative condition and this trend seems to coincide with increases in bighead and silver carp numbers. That is why resource agencies are concerned.

Comment: Jim Avery - May not be able to make comparisons between two different systems.

Black carp producers have received word from foreign sources that there is a serious disease they can be infected with.

Q and A: Double screening: What safeguards are in place to prevent release during flooding and what type of punishment for those who lose fish?
Answer: (Jim Avery) Did have some flooding ten years ago and did affect 500 acres of ponds and all of those have been raised above 550 year flood plane. No response to punishment.

Discussion of Catfish Industry, Diseases and Parasite, Black Carp Alternatives, Economics and Control of Escapement

Black Carp Risk Assessment (Leo Nico - USGS) (refer to handout)

- Has a wide distribution (Special Concern Species in Russia)
- Found in Eastern China and Vietnam
- Belongs in the minnows and carps family
- Common names: black carp, snail carp, Chinese black carp, etc.
- Native range: Chinese publication (found in major rivers)
- Behavior: bottom-dweller, rarely surfaces, schools. Habitat is in lower reaches of rivers and flood plain lakes; Climate: subtropical hot to cold.
- One of the larger carp species with life span of 15 years. Weights up to 90 lbs and length up to one meter.
- Reproduction: Males 3-9 years and females 3 –11 years old. Annually migrate upriver and spawn in main channel. Females produce 129,600 to 1.5 million eggs.
- Diet change: small zooplankton; up to 1 inch long, benthic insects, after 1" long each mollusks/snails
- Adult Diets: snails, clams, other – shrimp crabs, insect larvae etc.
- Depend on pharyngeal teeth for breaking apart food items
- First used in fish culture during Tang Dynasty (618-197 AD), first introduce to US in 1970s as contaminant in Grass Carp shipments; reintroduced in 1988;
- Reasons for past introductions: Aquaculture food fish, control large populations of mollusks-snails, and control fish and human parasites
- Grass carp and black carp identity is very similar
- Spread potential is high

Q and A: Has there been economic comparison in aquaculture if black carp not used vs. if black carp escape into the wild?
Answer: Not aware of this type of analysis being done. Not familiar with status of economics in terms of turnover.

Certification Process for Triploid Asian Carp (Vince Mudrack-USFWS) (refer to handout)

- Asian Carp importation: in 1960s, 1970s Asian Carp came in at US Bureau Sport Fisheries and distributed within Arkansas.
- Originally agreements for fish not to be distributed but it did happen.
- At end of studies, fish were performing as people had intended – controlling the weeds, etc. and received good report. Other issues, reproduction, etc. overshadowed by air of enthusiasm.
- Diploid entries sparked debate, and states began to enact laws.
- US Fish and Wildlife were encouraged to inspect triploids
- Continued concern over time – fish reproducing and legislation became tighter state by state and therefore Triploid Certification Program was implemented.
- Demand for triploid grass carp certification increased.
- Geographic expansion called for training (Calif. Ariz, Idaho – more states needed training – at least one inspector from each region to certify a producer's operation in a standardized way.
- Over time, early 1990s, budget problems / change in philosophy and focus / new priorities changed Service focus away from triploid certifications. But, now addressing the issue.
- Legislation – Grass Carp Legislation (USFW would continue with Triploid program and costs would be recovered from producers).
- Initially 17 cents per fish shipped as a result of service inspection. (would only work in some parts of the countries and not others – geographical differences called for changes in fee schedules).
- National Standards for Triploid Certification – legislation led to accountability and standards (sets quality control for site inspections) – requirements for inspectors, requirements for producers, checklist for producers and inspectors, certification forms and reporting to states, fee structure and fiduciary responsibilities.
- Reasons for Diploids: (1) intentional deception (2) management negligence – improper facilities, uneducated workers, summer holding ponds.
- Many producers have been asking Service to stronger program intervention.
- Goal of FWS inspectors should be on-site inspection of the sites so everyone doing best they can do.
- The future is on open book – hope to close with much more responsible approach and will provide assurance to states that what goes out is triploid.

Q and A: Triploids sound good but field biologist find poor point of control. Why would we want triploid program when map says diploids all over the place?
Answer: For California, Oregon, New York – don't want reproducing populations, this is important issue and does work for them.

Q and A. What percentage of fish inspected turn out to be triploid?
Answer: Don't know percentage overall but can talk percentage of inspections.

Q and A.(Comment) Graph on triploid and diploid not clear.
Answer: That is exactly right. Issue is if state's law indicates that they would honor wishes of public and state would like to have triploid and not diploid those states say we would like someone to provide assurance that USFWS will help certify them.

Q and A. If system has not worked for bighead, silver, or grass what makes you think it will work for black?
Answer. Never said it would especially in area where diploid is allowed to be moved.
Comment: Monitor reading – very clear (even though overlap). System does work.

Comment: These are large river fish and will cross lines.

Comment: To improve certification program, any talk about certifying individual fish instead of lots.
Answer: That has been requested by Chesapeake Bay area and can be done but is more expensive (.24 to $1.00 per fish)

Black Carp in Mississippi (Dennis Riecke - MSDWC) (refer to handout)

- Initially developed guidelines for aquaculture: Exempted from obtaining an aquaculture permit: culture of catfish by the catfish industry, where initially catfish and catfish products are grown, farmed and processed for sale and no other species of aquatic plants or animals are cultured for sale. Aquaculture permits were required for following culture activities: culture of all nonnative aquatic plants and animals; culture of game fish (black basses, bream, crappie, flathead catfish, walleye . .)
- Controversies continued on diploid/triploid issue.
- Revised guidelines for aquaculture were presented. Black carp not prohibited because people already had them. Took list Texas and Florida had for prohibited and followed. If MDWFP determines that the presence of these non-native species could become or is detrimental to native fishes, Department personnel may attempt to remove or eradicate all non-native species.
- Current crises: New applications for black carp were received for comment and concern was voiced about permitting the stocking of black carp and a potential for disease.
- Conclusion: some commercial channel catfish farmers are facing a serious disease; many farmers don't realize they need to obtain an aquaculture permit prior to stocking black carp; there is a limited supply of triploid black carp and probably an insufficient supply of diploids; by flooding and/or other means black carp will escape to the natural waters of the state; eradication of black carp from the natural waters of the state is impossible; and black carp will negatively impact several species of endangered turtles and mussels through competition and predation.
- Pressure came because of cost difference between diploids and triploids. Diploids were allowed for one year but use of triploids first was encouraged.

- Serious problem facing catfish industry, need research, need to work together to address this issue.

Q and A. How many diploids have been stocked?
Answer. No records of numbers of diploids or triploids but triploids are encouraged.

Preview of Tomorrow's Agenda/Activities (Dale Brown)

ASIAN CARP MANAGEMENT AND CONTROL
WORKSHOP NOTES
St. Louis, Missouri
Holiday Inn Westport
April 20, 2000

The Development of a DNA Vaccine Against Digenetic Trematodes (Vince Mudrak)

- Background on whether or not biological entity could control yellow grub and explore redear sunfish (decided unless made triploid would have same problems as black carp).
- Considered chemical control agent as alternative and last year developed study proposal on looking at a vaccine. Veterinarian working with them and EPA and North Carolina Vet School and found that there was work on a vaccine for a yellow grub and decided to explore an alternative for the white grub.
- An approach to deal with trematode problem is to develop a vaccine for fish to kill off trematode prior to infecting fish. Vaccine would be capable to protect fish, but are expensive and time intensive to develop.
- Proposed ethnicity of DNA vaccine to protect channel catfish. DNA vaccines have proven in the past to be effective in organisms, animals, and humans. Advantages: developed in short period of time at low cost, stable, induce humeral and cellular identify, and no antigen required. They promise to be a powerful tool for infectious diseases. (slide presentation)
- The development of a DNA Vaccine Against Digenetic Trematodes: An Alternative to the use of biological controls. Stage that infects fish is cercaria and a vaccine would have to stop the infection at this stage. Taking cercaria and getting cercaria DNA, breaking it into minute fragments, taking fragments and putting into a plasmids to inject back into fish, within fish the plasmid would enter cell and produce protein specific for DNA removed and hopefully elicit a antibody response. There will be a lot of DNA fragments and need to find those that produce antibodies. For those that do, a challenge test would be done and put in proximity to snails that are releasing cercaria.
- From this lab procedure, clone process and synthesize the product and then put in form that could be entered into fish orally or with immersion.

  Advantages:
  - Eliminates need for exotic control species
  - Does not permanently alter host DNA
  - Non-permanent immune response in fish
  - Relatively inexpensive to develop and produce
  - Can be further engineered to induce immunity to other agents
  - No danger of organisms reverting to an active form (not a live vaccine)

  Goal: To find people who want to collaborate.

Closing Statement:

- For the reasons above, DNA based vaccines represent a major advance over previous immunization methods and will profoundly change the practice of fish medicine and veterinary medicine as a whole. The ultimate goal of this work is not only the protection of channel catfish against the catfish trematode, but also the development of a strategy that has the potential of developing a vaccine on time scales of several months that can be field tested within a year. Having the capacity to develop vaccines rapidly would represent an important management tool that could be made available to producers of other commercially cultured fish and others who want to protect fish health.
- Important thing is that there are new things out there, and maybe it's time to start applying these.

Q and A: What would be a realistic time frame to make it available to the aquaculture industry?

Answer: Veterinary school talking about development within a year and having field tested within a year.

Work Group Break Out Overview and Assignments (Dale Brown)

Focus: *Identifying Environmental and Economic Impacts and Benefits*

Breakout Groups

BLACK CARP (Wayne & Joanne) • Kevin Cummings • Anita Kelly • Ted McNulty • Bill Posey • Bill Reeves • Dennis Riecke • Brian Wagner • Hugh Warren	BIGHEAD CARP (Rick & Louise) • Michael Armstrong • Jim Avery • Kari Duncan • Steve Eder • Tom Mosher • Jay Rendall • Tom Russell • Chuck Surprenant • Vernon Tabor
SILVER CARP (Al & Mike) • Steve Adams • Mark Cornish • Brian Lubinski • Joe Myers • Leo Nico • Bernard Schonhoff • Vince Travnichek	GRASS CARP (Pam & Jerry) • Kevin Aitkin • Ron Beck • Pat Carter • Greg Conover • Bob Hopper • Gerald Mestl • Andrew Mitchell • Vince Mudrak

Break Out Group Reports

Grass Carp (Vince Mudrak)

Environmental Benefits

1. Nonchemical/mechanical control of weeds.

2. Recreational use in ponds and lakes (improve).

3. Improve water quality in ponds and lakes.

Environmental Impacts

1. Alter wild ecosystems.

2. Interspecific competition (food, habitat)

3. Use of non-certified triploids.

4. Introduce parasites and diseases and non-target species.

5. Introduction is forever.

6. Look alike with Black Carp.

Economic Benefits

1. Opportunity for economic diversification.

2. Less costly than mechanical/chemical controls.

3. Enhanced sportfish opportunity.

4. H_2O district use to enhance H_2O flow.

5. Recreational use benefit.

Group agreed with presentation.

Q AND A: None

Black Carp (Anita Kelly)

Environmental impact

1. Impact diverse mollusk fauna of Eastern U.S.

2. Could impact native molluscivore

3. Could impact other benthic fauna
   Comment: once finished eating moss could start eating benthic fauna

4. May establish natural reproducing populations.

5. competition for food with endangered molluscivore turtles.

6. Concerns about dietary shifts of native species after food resources depleted.

7. Impacts to waterfowl populations due to depleting mollusks.
   Comment: talking about diving birds

8. Maybe vector for exotic parasite.
   Comment: look like grass carp

9. Unknown impacts to stream/river ecological processes through food web shifts.

10. Potential for range expansion beyond immediate basin.

11. Escapement is concern whether diploid or triploid – eat mollusks anyway.

12. Aquaculture industry's good stewardship approach to resource management could be damaged.

Environmental Benefits

1. Indications that trematode problem will be increasing, so impact to fish farms will be increasing.
   Comment: use of black carp good to decrease trematode problem

2. Escapes may mitigate zebra mussel populations.
   Comment: not just catfish trematode but other diseases

3. Elimination of snails that cause human diseases in some parts of world.

<u>Economic Impact</u>

1. Impact to local and international commercial pearl industry by consumption of mussels.

2. Including black carp in polyculture makes harvesting and processing fish more difficult.

3. Potential to severely impact waterfowl hunting.

4. Use as biological control is only an expense to aquaculture industry.

5. Potential to impact traditional commercial fishing if populations get as large as bighead carp have.

6. Eradication would be expensive/impossible (politics, funding, geography) in wild.

7. Potential for impacting sportfish forage base and sportfishing (because black carp are higher on food chain)

8. Diversion of agency and industry funds from other projects.

Economic Benefits

1. Prevent losses to fish farmers.

2. Is an important food/aquaculture crop.

3. Economic benefit to have healthy people (black carp controls vectors of snail-borne diseases)

4. Potential for new market for black carp (recipe)

5. Potential new recreational species (grass carp – fly rods)

6. Use as research animal.

7. Catfish farmers currently do not have any other tools to control snail populations.

Group agreed to content

Q and A: Second environment benefit? How is first item an economic benefit? Answer: Since it is not just catfish problem, we have a method here to control snail population and get rid of disease-born snails.

Q and A: Under environmental impact, why did you confine the item to the eastern US?
Answer: We were just pointing out that the eastern US has more diverse mollusk fauna. We could have listed Canada or anywhere but we just wanted to point out an Eastern concern.

Q and A: Are any snailborne disease in this country or continent?
Answer: No known. But everything has potential to be. Set up is there for Asian river fluke in New Orleans area.

Q and A: Benefit for zebra muscle control – any new research?
Answer: Some things listed were possibilities. Can't say for certain that black carp do eat zebra mussel. No good evidence that they ill feed on zebra in wild, they don't seem to be able to break apart the rafts. Where black carp do feed on zebra is where individual zebra were fed to black carp or where Chinese are feeding zebra mussel to black carp as a food source out of ditches.

Q ad A: What does native mussel fauna look like in China?
Answer: Not diverse in southeast Asia and has co-adapted.

Q & A: Are black carp harvested in China?
Answer: Yes, and actively raised. With damns being created may cause decline in natural areas.

Silver Carp (Leo Nico)
Dialogue was very good but needed someone who was a proponent of aquaculture community or use of silver carp.

Environmental impacts

1. Impacts on native species (including R, T, and E) Competition plus predation resulting in displacement, decline, and possible elimination.
   Comment: Rare, threatened, and endangered species (competition for food resources, competition for space)

2. Rapidly colonize and potential to become established throughout much of North America – difficult to control; no natural controls.
   Comment: based on native distribution and seen in wild.

3. Alters Aquatic Communities, including structure, plankton, numbers, and abundance, food web

4. Locks up primary production.
   Comment: since they feed on bottom of food chain and are of a large size

5. Potential to change water quality.

6. Potential disease vector.

Environmental Benefits

1. Excess nutrients in sewage treatment plant discharge areas and serve as nutrient removal strategy.

2. Control phytoplankton blooms in production ponds.

Comment: if used in a particular way

3. Potential use for nutrient uptake in hyper-eutrophic sites.
   Comment: some ponds and polluted lake situations

4. Potential for use in bioaccumulation studies.

Economic Impact

1. Impact native commercial and sport fisheries
   -- reduce abundance and growth of commercial and sport species (fish and mussels)
   -- reduce gear effectiveness (used by commercial fisherman)
   -- Interfere with angling

2. Cost of protecting and restoring native species.

3. Marketability
   -- low current market value
   -- grow too fast and large (Asian community will want live fish in markets)
   -- transport challenges

4. Sorting costs in polyculture

Social Impacts

1. Negative public perception.
   Comment: with species in general

2 Reduces public confidence in resource managers.
   Comment: if not dealt with in an appropriate manner

3. Decreases perceived value of resource – reduces value of resource experience

4. Reduces optional sustained yield.

Economic Benefits

1. Food source for humans.

2. Other commercial uses: zoos, fish meal, cat food, aquaria.

3. Reduce off flavor of cultured fish by controlling phytoplankton.

4. May provide angling opportunities.

5. Potential model(s) for bioaccumulation studies.

Group agreed to content.

Q and A: If bioaccumulate, is it because of concentrated toxins, etc.
Answer: Semantics issue: Optimal sustained yield as opposed to species diversity: Depends how define optimal sustain yield. Maximum sustain yield = biomass. Optimal sustained yield is a predetermined qualifier.

Bighead Carp
List benefits and impacts them combine highest priority or greatest concerns:

Environmental Impact

1. Altered food chain leading to adverse impacts on native species.
   Comment: Diet overlap with many native species. . . . (planktivores and mussels)

2. Physical exclusion of native species by high standing crop and large size of bighead carp.
   Comment: have large standing crops.

3. Cumulative impacts on public attitude.
   Comment: one more exotic species being release or becoming established and public may not have same view as resource managers may have.

4. Management implications are different in systems where bighead carp are self sustaining.
   Comment: (in terms of things that might be done) if sustaining themselves, management implications are different.

5. Displace native mussel hosts.

Environmental Benefits

No benefits listed for big head carp.

Economic Impacts

1. Increased costs to fish management (e.g. fish passage costs)
   Comment: may affect how we intensively management wetland systems

2. Decreased economic benefits to communities due to lost recreational fish revenues (e.g. paddlefish)
   Comment: some areas paddlefish fisheries which attract followings and bring economic value

3. Intangible costs – lost environmental quality.
   Comment: because of potential for bighead carp to have impact on environment water quality – could have intangible costs.

Economic Benefits

1. $1.5 million aquaculture industry.

Comment: in some areas harvested in large numbers – but not good markets.
Must develop markets for fish or products made from fish.

2. Must make it profitable for commercial fishers thru development of products/markets.

Group Agreement with Presentation.

Q and A. What does 1.5 million refer to?
Answer: (Arkansas)

Comment: No environmental benefit listed in your presentation but bighead carp might be a less environmentally destructive source of protein that some other sources.

Q and A. Ever found that any Asian carp species serves as glochidia host of native mussels?

Answer: Will have to look into.

SIMILARITIES / COMMONALITIES

- Potential opportunity for new food source.
- Increased economic benefits from harvest and production of these organisms.
- Potential negative effects on native species – especially mussel (directly or indirectly)
- Increased management costs.
- Altered habitat and food chain.
- Vector for parasites.
- Modifications to water quality. (positive and negative)
- Competition for food and resources.
- Economic impacts to commercial fishing.

Overview of Work Group Breakout Sessions on *Reducing Impacts and Optimizing Benefits Through Preventing Spread, Detection and Monitoring and Controlling Populations*

Report Backs

Grass Carp

<u>Preventing Spread</u>

1. Stock only triploids (new areas)
   Comment: especially areas where there are no diploids

2. Prevent releases of diploids by aquaculture to states where they are not permitted.

Comment: where they might get out and go to states or neighboring waters they are not permitted

3. All states use FWS certification.
   Comment: all state require triploid use FWS certification

4. Certify producers.
   Comment: certify producers have know-how to do this

5. Standards for producers, haulers, inspectors, and dealers. (New-hauler and dealers)
   Comment: remain sure they remain high – probably development of standards for haulers and dealers – time constraints and hauling constraints

6. Improvements of consistency in certification procedures and state regulations.
   Comment: are some inconsistencies in requirements

7. Public education.
   Comment: partially out of triploid arena – let public know of dangers.

8. Increase law enforcement.
   Comment: put bite behind words.

9. Cautious removal of dams.
   Comment: ongoing state initiatives to remove dams which would open up waterways

10. Develop commercial fisheries

11. National policy on Asian Carp.
    Comment: putting better grass carp triploid program together requires national policy establishing guidelines

12. Develop and strengthen import policy (diseases, parasites).
    Comment: things don't want in with them – diseases/parasites

13. Encourage states to do random checks on Certified Triploid lots entering state.
    Comment: on fish and wildlife service triploids entering that state

Detection and Monitoring

1. Education and outreach.
   Comment: like at fishing docks and areas where just released or thought to have been released to let public know and hopefully receive reporting of siting from public.

2. Increase funding for surveys.

3. Centralized database.
   Comment: all information needs to be gathered centrally for use of all parties

4. Fish tagging program.
   Comment: what lots of fish came from what place and whether individuals had right groups of fish and movement tracking, monitoring movement of fish

5. Information on sampling techniques (how to catch fish)

6. Larval fish studies.
   Comment: what water temp they like, where they will be found – helpful for survey work and understanding larval grass carp

7. Movement studies.
   Comment: some aquarium shops bringing in grass carp up there.

8. Monitor Black Market (aquarium markets)

Controlling Populations

1. Develop commercial fishery.
   Comment: Already out there and commercial fisherman needs to increase commercial fishing

2. Bounty.

3. Develop sport fishery.
   Comment: along with commercial fishery.

4. Contingency plan (population depletion plan)
   Comment: depopulation plans needs to be developed for areas where only are found

5. Chemical use.

6. Public education on food quality.
   Comment: this is a fish that can taste great – may then buy from commercial fisherman

7 Develop markets.

Group agreed with presentation.

Q and A: How will developing markets control populations?

Answer: That was talked about and part "barnyard door open" can't de-water the Mississippi.

Bighead Carp

Preventing Spread

1. Public Outreach
   -- disseminate strengths and weaknesses
   -- poster child
   Comment: elevating public awareness of problem plus strengths of species

2. Prohibit introductions in watersheds where they don't exist (by hydrologic units)
   Comment: decide what watershed is and keep out where don't already exist

3. Require guaranteed triploid/sterile fish for aquaculture.

Detection and Monitoring

1. Develop objectives and guidelines for standardized monitoring.
   Comment: increase ability to detect 0-1 year class.

2. Improve state and federal reporting.
   -- commercial records
   -- integrated database.

3. Train biology/conservation agents in I.D. of all phases of bighead and improve public outreach.

Controlling Populations

1. Maximize sport/commercial harvest – economic incentives.
   Comment: realize the double edge nature of that – create economic incentive trends to increase use.
2. Research spawning requirements/strategies.
   Comment: (or use as leverage to prevent deterioration of healthy habitats)

3. Restoration of altered riverine habitats.
   Comment: release of sterile males – off success of use of sterile males in great lakes area

Group agreed with presentation.

Black Carp

Preventing Spread

1. List as injurious species under Lacey Act

-- states prohibit if not currently listed as acceptable.

2. Use triploids or monosex populations
   -- only triploid producing facilities with diploids
   -- states that currently have black carp should follow AFS guidelines.
   Comment: Accept for facilities who make triploids.

3. Permit development
   -- research to develop minimum effective stocking rate
      Comment: So not overstocking black carp in aquaculture settings.
   -- require screening/barriers at all sites.
   -- expand carp certification to include black carp.
   -- mandatory levee height above 100 year flood.
      Comment: seems 100 year flood occurs every 10-15 years.
   -- recommend stocking only where necessary
   -- strict penalty for non-compliance.
      Comment: pay penalty if don't play the game.

4. Develop alternate means for snail control.
   -- continue research for alternate control species.
   -- quantify impacts on native species (mollusks, fishes, other inverts)

Detection and Monitoring

1. Sample commercial harvest for presence of black carp mixed with grass carp.

2. Establish/continue routing and standardized sampling.
   Comment: in large rivers, especially where grass carp are now.

3. Develop outreach program (posters, cards, etc.)
   -- commercial fisherman
   -- state and federal biologists
   -- sport anglers

4. Establish monitoring system for aquaculture as part of permitting.

5. Mandatory reporting for escapees (flooding, barrier failure, levee failure)

Controlling Populations

1. Use triploids with strict monitoring.

2. Introduce sterile males where black carp are in the wild.

3. Develop quick response team/equipment to deal with escapes.

-- rotenone (or other piscicide)
-- escaped fish in confined small areas.
Comment: Delta Force for Black Carp.

4. Develop carp pathogens to control carp populations.

5. Introduce high dollar fishing tournaments for black carp. (without catch and release)

6. Help develop market for black carp / develop a bounty.

7. Develop a toxic implant coated with a biodegradable substance that would degrade after 18 months releasing rotenone within the body cavity to kill fish.

Group in agreement with presentation.

Silver Carp

Preventing Spread

1. Deny possession
   -- deny importation
   -- no transfer of live fish
   -- destroy all captive stocks.

2. Increase accountability
   -- require pit tags or genetic ID marking of stocks.
   -- Impose fines on individuals who release fish into the wild and hold accountable for damages.

3. Restrict movement
   -- avoid interbasin transport of fish and water
   -- create/maintain barriers
4. Restrict possession
   -- require use of sterile triploids
   -- no transport of live fish
   -- require certification of all triploids

5. Re-assess need for silver carp in U.S.

Detection and Monitoring

1. Monitor commercial – recreational catch

2. Educate – inform commercial and recreational anglers, biologists, public on I.D.
   Comment: be sure what people are seeing is silver carp and not bighead.

3. Develop mechanisms for verifying the location, distribution and movement of captive and wild silver carp.

4. Develop comprehensive state and federal sampling program.
   -- develop sampling techniques (eggs – larvae – adults)
   -- train and equip appropriate personnel
   Comment: agency look at developing adequate sampling techniques and training and equip appropriate personnel

5. Study/Determine displacement mechanisms in silver carp.

Controlling Populations

1. Determine spawning strategies (movement patterns and habitat use in order to identify control strategies.)

2. Promote angling and commercial harvest.
   Comment: here – might as well make resource out of them.

3. Establish removal programs (incentives, etc.)

4. Assist in market development – educate public on value as a foodfish.
   Comment: Can be prepared in a tasteful manner.

5. Develop viruses.

6. Develop oral piscicides.

Group agreed with presentation.

COMMENT: In areas where you say promote the fishery – better to say promote removal of fish by people who are out there. Once people catch – remove them. Promote people to fish for them for purpose of removal. This comment directed to every statement to establish a fishery. Educate people.

COMMENT: If no economic incentive, can't get people to remove the fish.

COMMONALITIES

- across the board use of triploids
- public outreach/education
- sterile males
- restricting their movement
- don't take where they aren't – restricting where they already don't exist
- improve monitoring and reporting

- develop a removal system of bounty
- one comprehensive national policy
- increasing public awareness of identification
- commercial harvest
- sampling techniques
- spawning requirements across all groups

Jim:
Our purpose was to get communication started on Asian carp species which would lead to development of management and control plans. The information produced here will all be very useful. The next step for plan development requires volunteers. Need several days over the next few months to begin drafting elements of plans. Will use conference calls and perhaps a couple of meetings. Will involve draft development, editing, etc. Please submit name/business card if interested in helping to Jim and Linda.

Learned a lot from each other and this is a great start to plan development.

Linda:
Thanked everyone for contributions made. Got us on road to management plan. More expertise we have, better document will be so encouraged participation.

Workshop summary and identification of volunteers to assist with developing alternatives into a draft ANS Asian Carp Management and Control Plan. A minimum commitment of 3 days is required to review workshop results, identify information gaps, and initiate plan formulation.

ASIAN CARP WORKSHOP ATTENDEES

NAME/AGENCY	ADDRESS	PHONE/FAX	EMAIL
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Asian Carp Workshop Handouts

Life History and Ecology of

Bighead, Silver,

Grass, and Black

Carp

Bighead Carp

Means of Bighead Carp Introductions into the United States

First brought into the United States in 1972 by a fish farmer in AR to improve water quality in ponds

In 1994, several thousand escaped into the Osage River (MO) from a flooded aquaculture facility

Dispersed downstream into Ok from illegal stockings originating in KS

Illegally introduced with grass carp into CA from an AR facility

Bighead Carp Ecology

Prefers large river systems and associated backwater habitats

Spawning is initiated during a large rise in water levels

In water temperatures between 19° and 28° C

Fertilized eggs drift suspended between 20 and 60 hours until they hatch

Bighead Carp Ecology

Bighead carp progress through five shifts in feeding ecology from phytoplankton to zooplankton and insect larvae

Bighead carp are opportunistic feeders, they can decimate large concentrations of zooplankton and then shift to phytoplankton and detritus

Bighead carp can detect chemical cues given off by plankton concentrations

Silver Carp

Means of Silver Carp introductions in the United States

First brought into the United States during 1973 by an AR fish farmer to control phytoplankton in ponds and as a food fish

By 1980 they were discovered spawning and recruiting in natural waters,likely escapes from aquaculture facilities and sewage lagoons

Accidently stocked into FL and AZ with contaminated lots of grass carp

Silver Carp Ecology

Silver carp are similar in appearance and their spawning cues are similar to bighead carp

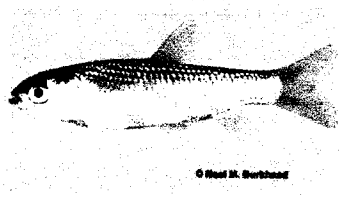
Spawning habitats are not as well known

Females reach sexual maturity in 3-4 years and males one year earlier

A three year old fish can reach 4-5kg in the wild

Primarily filter feed plankton and secondarily zooplankton but shift to organic detritus and bacteria when food resources are low

Grass Carp



Means of Grass Carp introductions in the United States

First imported to the US in AL and AR during 1963 to control aquatic vegetation in aquaculture facilities

First escaped into the wild from a Fish Farming Experimental Station in AR

Diploid and triploid fish have been intentionally stocked by numerous State and Federal resource management agencies and private individuals

Grass Carp Ecology

Migrations have been as long as 1700km in large riverine systems

Spawn when water levels rise at least 20cm and temperatures reach 17°C

Fry feed primarily on zooplankton but shift to an omnivore diet as juveniles

In adults the intestine is about 250% of the body length and they feed almost exclusively on plants

Digest about half of the food they consume leading to organic enrichment of their environment

Black Carp

Means of Black Carp Introduction into the United States

First brought to the US in the early 1970's in grass carp stocks

In the early 1980's imported as a food fish and as a biological control agent for the yellow grub in aquaculture ponds

In 1994, about 30 escaped into the wild when the Osage River in MO flooded an aquaculture facility.

Uncertain whether these fish were sterile.

Black Carp Ecology

Black carp are similar in appearance to grass carp so they could be accidently stocked out together

The largest of the Chinese carp and in its native range averages 15kg and 1m in length

Spawn in large rivers during moderate rises or receding waters

Males are sexually mature between six and eleven years and females about one year later

Black Carp Ecology

Utilizes benthic habitats partly due to their feeding behavior

Tolerates dissolved oxygen levels down to two ppm

Between 20 and 30mm their pharyngeal teeth are fully developed and begin to feed on insect larvae

The adults have well developed masticators and they prey primarily on mollusks but also use other shelled invertebrates

Redear Sunfish

Freshwater Drum

Summary

Bighead, silver, grass, and black carp utilize similar habitats but have unique feeding ecologies indicating that the impacts of each introduction are additive

Bighead and silver carp are similar in appearance as are grass and black carp making their accidental introductions into new areas likely

They are large river fish that migrate long distances and are easily capable of moving from one jurisdiction to another

Summary

Bighead, silver, grass, and black carp each have unique life history requirements that overlap native species at sometime in their life cycle.

Habitats and food resources utilized by these introduced carp species are often limited in large riverine systems

Grass carp feeding ecology greatly alters natural habitats often to the detriment of native species

Black carp in particular have the ability to directly compete with native species as well as prey on already declining species of mollusks

PRESENTER:
Leo G. Nico, U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, FL 32653; 353/378-8181; FAX 352/378-4956.

TITLE:
Distribution and Impacts of Asian Carps

ABSTRACT:
The Asian or Chinese carps introduced into the United States during the past few decades include grass carp (Ctenopharyngodon idella), silver carp (Hypophthalmichthys molitrix), bighead carp (Hypophthalmichthys nobilis), and black carp (Mylopharyngodon piceus). The grass carp was first imported to the United States in 1963 to aquaculture facilities in Alabama and Arkansas. The first known release into open waters in this country took place in Arkansas as the result of a fish escape from a fish farm. To date, grass carp have been recorded from 45 states (there are no reports of introductions in Alaska, Maine, Montana, Rhode Island, and Vermont). The silver carp was first brought into the United States in 1973 when a private fish farmer imported the fish into Arkansas. The species was first discovered in open waters some time around 1980, probably the result of escapes from fish hatcheries and other types of aquaculture facilities. Records of silver carp in open waters are available for 12 states. The bighead carp was first imported into the United States in 1972 in Arkansas. The species first began to appear in open waters, the Ohio and Mississippi rivers, in the early 1980s, likely as a result of escapes from aquaculture facilities. To date, the bighead carp has been recorded from within, or along the borders of, at least 18 states. The black carp first appeared in the United States in the early 1970s as a "contaminant" in grass carp stocks imported from Asia. In the early 1980s it was intentionally introduced by private fish farmers in Arkansas. To date, the only known record for open waters is a report of a farm escape during a flood event in Missouri in 1994.

Title: Bighead Carp in the Missouri River.

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Abstract:

Bighead carp *Hypophthalmichthys nobilis* were introduced into Arkansas in 1973 and have subsequently dispersed upstream through the Mississippi River and its tributaries. The population of bighead carp in the Missouri River has been increasing, as is evident in commercial harvest. Basic biological data on bighead carp in the Missouri River is needed to predict potential ecological problems and provide a foundation for manipulative studies. The objectives of this study were to assess general life history characteristics of bighead carp in the Missouri River and to test for competitive interactions between bighead carp and paddlefish *Polyodon spatula*. Bighead carp are pelagic spawners and larvae were found in the drift after periods of high discharge (> 2,400 m^3/s) and corresponding temperature regimes (between 25.5 °C and 28.0 °C). Egg diameter exhibited a bimodal distribution, suggesting protracted spawning; and fecundity (mean = 226,213 eggs; max = 769,964 eggs) was similar to populations documented in the Asian literature. Bighead carp exhibit fast growth in the Missouri River (e.g., up to 300 mm per year), which is also similar to Asian populations. Age-0 paddlefish lost weight significantly greater in mesocosms with age-0 bighead carp than in mesocosms with conspecifics. These results suggest that bighead carp have become well established in the Missouri River, and may negatively impact paddlefish. We surmise that increased dispersal and population density of this exotic species will negatively impact native planktivores in the lower Missouri River.

MISSISSIPPI INTERSTATE COOPERATIVE RESOURCE ASSOCIATION

SUMMARY (BY STATE) OF ASIAN CARP DISTRIBUTION IN THE MISSISSIPPI RIVER BASIN

Prepared by
Jerry Rasmussen, Coordinator/Executive Secretary

April 17, 2000

State	Grass Carp	Bighead Carp	Silver Carp	Black Carp
Alabama	Statewide in all river systems, both diploid and triploid have been privately and publically stocked for 30 years - Biologists are not aware of any natural reproduction.	Tennessee, Alabama, Mobile and Tombigbee rivers with suspected populations in the Chattahoochee River - Biologists are not aware of any natural reproduction.	Tennessee, Alabama, Mobile and Tombigbee rivers with suspected populations in the Chattahoochee River - Biologists are not aware of any natural reproduction.	Not known to occur in the state in either public or private waters. Possession, sale, importation and/or release is restricted by law.
Arkansas	Diploid stocking is allowed and grass carp have been stocked extensively in south and east Arkansas for vegetation control. Numbers and biomass in the Arkansas River typically don't exceed 5-10% of the total fish standing crop – usually much less. The fish is sought by commercial anglers for market. Nothing smaller than an adult has been observed. One biologist noted extremely abundant grass carp in the White River below Lock & Dam 1 at Batesville.	Arkansas, St. Francis, White, Cache and Mississippi rivers, and Bayou Meto – all of these observations are in areas adjacent to commercial fish farms and biologists assume escapement. Very common in the Arkansas River below Dam 2, the last dam before the mouth into the Mississippi River. Observed by biologists in Arkansas River upstream to Pool 9 below Lake Dardanelle, but not in Lake Dardanelle. However, one commercial catch in Lake Dardanelle was reported, but has not been confirmed. One observed in Bull Shoals Lake several years ago. At one time sale for bait was permitted, but has since been disallowed. Anglers snag them for food, and all observations have been adults.	Cache, St. Francie, White, and Arkansas rivers, and Bayou Meto – all observations have been adjacent to aquaculture production areas. One young of the year silver carp has been collected from the Mississippi River in Mississippi County north of Memphis.	Never observed in the wild, but cultured by private aquaculturists.
Colorado				

Georgia	Triploids are widely distributed throughout the state, however, in the 1990's a number of adult	A bighead carp was captured by an angler and positively identified in a private pond in	Not known to occur in the state. Possession, sale, and stocking is prohibited	One known collection from a private pond in the lower Altamaha river drainage.
State	**Grass Carp**	**Bighead Carp**	**Silver Carp**	**Black Carp**
	diploids were collected from the Oconee River near Dublin. No reproduction in the wild is known, and these collections are thought to be the result of escapment from private ponds. Possession of diploids is illegal without a license, and only one such license has been issued in the state. Possession, sale, and stocking is prohibited without a permit and permits are only issued if escapement can be positively prevented.	the lower Altamaha River drainage in 1993, but no other records exist. Possession, sale, and stocking is prohibited without a permit and permits are only issued if escapement can be positively prevented.	without a permit and permits are only issued if escapement can be positively prevented.	Possession, sale, and stocking is prohibited without a permit and permits are only issued if escapement can be positively prevented.

Illinois	Widespread and numerous in Mississippi, Illinois, Kaskaskia, Wabash, Little Wabash, and Ohio rivers; as well as some smaller streams. Culture, transport, stocking, Importation, and possession controlled by state permit program. Current Asian carp permit holders are in close proximity to the Mississippi and Kaskaskia rivers.	Widespread and numerous in Mississippi, Illinois, Kaskaskia, Wabash, Little Wabash, and Ohio rivers; as well as some smaller streams. Most abundant of the Asian carp species. Culture, transport, stocking, Importation, and possession controlled by state permit program. Current Asian carp permit holders are in close proximity to the Mississippi and Kaskaskia rivers. Most bighead carp caught by commercial fishermen are killed and thrown up on the bank. They are starting to run in the 40-60 lb. range and tear up angler's nets. The dead market for this species is minimal at best.	Widespread and numerous in Mississippi, Illinois, Kaskaskia, Wabash, Little Wabash, and Ohio rivers; as well as some smaller streams. Culture, transport, stocking, Importation, and possession controlled by state permit program. Current Asian carp permit holders are in close proximity to the Mississippi and Kaskaskia rivers.	Not recorded in the state.
State	**Grass Carp**	**Bighead Carp**	**Silver Carp**	**Black Carp**
Indiana				

Iowa	Collected by biologists from Missouri, Big Sioux, Mississippi, Des Moines (mouth to Green County), Racoon (mouth to Carroll county), Iowa (Iowa, Johnson, Marshal and Hardin counties), South Skunk (Keokuk County), Winnebago (Cerro Gordo County), and Cedar (Linn County) rivers. Importation permit required to receive, propagate, or sell in the state. Stocked statewide under permit in man-made lakes for use in vegetation control.	Collected by biologists from Missouri, Big Sioux, Mississippi (pools 16-19 and possibly Pool 9), Des Moines (mouth to Red Rock Dam), Iowa (at Iowa City), Cedar (at Cedar Rapids), and Walters Creek (tributary of E. Nodaway River) rivers. Importation permit required to receive, propagate, or sell in the state. No permits issues.	Not recorded in the state. Importation permit required to receive, propagate, or sell in the state. No permits issues.	Not recorded in the state. Importation permit required to receive, propagate, or sell in the state. No permits issues.
Kansas	Used statewide by pond owners for vegetation control, but no wild populations documented. However, young of the year (YOY) were captured in John Redmond Reservoir on the Neosho River in the 1980's; it is not known if they were naturally reproduced or escaped from production facilities. No other YOY have been collected in the wild.	Plentiful in the Missouri and Kansas (Missouri River upstream to Bowersock Dam) rivers. Less abundant above Bowersock Dam. Reproducion documented in the Missouri, but not the Kansas River. Regularly collected from Missouri River tributaries in Northeast Kansas. Collected from the Whitewater River of the Arkansas River drainage in the central Kansas. Used illegally by state fish farmers in catfish ponds to increase production. Importation, possession and release prohibited by state law.	May be present, but not documented. Importation, possession and release prohibited by state law.	May be present, but not documented. Catfish farmers are requesting that use be permitted in catfish ponds. Currently attempting to prohibit importation, possession and release in the state.
State	**Grass Carp**	**Bighead Carp**	**Silver Carp**	**Black Carp**

Kentucky	Lower Ohio River (mouth to Cannelton Lock and Dam), lower Tennessee River, lower Cumberland River, and lower Green River (below Lock and Dam No. 2). Importation, possession and sale regulated by state permit program.	Ohio River (mouth to at least McAlpine Lock at Louisville), lower Tennessee River (below Kentucky Lake Dam), lower Cumberland River (below Barkley Dam), lower Green River (below Lock and Dam No. 3, and the Mississippi River. Importation, possession and sale regulated by state permit program.	Mississippi River and lower Ohio River (mouth to Uniontown Lock and Dam). Importation, possession and sale regulated by state permit program.	Not recorded in the state. Importation, possession and sale regulated by state permit program.
Louisiana	Lake Providence; Grand Lake; Bayou LaFourche; Caney Creek; Chauvin Canal; and Mississippi, Red, Amite, False, Atchafalaya, Tensas, Boeuf, Calcasieu, Black, Little and Ouachita rivers. Self-sustaining wild populations documented in Bayou Lafourche and in the Tensas, Boeuf, Little and Ouachita rivers. Triploid possession, tranport, and use regulated by permit process.	Lake Providence; Bayou LaFourche; Bayou Courtableau; Prairion Bayou; Bayou Benoit; and Mississippi, Red, Atchafalaya, Tensas, Boeuf, and Ouachita rivers all have self-sustaining wild populations. Live possession prohibited by regulation.	Lake Providence; Lake Louis; Lake LaFourche; Henderson Lake; Bayou LaFourche; Gourd Bayou; Chauvin Canal; and Mississippi, Red, Tensas, Boeuf, Black and Ouachita rivers all have self-sustaining wild populations. Appears to be increasing in abundance, and may be the most abundance species in the Boeuf River where it is displacing native species like buffalo. Live possession prohibited by regulation.	No reports. Live possession prohibited by regulation.
Minnesota				
Mississippi	Distributed statewide.	Pascagoula, Mississippi, Sunflower and Yazoo rivers, Mathews Break, and Sardis Lake.	No records of collections from the wild.	No records of collections from the wild, but is being used in catfish ponds on the Yazoo River Basin.

State	Grass Carp	Bighead Carp	Silver Carp	Black Carp
Missouri	Established and reproducing in many waters of the state, especially the Mississippi and Missouri rivers and the lower reaches of their tributaries. May also be occasionally found in most streams of the state.	Considerably more numerous than the other Asian carp species. Widely distributed with large populations in many streams, especially in the Missouri, Mississippi, Osage and Salt rivers, and the lower reaches of their tributaries as well as floodplain waters. Larvae and fingerlings have been collected in the Missouri and Mississippi rivers.	Less abundance than grass and bighead carp, but numbers are increasing. Most often reported from Missouri and Mississippi rivers and some major tributaries. Believed to be reproducing in the state.	Not documented in public waters, but a small number escaped from a private aquaculturist in 1993, and haven't been reported since.
Montana	One illegal introduction (west of the Continental Divide) detected and destroyed in 1998. Importation and possession for commercial or private use is prohibited by regulation.	Not known to occur in the state. Importation and possession for commercial or private use is prohibited by regulation.	Not known to occur in the state. Importation and possession for commercial or private use is prohibited by regulation.	Not known to occur in the state. Importation and possession for commercial or private use is prohibited by regulation.
Nebraska	Collected by biologists from the Missouri and Platte rivers as well as Middle Creek below Pawnee Reservoir. Importation, stocking and exportation prohibited by state law.	Collected by biologists from the Missouri River and Middle Creek below Pawnee Reservoir. Importation, stocking and exportation prohibited by state law.	Not known to occur in the state. Importation, stocking and exportation prohibited by state law.	Not known to occur in the state. Importation, stocking and exportation prohibited by state law.
New York	Rumored, but not confirmed in the Hudson River. Commonly sold in New York City fish markets. Importation restricted by law, and triploid use for vegetation control permitted in ponds less than 5 acres. Large lake stocking is	Not documented in state.	Not documented in state.	Not documented in state.

State	Grass Carp	Bighead Carp	Silver Carp	Black Carp
	infrequent. Wild populations not known			
North Carolina	Widely distributed (supposedly triploids) throughout the state.	Not documented in the state.	Not documented in the state.	A small number were imported several years ago for a University of North Carolina Sea Grant study. None have been legally imported since, and no records were reported in the wild. Plans are being made to ban introductions under the next regulation cycle.
North Dakota	Spiritwood Lake (illegal introduction in 1977, no reproduction/no grass carp seen in 5 years) and one small lake in eastern part of state (illegal introduction eradicated)	Not recorded in the state.	Not recorded in the state.	Not recorded in the state.
Ohio				

Oklahoma	Statewide including Thunderbird, Arbuckle, Canton, and most major reservoirs in southeast Oklahoma, and the Arkansas River Navigation System. Can be legally stocked in private waters for vegetation control. Dr. Bill Shelton, University of Oklahoma, has a permit to culture all 4 Asian carp species and has some of each in research ponds	Below Denison Dam on Lake Texoma, Muddy Boggy River, and Grand Lake and its tailwaters. Dr. Bill Shelton, University of Oklahoma, has a permit to culture all 4 Asian carp species and has some of each in research ponds	Confirmed in southeast Oklahoma, but exact location not recorded. Dr. Bill Shelton, University of Oklahoma, has a permit to culture all 4 Asian carp species and has some of each in research ponds Also, Langston University has a permit to conduct research on silver carp.	Non reported, but Dr. Bill Shelton, University of Oklahoma, has a permit to culture all 4 Asian carp species and has some of each in research ponds.
State	**Grass Carp**	**Bighead Carp**	**Silver Carp**	**Black Carp**
Pennsylvania	Triploid stocking strictly regulated under a permit and tracking process (i.e. 6,710 triploids have been stocked in waters (primarily farm ponds) of the Ohio River Basin since 1994. Permit applicants must screen pond's effluent to ensure against escapement, and thus far no triploids have been captured in the wild. Diploid use prohibited and are not known to occur in the state.	Not known to occur in the state, and cannot be imported, transported, propagated or released in the state.	Not known to occur in the state, and cannot be imported, transported, propagated or released in the state.	Not known to occur in the state, and cannot be imported, transported, propagated or released in the state.

South Dakota	Documented in the Missouri River below Gavin's Point Dam. Suspected occurrence in tributaries (i.e. James, Vermillion and Big Sioux rivers. Very concerned about lakes in the Big Sioux drainage. Transport and stocking is prohibited without permit. Emptying of bait containers in public waters prohibited.	Documented in the Missouri River below Gavin's Point Dam. Suspected occurrence in tributaries (i.e. James, Vermillion and Big Sioux rivers. Very concerned about lakes in the Big Sioux drainage. Transport and stocking is prohibited without permit. Emptying of bait containers in public waters prohibited.	Not known to occur in the state. Transport and stocking is prohibited without permit. Emptying of bait containers in public waters prohibited.	Not known to occur in the state. Transport and stocking is prohibited without permit. Emptying of bait containers in public waters prohibited.
Tennessee	Probably statewide in most main channel reservoirs. Exceptions - headwater streams and upland, non-navigable reservoirs	Mississippi River, Tennessee River (Kentucky Lake), Cumberland River (Cheatham Reservoir)	No verified captures, but assumed to be present in the Mississippi River	Not known to occur in the state.
Texas	Illegal stockings throughout the state. Fertile diploids were legally stocked in Lake Conroe (San Jacinto River drainage) in	Entered the state as contaminants in grass carp shipments, or were deliberately imported and sold as trotline	No records available, but could be stocked legally under a state permit.	May be present in ponds at Texas A&M University, but is not confirmed.
State	**Grass Carp**	**Bighead Carp**	**Silver Carp**	**Black Carp**
	the early 1980's, where they are still present. Trinity River downstream of Lake Livingston Dam, where spawning has occurred in at least two years producing viable eggs and larvae. Triploids have been stocked statewide throughout the 1990's.	bait (now illegal). One or two specimens collected from Lake Conroe, Victor Braunig Reservoir (San Antonio River drainage), Red River, and upper Brazos River drainage. No evidence of established wild populations exists.		

Virginia	Possession, sale, or importation is prohibited without a permit from the state. Routine permits are issued for the stocking of triploids from list of state approved suppliers . Shipments are routinely inspected by the U.S. Fish and Wildlife Service and spot checked by state officials. Ten individuals have been collected by state biologists in the wild, all tested to be triploid. One percent escapement is estimated from permit holders.	Possession, sale, or importation is prohibited without a permit from the state. None have been issued.	Possession, sale, or importation is prohibited without a permit from the state. None have been issued.	Possession, sale, or importation is prohibited without a permit from the state. None have been issued.
West Virginia				
Wisconsin	The only confirmed population is in Sheboygan County (east central Wisconsin).	Not recorded in the state.	Not recorded in the state.	Not recorded in the state.
Wyoming				

MISSISSIPPI INTERSTATE COOPERATIVE RESOURCE ASSOCIATION

Summary of Permit Authority and Prohibited Species by State With Special Emphasis on Asian Carp

Prepared by
Jerry Rasmussen, Coordinator/Executive Secretary
April 17, 2000

State	Authority	Prohibited Species	Need for Basinwide Policy
Alabama	Controlled under state code and permit program.	Possession, sale, importation, and/or release prohibited for the following: Fish Species - walking catfish or any *Clarius spp.* - Piranha or any *Serrasalmus spp* - black carp (*Mylopharyngodon sp.*) - *Siniperca spp* - *Channa maculuta* - *Chirrhinus molitonella* - blue back herring (*Alosa aestivalis*) - rudd (*Scardinius erythrophthalmus*) - roach (*Rutilus rutilus*) - Possession, sale, importation, or release of any non-native sturgeon, except as permitted Plant Species - African elodea (*Lagarosiphon spp.*) - alligatorweed (*Alternanthera philoxeriodes*) - Brazilian elodea (*Egeria densa*) - curlyleaf pondweed (*Potamogeton crispus*) - Eurasian watermilfoil (*Myriophyllum spicatum*) - floating waterhyacinth (*Eichhornia crassipes*) - giant salvinia (*Salvinia molesta*) - hydrilla (*Hydrilla verticillata*) - hygrophila (*Hygrophila polysperma*) - limnophila (*Limnophila sessiliflora*) - parrot-feather (*Myriophyllum aquaticum*) - rooted waterhyacinth (*Eichhornia azurea*) - spinyleaf naiad (*Najas minor*) - water-aloe (*Stratiotes aloides*) - water-lettuce (*Pistia stratiotes*) - water chestnut (*Trapa natans*) - water spinach (*Ipomea aquatica*)	A basinwide policy or protocol for introductions of exotic species should be considered.

Arkansas	Controlled under state code and permit program. It shall be unlawful to place silver carp, black carp, or bighead carp into any body of water where ingress into public waters of said fish is not entirely blocked. It is unlawful to engage in the rearing or sale of non-native fish species without first being	walking catfish stickleback Mexican banded tetra prianha These prohibited species may be possessed for display and educational purposes with a written permit from the Arkansas Game and Fish	No comment made on need for basinwide policy.
State	**Authority**	**Prohibited Species**	**Need for Basinwide Policy**
	registered in writing as a vendor of said species with the Director of the Arkansas Game and Fish Commission.	Commission. A list of all known and approved non-native fish is maintained by the state, and fish intended strictly for aquarium hobbyist trade is excluded from any of these regulations.	
Colorado			
Georgia	Sale, possession, and stocking of exotic fish species is regulated by a state wild animal law, requiring anyone who possesses an exotic species to obtain a wild animal license. Conditions are tailored to each individual situation to prevent escapement of exotic fishes into the wild. Licenses are not issued if escapement cannot be positively prevented. Sale and stocking is also controlled by state permit.	No list is maintained, but certain species such as diploid grass carp are more closely regulated than other species. An exotic species is defined as any species which is not native to the state or is not recognized as having an established populations in public waters prior to 1992.	Support the development of a basinwide policy.

Illinois	Aquaculture, transportation, stocking, importation and/or possession of aquatic life is controlled under state code and a permit program.	Species prohibited for use as bait include the following: - rusty crayfish - river ruffe - round goby - tube nose goby - rudd Any species that does not appear on the Aquatic Life Approved Species List is illegal to raise, transport, stock, import or possess without permission of the DNR Director. For such exotic species, an aquaculture permit combined with a Letter of Authorization to Import/Possess is required. Persons requesting to rear a species not on the List must have their facilities inspected to see if they meet the criteria set by the Aquaculture Advisory Committee. Permits are granted on a case by case basis.	Support development of a basinwide policy, but suggest the only reasonable approach for such a policy to be acceptable would be that it address species which have not yet been imported into this country, or are in such limited distribution that their extermination might still be achievable, such as the black carp.
Indiana			
State	**Authority**	**Prohibited Species**	**Need for Basinwide Policy**
Iowa	Possession, propagation, sale, and transport is controlled under state code and permit program. Nonindigenous species may not be received or sold without an importation permit.	An approved list of 135 species is maintained for aquaculture species. Importation permit is required to receive, propagate or sell in the state any aquaculture species not listed.	Support the development of a basinwide policy.

Kansas	Controlled under state code and permit program.	Prohibited species include the following: - walking catfish (*Clarias batachus*) - silver carp (*Hypophthalmichthys molitrix*) - bighead carp (*Aristichthys nobilis*) Any live member of the fish and bird species listed in subsection (1) and possessed prior to February 1, 1978 may be retained in possession, in closes confinement, by making application to the secretary stating the circumstances, location and other information by which the animal came into possession. The manner in which the specimen is to be used shall be identified in the application.	Would welcome development of a basinwide policy.
Kentucky	Controlled under state code and permit program. The raising, hatching, or release of fish in public waters is closely regulated. Importation and possession of fish considered detrimental to Kentucky's resident fish populations are also prohibited. Non-native fishes may be imported, possessed or sold with approval by the Division of Fisheries.	No prohibited species list was provided.	Support the need for such a policy, but question it's effectiveness. There needs to be an enforceable federal law prohibiting the possession of exotic fish that pose a threat to our native fish species.
Louisiana	Possession, sale, and transport controlled under state code and permit program. Triploid grass carp and tilapia covered under special regulations.	Importation, possession, transport, and sale is prohibited for the following fish species (except as permitted in writing): - carnero catfish (*Clarias batrachus*) - all members of the family *Claridae* - freshwater electric eel (*Electrophorus sp.*) - carp (except those taken in state waters, provided such fish shall be dead when in a person's possession or triploid grass carp held under permit) - common carp (*Cyprinus carpio*) - goldfish (Carassius auratus)	No comment made on this issue.
State	**Authority**	**Prohibited Species**	**Need for Basinwide Policy**
		- rudd (*Scardinius erythrophthalmus*) - tilapia (all species) - piranha (except under permit at public facilities) - Rio Grande tetra	
Minnesota			

		mud carp, sandhkol carp (*Cirrhinus spp.* and *Thynnichthys spp.*) rudd and roach (*Scardinius spp.* and *Rutilus spp.*) old world breams (*Abramis spp.*, *Blicca spp.*, *Megalobrama spp.* and *Parabramis spp.* old world chubs, ide and dace (*Leuciscus spp.*) asps and yellowcheek (*Aspius spp.*, *Psedaspius spp.*, *Aspiolucius spp.* and *Elopichthys spp.*) giant barbs and mahseers (*Tor spp.*, *Barbus tor* and *Barbus hexagonolepis* catla (*Catla spp.*) whale catfishes (*Cetopsidae*) pike killifish (*Belonesox belizanus*) marine stonefishes (*Synanceiidae*) ruffes and schraetzers (*Gymnocephalus spp.*) zanders (*Stizostedion lucioperca, S. volgense* (*volgensis*) and *S. marinum* cichlids (*Crenicichla spp.* and *Batachops spp.*) Asian pikehead (*Luciocephalus*) <u>Plant Species</u> hydrilla (Florida elodea) (*Hydrilla certicillata*) egeria (African elodea) (*Egeria densa)* water hyacinth (*Eichhornia crassipes*) rooted hyacinth (*Eichhornia azurea*) Eurasian watermilfoil (*Myriophyllum spicatum*) water lettuce (*Pistia stratiotes*) paperbark (Melaleuca) (*Melaleuca quinquenervia*) <u>Invertebrate Species</u> yabbie lobster (*Cherax destructor*) zebra mussel (*Dreissena polymorpha*) Tasmanian giant crayfish (*Astacopsis spp.*) Dept. of Wildlife, Fisheries and Parks list has not yet been developed, but walking catfish, piranha are prohibited under separate regulation.	
Missouri	No permits required in Missouri for commercial fish producers except for the importation of live fish, eggs and gametes of the family *Salmonidae*. Otherwise only	**<u>Approved Species List</u>** - includes all subspecies, varieties and hybrids of the same bought, sold, transported, propagated, taken and possessed for purposes of aquaculture):	Support the need for a basinwide policy.
State	**Authority**	**Prohibited Species**	**Need for Basinwide Policy**

Mississippi	Aquaculture industry controlled by Dept. of Agriculture and Commerce. The culture of any non-native carp species (such as bighead carp, black carp, grass carp, silver carp and common carp) shall be conducted in a responsible manner that excludes the possibility of escape. It is necessary to construct a barrier that prevents escape of juvenile and adult fishes. Permit required for all non-native plants and animals. Stocking in state waters is controlled by Dept. of Wildlife, Fisheries and Parks permit program.	The following prohibited species may be allowed under a Dept. of Agriculture and Commerce permit process where environmental impact has been assessed: Fish Species lampreys (*Petromyzontidae*) piranha and pirambebas all species (*Serrasalminiae*) banded tetra (*Astyanax fasciatus*) Mexican tetra or silvery tetra (*Astyanax mexicanus*) tiger characin or trahira (*Hoplias malabaricus*) skinny tiger characin or biara (*Raphidon vulpinus*) pencil or parasitic catfishes (*Trichomycteridae*) airbreathing or walking catfishes (*Clariidae*) bony-tongue (*Osteoglossidae*) dorados (*Salminus*) freshwater stingrays (*Potamotrygonidae*) Nile perches (*Lates* and *Luciolates*) African electric catfishes (*Malapteruridae*) African tigerfishes (*Alestidae/Hydrocyninae*) freshwater electric eels (*Electrophoridae*) snakeheads (*Channidae*) South American tigerfishes (*Erythrinidae*) airsac catfishes (*Heteropneustidae*) peacock bass or peacock ciclid (*Cichla ocellaris*) South American pike characoids (*Acestrorhynchus spp.* and *Ctenolucious spp.* and *Luciocharax* (*Boulengerella*) *spp.* African pike characoids (*Hepsetus spp.* and *Ichthyboridae*, rhapiodontid characoids (*Hydrolycus spp.* and *Raphiodon* (*Cynodon*) *spp.* banded knifefish (*Gymnotus carapo*)	Support the need for a basinwide policy.
State	**Authority**	**Prohibited Species**	**Need for Basinwide Policy**

	listed species may be bought, sold, transported, propagated, taken, and possessed by any person. Possession of any other species requires written permission of the Missouri Dept. of Conservation Director. Do not routinely inspect aquaculture facilities, rely on U.S. Ports of Entry for this.	Fish Species shovelnose sturgeon (*Scaphirhynchus platorhynchus*) paddlefish (*Polyodon spathula*) spotted gar (*Lepisosteus oculatus*) longnose gar (*Lepisosteus osseus*) shortnose gar (*Lepisosteus platostomus*) bowfin (*Amia calva*) gizzard shad (*Dorosoma cepedianum*) threadfin shad (*Dorosoma petenense*) rainbow trout (*Oncorhynchus mykiss*) golden trout (*Oncorhynchus aquabonita*) cutthroat trout (*Oncorhynchus clarkii*) brown trout (*Salmo trutta*) brook trout (*Salvelinus fontinalis*) coho salmon (*Oncorhynchus kisutch*) northern pike (*Esox lucius*) muskellunge (*Esox masquinongy*) goldfish (*Carassius auratus*) grass carp (*Ctenopharyngodon idella*) common carp (*Cyprinus carpio*) golden shiner (*Notemigonus crysoleucas*) bluntnose minnow (*Pimephales notatus*) fathead minnow (*Pimephales promelas*) bigmouth buffalo (*Ictiobus cyprinellus*) black bullhead (*Ameirus melas*) yellow bullhead (*Ameirus natalis*) brown bullhead (*Ameirus nebulosus*) blue catfish (*Italurus furcatus*) channel catfish (*Ictalurus punctatus*) flathead catfish (*Pylodictis olivaris*) mosquitofish (*Gambusia affinis*) white bass (*Morone chrysops*) striped bass (*Morone saxatilis*) green sunfish (*Lepomis cyanellus*) pumpkinseed (*Lepomis gibbosus*) warmouth (*Lepomis gulosus*) orangespotted sunfish (*Lepomis humilis*) Bluegill (*Lepomis macrochirus*) longear sunfish (*Lepomis megalotis*) redear sunfish (*Lepomis microlophus*)	

State	Authority	Prohibited Species	Need for Basinwide Policy
		smallmouth bass (*Micropterus dolomieu*) spotted bass (*Micropterus punctulatus*) largemouth bass (*Micropterus salmoides*) white crappie (*Pomoxis annularis*) black crappie (*Pomoxis nigromaculatus*) yellow perch (*Perca flavescens*) walleye (*Stizostedion vitreum*) bighead carp (*hypophthalmichthys nobilis*) Crustaceans northern crayfish (*Orconectes virilis*) White River crayfish (*Procambarus acutus*) red swamp crayfish (*Procambarus clarkii*) Amphibians tiger salamander (*Ambystoma tigrinum*)	
Montana	Controlled under state code and permit program. Importation of any fish or fish eggs of any species, except fish intended solely for use in private aquariums, is closely regulated. An import permit is required before any fish of any species may be imported into Montana for stocking into any open water. Importation of minnows and other bait fish is not allowed in Montana, with the exception of bait minnows for private use in the Big Horn and Tongue River drainages. In the case of those exceptions bait fish only from those specific immediate drainages in Wyoming are allowed for fishing in Yellowtail Reservoir and Tongue River Reservoir. Rainbow trout stocking is now being closely watched where native cutthroat trout exist. An approved species list is maintained.	Prohibited species list not provided. Permitted species include: rainbow trout (*Salmo gairdneri*) golden trout (*Salmo aquabonita*) brown trout (*Salmo trutta*) brook trout (*Salvelinus fontinalis*) lake trout (*Salvelinus namaycush*) northern pike (*Esox lucius*) black bullhead (*Ictalurus melas*) yellow bullhead (*Ictalurus natalis*) largemouth bass (*Micropterus salmoides*) smallmouth bass (*Micropterus dolomieui*) pumpkinseed sunfish (*Lepomis gibbosus*) bluegill (*Lepomis macrochirus*) green sunfish (*Lepomis cyanellus*) rock bass (*Ambloplites rupestris*) black crappie (*Pomoxis nigromaculatus*) white crappie (*Pomoxis annularis*) yellow perch (*Perca flavescens*) walleye (*Stizostedion vitreum*) cisco (tulibee) (*Coregonus artedii*) spottail shiner (*Notropis hudsonius*) kokanee salmon (*Oncorhynchus nerka*) chinook salmon (*Oncorhynchus tshawytscha*) lake whitefish (*Coregonus clupeaformis*)	Would participate in discussions regarding a policy to deal with introductions of exotic species.

State	Authority	Prohibited Species	Need for Basinwide Policy
		golden shiner (*Notemigonus crysoleucas*)	
Nebraska	Importation, sale, and stocking controlled under state code and permit program. "Sport fish", "Baitfish", "Commercial fish", "Game fish" and "Nongame fish" defined by statute. Commercial put-and-take, bait dealers, aquaculture, importation, and exportation closely controlled by permit system. Do not regulate the aquarium trade.	Prohibited species list not maintained. An approved list is maintained, but a copy was not provided. Approved baitfish include 16 species (14 cyprinids, 1 topminnow, and 1 shad). The only nonnative species on the list is the goldfish.	Did not comment on the basinwide policy.
New York	Importation and sale controlled under state code and permit program.	Importation and sale is prohibited for the following fish species (except as permitted): - piranha - grass carp - round goby	Support the need, but question it's effectiveness.
North Carolina	Controlled under state code and permit program.	A few black carp were imported into the state under a University of North Carolina Sea Grant study a few years ago, but none have been legally imported since. Plans are being made to ban black carp under the next regulation cycle.	No comment made on a basinwide policy
North Dakota	State code provides the authority to permit or deny importation (except pet trade) or stocking of any aquatic species in state waters. Authority becomes "gray" in some instances.	No formal list established, but nothing allowed without tremendous safeguards.	No comment made, except "gray" area noted in some instances of authority.
Ohio			
Oklahoma	Stocking and possession controlled under state code and permit system. No species of wildlife can be legally released into the wild by private citizens without written consent of the Director of the Dept. of Wildlife Conservation.	I. The importation and/or possession of the following exotic fish or their eggs is prohibited: - *Claridae* (all species of the walking catfish family) - grass carp (*Ctenopharyngodon idella*), except it is legal to stock in private waters - boney-tongue fish group (*Osteoglossum spp.* and *Arapaima spp.*) - piranha (*Serrasalmus spp., Pygocentrus spp, Rooseveltiella spp., Catoprion spp., Hydrocynus spp.*, and *Salminus spp.*)	Would support development of basinwide policy, but concerned about how the stocking of species such as striped bass and walleye may be effected.

State	Authority	Prohibited Species	Need for Basinwide Policy
		- electric eel (*Malapterus electricus*) - gar-pike topminnow (*Belonesox belizanus*) - snakehead groups (*Opicephalus spp.* and *Channa spp.*) - pavon or peacock bass (*Chichla temensis* and *Chichia ocellaris*) - parasitic South American group (*Candiru)*, genera and species of the *Trichomycteridae* family (*Vandellia spp., Tridens spp.*, and *Pyqidium spp.*) - freshwater stingray group (*Paratrygon spp., Potomotrygon spp,* and *Disceus spp.*) - houri (from South America) (*Macrodon spp.* and *Hoplias spp.*) - rudd and rudd hybirds (*Scardinius spp.*) II. The following species shall be permitted for use in research projects only: - bighead carp (*Hypophthalmichthys molitrix*) - silver carp (*Aristichthys nobilis*) - black carp (*Mylopharyngodon piceus*) - alewives (*Aloso pseudoharengus*) - rainbow smelt (*Osmerus mordax*) III. Tilapia - sale and use as bait is prohibited - stocking in any heated water reservoirs is prohibited including Sooner, Konawa and Boomer reservoirs - sale of dead and/or processed Tilapia for human food is permitted - sale or transport for the purpose of aquatic vegetation control in private ponds is permitted	

Pennsylvania	Importation, stocking, propagation, and release controlled under state code and permit program, portions of which (i.e. aquaculture and propagations) were recently transferred from authority of the Fish and Boat Commission to the Department of Agriculture.	A list is maintained, but is currently under revision, a general regulation states that it is unlawful to introduce species into a watershed where it does not already occur. Therefore, it is illegal for anyone to introduce black, silver, or bighead carp into PA waters.	Such a plan may have a great impact and benefit, and suggest patterning it after other existing plans (e.g. Chesapeake Bay) to expedite the difficult process of coming to a consensus.
State	**Authority**	**Prohibited Species**	**Need for Basinwide Policy**
South Dakota	Transportation, handling, and stocking controlled under state regulation and a permit program, but this is a difficult task and many "after the fact" problems arise.State regulation also makes it illegal "for any person to empty the contents of any minnow bucket or other receptacle containing bait into any public waters of the state."	A list of prohibited species is not maintained, with the exception of several species (list not provided) that are prohibited for use as bait.	Very interested in exploring the development of a basinwide policy or protocol.
Tennessee	Importation and stocking is controlled under state code and permit program; except a permit is not required for triploid grass carp, rainbow trout, brown trout, and all species of salmon. Asian carp can be imported under permit.	A species list was not provided.	Support the need for a basinwide policy.
Texas	Controlled under state code and permit program.	Texas Parks and Wildlife Dept. can issue permits to import and possess black carp, and there appears to be some suggestion that this has probably happened – awaiting official correspondence from Austin.	No comment made on the need for a basinwide policy.

Virginia	Possession, sale, or importation controlled under state code and permit program. State regulation also makes it illegal "for any person to empty the contents of any minnow bucket or other receptacle containing bait into any public waters of the state."	A species list was not provided.	Support for a basinwide policy was alluded to in comments that suggested the need for any such policy to (1) be based on sound science, (2) be enforceable, (3) be provided with mechanisms to verify that it is being followed by all participants, and (4) that it address the interstate shipment of live fish to guard against the potential catastrophic results of the crash of a fish transport vehicle while passing through a state which is neither to origin or destination of the shipment.
West Virginia			
State	**Authority**	**Prohibited Species**	**Need for Basinwide Policy**

Wisconsin	Importation and stocking is controlled under state regulation and a permit program. If a person wishes to import a non-native species, they must first work with local fisheries biologists to develop an environmental assessment (EA) for this activity. The EA is reviewed by DNR staff and if there is a possiblity of escapement and related habitat loss or reproduction in the wild, DNR will not issue the permit. If the DNR feels there is no biological concern, the activity is approved. But then the applicant must apply to the Dept. of Agriculture, Trade and Consumer Protection for an import permit that covers fish health only (no ecological issues are addressed). These determinations are made on a case by case basis. With the exception of trout and salmon (browns, rainbows, coho, and chinook) the DNR does not issue stocking permits for exotic species. Fish that are determined to be detrimental to any of the waters of the state may be removed by the DNR or the DNR may cause them to be removed.	No list of prohibited species exists, and each application is reviewed on a case by case basis.	Support development of a basinwide policy.
Wyoming			

CATFISH FARMERS OF AMERICA
1100 HIGHWAY 82 E. SUITE 202
INDIANOLA, MISSISSIPPI 38751
(601) 887-2699
662

Catfish Farmers of America founded in 1968, is the nations strongest aquaculture organization with membership from thirty-five states. CFA is primarily a trade association of farm-raised catfish producers, suppliers, processors, researchers and academia.

Major functions are legislative activity, research initiatives and member services. At least two national conferences are held each year.

The Catfish Journal, recognized as the industry leader for news and information, is CFA's official publication.

Funding for the association is provided by member dues and voluntary endowments from the major catfish feed mills.

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Use of Asian Carp in Aquaculture

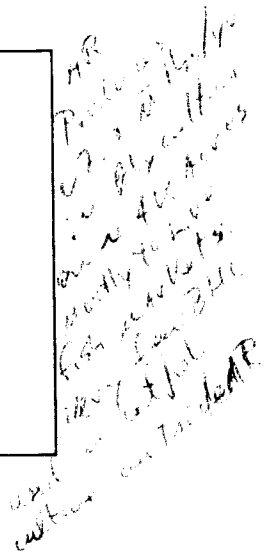
Jimmy Avery, Ph.D.
Assoc. Extension Specialist - Aquaculture
National Warmwater Aquaculture Center

Species Used

- Bighead Carp
- Silver Carp
- Grass Carp
- Black Carp

Bighead Carp (+)

- Filter-feeding omnivores
- 100 - 500 / acre when polycultured with catfish
- Reach 3 pounds in single growing season



Bighead Carp (-)

- Actually increase phytoplankton biomass
- Must be hand sorted
- Few markets
- Dockage by processors
- Few farmers outside of AR

Silver Carp (+)

- Filter-feeding omnivores
- 100 - 500 acre when polycultured with catfish
- Reach 1 to 3 pounds in single growing season

Silver Carp (-)

- Actually increase phytoplankton biomass
- Must be hand sorted
- Fewer markets than bighead
- Injury to labor
- Dockage by processors
- Extremely few farmers outside of AR

Grass Carp (+)

- Control of nuisance aquatic weeds in nursery ponds (5 to 10 per acre)
- Do not compete with small catfish for food
- Consume large quantities of weeds
- Prefer *Najas* and *Chara*
- Reduced chemical usage

Grass Carp (-)

- Long time to reduce existing weed problems
- 2 to 3 year old fish switch to feed
- Injury to labor
- No commercial foodfish value
- Few weed problems in foodfish ponds

Black Carp

- Used by AR baitfish producers to control grub problems
- No interest by catfish farmers until late 1999
- Integral part of control measures for *Bolbophorus confusus*

Current NWAC Recommendations

- Margin treatments of hydrated lime or copper sulfate to reduce populations
- Aquatic weed control to remove habitat
- Socking 10 black carp / acre to reduce populations and control recruitment (10 - 20 % annual replacement)

MDAC Guidelines for Use of Black Carp

- Cultivation Marketing Permit
- Facility inspection for filtering system
- Stock as follows
  - Triploids
  - Non-certified triploids
  - Diploids until December 31, 2000
- Notification of shipping
- Black Carp fingerling producers

Double Screen on Pond Drains

- Expanded metal mesh (1/4") or slotted well pipe (1/4") on inside
- Soft screening devices (1/2" mesh) on outside alfalfa valves and riser pipes
- Soft screens checked twice annually and replaced when needed

How many farms?

- 396 potential farms as of January 1999 (1997 Census of Agriculture)
- Only 6 permitted farms (1.5% of total)
- One permitted research station (NWAC)
- Pending
  - 5 farms
  - 1 research station
- Number may increase due to increasing bird numbers

How many ponds?

- Unknown
- Not all ponds on a farm
- Preference in stocking
  - Ponds with active infection
  - Ponds with pelican pressure
  - Ponds with stockers or fingerlings

Black Carp (-)

- Currently only out-of-state producers
- No economic recovery of costs
- Polyculture adds management problems
- Historically good stewards

The catfish trematode and other digenetic trematodes infecting cultured fish and the importance of controlling their snail hosts.

Andrew J. Mitchell

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Digenetic trematodes, often referred to as grubs or flukes, are flat endoparasitic worms with complex life cycles that often involve avian and molluscan hosts. They usually are less than one cm in length and often have two suckers. Some of the digenetic trematodes cause serious problems in commercially cultured fish.

There are at least thirty digenetic trematodes that are known to infect channel catfish, *Ictalurus punctatus,* and two of these have been responsible for economic losses. Recently digenetic trematodes, tentatively identified as *Bolbophorus confusus*, have infected fish on at least 17 catfish farms in Arkansas, Louisiana, and Mississippi. They were first confirmed as a problem in Louisiana in 1994, then spread and infected catfish in other ponds and farms in that state in 1995 and 1996. In 1998 they were confirmed as a serious problem on a single catfish facility in the Delta region of Mississippi. By 1999, the trematodes were found on 12 Mississippi farms and two Arkansas farms. On several of these farms moderate to serious losses were reported. *Bolbophorus confusus* infections, while not always serious, can kill over 90% of the catfish in ponds in less than a week, put fish off feed, slow fish growth, and affect fish marketability. These infections are also thought to stress fish making them more susceptible to other diseases. In 1998, at least one catfish producer went out of business because of this parasite. The dollar amount of actual losses attributed to the parasite is difficult to assess but it would not be unreasonable to assume that several hundred thousand to two million dollars in revenue were lost in each of the previous two years.

The trematode is vectored by the American white pelican *Pelecanus erythrorhynchos* and the brown pelican *P. occidentalis*, the definitive hosts, and two ram's horn snails *Planorbella trivolvus trivolvus and P. subcrenatum*, the first intermediate hosts. The metacercaria (the form in the fish) infect the muscle tissues and are usually found in the caudal peduncle. They are characterized by the presence of lateral pseudosuckers, a clear cyst of parasite origin, interconnecting excretory channels, a tribocytic or holdfast organ, and distinct hind- and forebody regions. The length of metacercarial trematodes usually ranges from 1 to 2 mm. The furcocercous cercaria (the form that is released from the snail and penetrates the fish) is about 310 µ in total length with the head region, anterior caudal portion, and furca all approximately the same length. It can survive in water for about 96 h and infects host fish from March through November. More than 1,000 cercariae can be released per day per snail. This trematode has also been found in brown trout in Montana in 1962 and 1965, bluegill in the North Central U.S. in 1981 and fathead minnows from South Dakota in 1982.

The other trematode that has caused losses in catfish is the yellow grub, *Clinostomum complanatum*. This parasite also has *Planorbella spp.* as the snail hosts, but the avian hosts are several heron species. It rarely kills catfish but can slow fish growth and make the fish unmarketable because of the presence of unsightly worms (about 1 cm in size) in the muscle. About two truck loads of catfish are rejected at the processing plants each year due to the trematode. In recreational ponds catfish have had to be restocked because the infection rate was high enough to prevent growth.

This yellow grub has accounted for some serious losses in other aquacultured species. A loss of $400,000 was reported by one hybrid striped bass producer in North Carolina. A whole year class of fish was unmarketable (these trematodes take three or more years to be eliminated from the muscle) and had to be destroyed. In at least one case, a pond full of fathead minnows died from a massive yellow grub infection.

A digenetic trematode, the gill trematode *Centrocestus formosanus,* was recently found infecting 12 of 17 fish, including an endangered darter, in the Comal River near San Marcos, TX. It has already caused serious problems (millions of dollars) in the tropical fish industry (many farms were put out of business) and has the potential to infect four major warmwater fish species (channel catfish, hybrid striped bass, fathead minnow and golden shiner). This trematode is carried by a number of different aquatic birds and by an exotic snail, the red rimmed melania, *Melaniodes tuberculata*.

Significant losses of striped bass, fathead minnows, and small mouth bass have been observed when massive numbers of white grubs, *Posthodiplostomum minimum* have infected the visceral cavity of these fish. Other trematodes known to affect fish sales include the brain grub *Ornithodiplostomum ptychocheilus* found in fathead minnows (they can affect the survival of the fish), the eye fluke Diplostomum sp. found in several fish species (they have prevented the shipment of fish into California), and the black grub, *Uvelifer ambloplites,* also found in several fish species (they can make the flesh unmarketable).

The only practical control option for digenetic trematodes is to eliminate the snail hosts. Control of bird hosts and direct control of the trematode in the fish have proved to be impractical because of time, economic and/or legal constraints. Chemical treatments for the control of snails have serious shortcomings. Almost all chemicals will kill fish at the same levels required to kill snails. If a chemical successfully controls snails without killing fish the snails quickly repopulate the pond and the treatment will have to be repeated. Snail-eating fish appear to be the best management tool for a permanent solution.

Biological Control of Snails *Planobdella* spp. in Channel Catfish *Ictalurus puntatus* Ponds in Mississippi.

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In 1999, an internal parasite never before seen in Mississippi was discovered in channel catfish. The trematode of concern in this research (*Bolbophorus confusus*) was first discovered in Louisiana, and has since been found in Mississippi and Arkansas. It is believed that *B. confusus* arrived in Mississippi via the white pelican *Pelecanus erythrorhynchos*. *B. confusus* lives in pelicans during its adult stage and are transferred to ponds through feces. In the pond, the parasite infects the intermediate hosts, the ram's horn snail and then channel catfish. *B. confusus* causes death in fingerlings and causes harvestable fish to be unmarketable to processors, resulting in economic loss. Chemical controls such as hydrated lime and copper sulfate application have had some success but are expensive and do not treat the entire pond. There is not a chemical control or therapeutic treatment for trematode metacercariae once channel catfish are infected. Biological control of the snail intermediate host is the most practical method of regulation. Black carp *Mylopharyngodon piceus*, redear sunfish *Lepomis microlophus*, freshwater drum *Aplodinotus grunniens*, redear-bluegill hybrid *Lepomis microlophus x L. macrochirus* and the blue catfish *Ictalurus furcatus* have all been known to prey on snails in nature. These four species will be tested for control of ram's horn snail populations in catfish ponds. Initial studies will be carried out in 30-gallon aquaria. Those species that exhibit favorable characteristics in aquaria will be tested in catfish ponds (3,500 catfish/acre) stocked with snails (1000/acre). Results of the predation of each species will be compared in order to determine the most effective foraging species and to determine minimal stocking densities. Results will show the most practical and economical means of trematode control for catfish producers.

Biological Control of Snails *Planobdella* spp. in Commercial Channel Catfish *Ictalurus punctatus* Ponds in Mississippi

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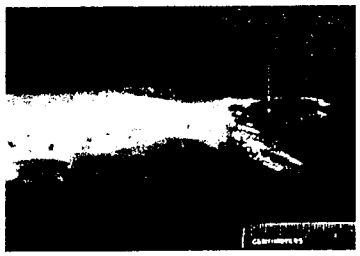
Introduction

- In 1999, a digenetic trematode was discovered in channel catfish on farms in the MS Delta.
- *Bolbophorus confusus.*
- Deleterious effects:
  - ➤harvestable catfish to be unmarketable.
  - ➤kidney and/or liver damage.
  - ➤mortality in fingerlings.

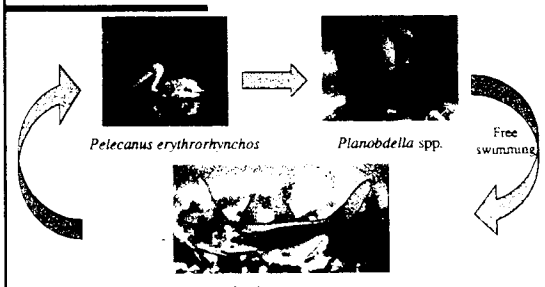
Bolbophorus confusus

Catfish External Appearance



Encysted in Muscle

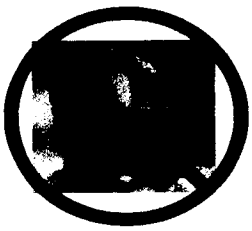
Life Cycle of *B. confusus*



Chemical Controls

- Hydrated lime at 50 lbs. for every 75-100 ft of levee.
  - ➤15 acre pond = $200 per application
- Potassium permanganate
- There is no control once metacercariae are encysted in the muscle.

Most Practical Means of Control



- Elimination of ram's horn snail from ponds with molluscivorous fish at a minimum stocking density

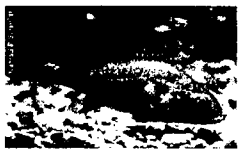
Requirements of Potential Biological Control Species

- Must be tolerant of warmwater conditions
- Must possess pharyngeal teeth capable of crushing ram's horn snail
  - ✔Black carp
  - ✔Freshwater drum
  - ✔Redear sunfish
  - ✔Redear-bluegill hybrid
  - ✔Blue catfish
  - ✔Freshwater shrimp

Black Carp *Mylopharyngodon piceus*

- aka snail carp, Chinese roach
- Exotic to NA
- Grows to 130 cm
- Eats snails as juvenile
- Will eat catfish feed when snails are limiting

Freshwater Drum *Aplodinotus grunniens*



- aka sheepshead
- Greatest lat. range of any NA fish
- Grow to 100 cm
- Known to eat snails as juveniles

Redear Sunfish *Lepomis microlophus*

- aka shellcracker, stumpknocker
- Native to the southeast
- Mature at 14 cm, grow to 24 cm
- May be too small to eat snails as juveniles
- Difficult to train to feed

Redear Sunfish-Bluegill Hybrid
L. microlophus x L. macrochirus

- Similar to redear
- May be more aggressive and therefore a better forager

Blue Catfish *Ictalurus furcatus*

- Blue catfish know to eat zebra muscles
- Not interfer with channel catfish production
- May prefer feed over snails

Freshwater Shrimp
Macrobrachium rosenbergii

- May consume small snails
- Fledgling business in MS
- Difficult to produce in ponds with catfish

Test Species Concerns

- Black carp escaping into the natural environment
- Seining ponds stocked with black carp, freshwater drum, and freshwater shrimp
- Trash fish fees with redear and hybrids
- Don't want test species to consume catfish feed
- Don't want test species to reproduce in ponds

Objectives

- Determine which test species will consume ram's horn snails in aquaria.
- Determine effects on snail populations by control species in channel catfish ponds.
- Determine minimal stocking density of the test species to adequately control snail populations.

Methods

- Research will take place:
  - ➤at the TCNWAC Eastern Research Unit (tank and ponds studies).
  - ➤at various farms in East Mississippi (determination of ponds with snail problems).

Methods for Aquaria Tests

- Test species (5/aquarium) will be held in 30 gallon aquaria equipped with a bead biofilter and removable glass divider.
- Test species will be starved for 24 hr prior to testing.
- Ram's horn snails (150/aquarium) will be placed on opposite side of divider.
- Divider will be repositioned in aquaria allowing test species access to snails.
- Floating catfish feed (3% body weight) will be offered to some treatments.

Data Collection

- Number of snails consumed
- Amount of catfish feed consumed
- Time until feeding stops
- Effect on channel catfish populations

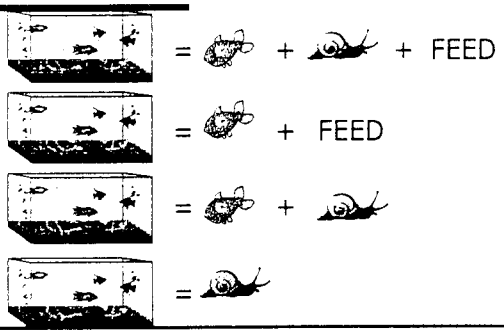
Methods for Pond Tests

- Each test species will be stocked in ponds
  - ➤0, 10, 20, and 40 fish/acre (for BlkC, FD, and BC)
  - ➤0, 50, 100, and 200 fish/acre (for RS and RBH)
- Snails will be stocked at 1000/acre.
- Catfish fingerlings will be stocked at 5000/acre.

Data Collection

- Monthly snail sampling
  - ➤20 random dipnet (2mm mesh) sweeps along shoreline
  - ➤Snail density will be determined by average number of snails per sweep
- Daily feeding
  - ➤It will be noted if the test species is seen eating catfish feed

Treatments for Tests



Management Implications

- Determination of most effective biological control of snails
- Native species may be as effective as exotic species
- Biological control may be as effective as chemical control
- Control species may be marketable

PRESENTER:
Leo G. Nico, U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, FL 32653; 353/378-8181; FAX 352/378-4956.

TITLE:
Black Carp Risk Assessment

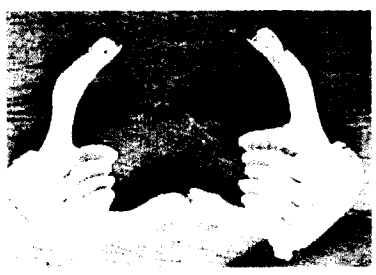
ABSTRACT:
The black carp is a large mollusk-eating cyprinid from eastern Asia that first entered the United States in the early 1970s as a "contaminant" in imported grass carp stocks. These fish came from Asia and were sent to a private fish farm in Arkansas. The second known introduction of black carp into this country occurred in the early 1980s, an intentional import by private farmers who were interested in its use as a food fish and as a biological control agent to combat the spread of yellow grub (Clinostomum sp.) in aquaculture ponds. To date, the only known record of this species in open U.S. waters is from Missouri where about thirty fish escaped into the Osage River from aquaculture ponds during a major flood event in April 1994. We reviewed the literature, visited aquaculture facilities, and consulted experts for the purpose of evaluating the risk associated with introduction of black carp. Risk assessment procedures followed those of the Risk Assessment and Management Committee of the Aquatic Nuisance Species Task Force. The black carp was chosen as a test organism for the "Generic Nonindigenous Aquatic Organism Risk Analysis Review Process" because it demonstrated: (1) a real case in which potential for positive gain has to be balanced with the potential of the species becoming established and causing economic and environmental damage; (2) a real issue in which political, economic, and environmental concern were already present; and (3) a situation in which there is time for sound management. The original Risk Assessment was completed in October 1996. The series of recommendations in that report were not intended to be mutually exclusive.

NONINDIGENOUS SPECIES OF THE UNITED STATES: THE BLACK CARP (*Mylopharyngodon piceus*) (Family: Cyprinidae)

U.S. Geological Survey, Florida Caribbean Science Center, Gainesville, Florida

COMMON NAMES: black carp, snail carp, black amur, Chinese roach

IDENTIFICATION The black carp is a large fish growing to more than 1 meter (> 3 feet) long and 36 kilos (about 80 pounds). It superficially resembles the grass carp (*Ctenopharyngodon idella*) in terms of body size and shape, the position and size of fins, and the position and size of eyes. Juveniles, in particular, are difficult to distinguish from young of grass carp. Adult black carp (and larger juveniles) can be distinguished from grass carp in terms of body color (black, blue gray, or dark brown versus olivaceous or silvery white) and the morphology of the pharyngeal teeth. Photo (above left) shows black carp pharyngeal teeth and chewing pad. The other photo (below) are teeth of grass carp.



NATIVE RANGE: Eastern Asia.

KNOWN NONINDIGENOUS OCCURRENCES: The only known record of an introduction of black carp into open waters of the United States occurred in **Missouri** in April, 1994. Available information indicates that the black carp has been, or is currently, being maintained in research or production facilities in Arkansas, Florida, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, and Texas, and maybe elsewhere

MEANS OF INTRODUCTION: Thirty or more black carp escaped from a fish farm during a flood event.

HABITAT: The black carp is a freshwater fish that inhabits lowland lakes and rivers. Like other Chinese carps (i.e., grass carp, silver carp, and bighead carp), black carp reproduce and spawn in large rivers. The eggs are pelagic or semipelagic and drift downstream.

IMPACTS: Adult black carp feed primarily on mollusks, crushing shells with their powerful pharyngeal teeth. In sufficient numbers, there is potential that the species would negatively impact native aquatic communities by reducing populations of native mussels and snails, many of which are considered endangered or threatened.

CONTACTS: If you have information on the capture or sighting of a black carp, please call the Nonindigenous Aquatic Species Toll Free Telephone Hotline **1-877-STOP-ANS** or fill out the reporting form at our web site at: **http://nas.er.usgs.gov/**

Prepared by Leo G. Nico (e-mail: Leo_Nico@usgs.gov)
PRE-RELEASE DRAFT: VERSION 31 Mar 2000

STANDARDS FOR
THE U.S. FISH & WILDLIFE SERVICE
TRIPLOID GRASS CARP INSPECTION AND CERTIFICATION PROGRAM

PURPOSE

The US Fish and Wildlife Service (USFWS) offers a triploid grass carp inspection service for natural resource agencies in the United States and in other countries, to help states and others protect their aquatic habitats. The inspection program is to provide assurance to these agencies, and others concerned about protecting aquatic resources, that shipments of grass carp alleged to be all triploid, do not, within the confidence limits of the inspection program, contain diploids.

AUTHORIZATION

The inspection service was addressed by the Senate and House of Representatives of the United States of America, in the first session of the 104th Congress, assembled in Washington, DC, 04 January, 1995. Through Congressional Action (S.268): "The Secretary of the Interior, acting through the Director of the U.S. Fish and Wildlife Service, may charge reasonable fees for expenses to the federal Government for triploid grass carp certification inspections requested by a person who owns or operates an aquaculture facility."

INSPECTION PROGRAM

The USFWS Triploid Grass Carp Inspection and Certification Program evolved (B.R.Griffin and A.J. Mitchell, 1992, Aquaculture Magazine, 18:73-74) from years of work experience. Inputs from private grass carp producers and state resource agency needs were examined . The information which follows is a rendering of these ideas into standards, which the USFWS will use to provide consistency and fairness in dealing with different circumstances encountered in the implementation of a national triploid grass carp Inspection & Certification Program. The critical elements of the Program are described in four categories: (1) Standards for USFWS Inspectors; (2) Standards for Grass Carp Producers; (3) Checklist for Inspectors and Producers; and (4) Standards for Collection of Fees .

Standards for Triploid Fish Inspectors

1. The USFWS Inspector, before confirmation of an Inspection date, will ask the Producer whether the conditions, as specified in the Checklist for Inspection (i.e., available diploid controls, working Coulter Counter, etc.) will be met.

2. The USFWS Inspector will provide Inspection services for a minimum of 1500 fish to be shipped, within four working days, from isolated groups of fish being maintained within a containment unit, or units (tank/vat/etc). Inspection requests by the Producer for groups of fish of less than 1500 will only be performed when agreed upon by the USFWS Inspector, prior to the inspection trip (See: "Collection of Fees" page7, #4).

3. The Inspector will require that the sample size, for fish to be taken from the isolated group of grass carp to be certified, will be 120 randomly-selected fish. If fish to be Certified are from sufficiently different size lots, care must be exercised to ensure that diploid controls represent the lots to be Certified.

4. The Inspector will view the group of fish that is to be Certified, verifying that the group is isolated in a containment unit at least 100-ft away from the production ponds (thus reducing the chance of inadvertent mixing of triploids & diploids) and that numbers of fish are appropriate for the orders to be certified.

5. The Inspector will channelize (at a minimum) every tenth fish during the Inspection of the 120-fish sample of alleged triploid grass carp. Any sample with a questionable monitor reading will also be channelized, and any questionable data resulting from channelization will be considered non-triploid.

6. The observance by the USFWS Inspector of any non-triploid fish will immediately FAIL the Inspection. No Certification can be done until another inspection is rescheduled.

7. For states requiring an Asian tapeworm examination, Inspectors will report their on-site findings based on one initial exam of the numbers of fish as specified by the state.

8. The Inspector will contact the receiving state's representative within 24-hours and notify the prospective receiving state that the Inspection/Certification was completed. The USFWS Inspector will retain the original Certification report. Copies of the signed Inspection/Certification will be made and distributed as follows:
   (1) Triploid fish Producer (day of inspection)
   (2) State Agencies requiring official written notification (copy by USFWS)
   (3) USFWS Regional Accounting Office for grass carp work (optional)

9. Each USFWS Triploid Grass Carp Inspection Office will reserve one-day each week (generally Tuesday or Wednesday) for administrative duties, vehicle maintenance, and other required activities.

10. The USFWS Inspector will collect the appropriate fee-for-service, via one check, from the Producer prior to departure from the Inspection site. As of 01 January 2000, the fee structure requires the Inspector to collect twenty-four cents per Certified triploid grass carp that is shipped as a result of the Certification Inspection.

11. The USFWS will provide quality control assurances (QA/QC)for the Grass Carp Inspection and Certification Program.

    (1) Employee Training.

    (2)Retain records and maintain a Triploid Grass Carp database.

    (3)Maintain a file on State grass carp regulations.

Standards for Grass Carp Producers

1. The USFWS only provides the Inspection and Certification service to Producers that want to cooperate, and participation is completely voluntary.

2. The Grass Carp Producer, prior to the Inspection date, will examine the checklist of requirements for Triploid Grass Carp Producers, and ensure that the conditions of the Protocol will be met (i.e., available diploid controls, a working Coulter Counter, etc.) .

3. All grass carp, in an identified lot, offered for sale, will have been individually tested by Coulter Counter techniques before a USFWS Triploid Grass Carp Inspection will be performed. The USFWS Inspection consists of a retesting by the Producer, in the presence of the Inspector, of 120 individuals randomly selected by the Inspector from the identified lot of alleged 100% triploid grass carp.

4. Producers must have a fully operational particle sizer (such as the Coulter Counter) with channelizer, and trained personnel available to gather and process fish for the Inspection.

5. The Grass Carp Producer will ensure that the diploid grass carp control fish come from the same site, and be the same relative age/size as the group of fish that are to be Certified for triploidy.

6. The Grass Carp Producer will maintain the isolated group(s) of allegedly 100% triploid grass carp in containment units at least 100-ft away from production ponds (thus reducing the chance of inadvertent mixing of triploids & diploids).

7. The containment units will be provisioned with water that is clear enough to allow the isolated fish population to be viewed by the USFWS Inspector .

8. If a diploid is found in the course of testing the 120 fish sample, the lot fails Certification. All fish in that lot of fish must to be retested, individually, by the Producer, before another inspection of that lot of fish is rescheduled for Certification Inspection.

9. Producers who receive a Certification from a USFWS Inspector must sell or ship the Certified fish maintained in the defined holding area(s), within four working days. If fish are not sold or shipped within the four day working period of the certificate, the fish must be re-certified for sale or shipment.

10. Once Inspected and Certified, no additional fish can be added to an identified lot of triploid grass carp.

11. Officials, in states where fish are scheduled for delivery, will be notified by phone within 24 hours. Information to be communicated will be the number of fish involved in a shipment, the source of the fish, the final destination of the fish, estimated date/time of arrival, and the name of the dealer or hauler of the fish. Written documentation will then

be sent by mail.

12. No diagnostic services will be required of the USFWS Inspector. Nevertheless, a fully trained Inspector could assist the Producer in the finding and identification of Asian tapeworms.

13. If visual examination by the Inspector identifies some phenotypic anomaly, further scrutiny and investigation would not be the responsibility of the Inspector under the Grass Carp Program. If such work is desired by the Grass Carp Producer, it should be directed to a fish veterinarian, a certified fish health specialist, or a fish pathologist.

14. Grass Carp Producers will retain records of their Certification transactions and provide copies of the Certification to truck drivers, and others, delivering the fish to the place of destination.

15. The USFWS provides triploidy Certification; it is the obligation of the Producer to comply with laws, regulations, and guidelines of the states.

16. Fees for service will be handled by check, issued to the Inspector at the time of the Inspection, and made payable to the US Fish and Wildlife Service for the number of fish Certified to be shipped.

17. For additional information about the USFWS Triploid Grass Carp Inspection and Certification Program, Producers should direct questions to their closest regional representative:

Vince Mudrak	Chuck Surprenant	David Hendrix
Warm Springs, GA 31830	Marion, IL 62959	Neosho, MO 64850
Tele # (706-655-3382)	Tel. # (618) 997-6869	Tele # (417) 451-0554

Checklist for Inspectors and Triploid Grass Carp Producers

Before the Grass Carp Producer contacts the USFWS Inspector he/she will review their on-site conditions to ensure that the Certification process will be efficient and effective. The Grass Carp Producer will conform to the checklist requirements:

☐ [1]The Grass Carp Producer will contact the USFWS Inspector and schedule an Inspection.
[2]The Grass Carp Producer will identify the number of fish expected to be shipped and provide this number to the Inspector.
Number _____

☐ A minimum of two diploid grass carp control fish from the Producer's site (and preferably taken from the lot of fish being Certified) will be used to calibrate the Inspection equipment for each and every Inspection.

☐ [3]The Producer will individually check the group of grass carp for ploidy, and segregate the triploid grass carp within isolated containment units (vat/ tank) prior to the Inspection visit by the USFWS Inspector.

☐ The Channelizer and Coulter Counter will be in acceptable working order prior to on-site arrival of the USFWS Inspector.

Notes:

[1]Producers will recognize that each Inspection Office will keep one day "free" for other USFWS activites, and accordingly, the Producers will request Certification Inspections for an alternate weekday. The Producer will give the USFWS Inspector sufficient notice that a triploidy inspection is needed -- a minimum of two-working-days should give the USFWS Inspector sufficient time to adjust his/her schedule.

[2]Inspection requests by the Producer for groups of fish of less than 1500 will only be performed when agreed upon, in advance, by the USFWS Inspector (See: "Collection of Fees" page7, #4).

3 If fish are not sold or shipped within the four day working period of the certificate, the fish must be re-certified for sale or shipment after the expiration date of the original certificate.

Producer _____ Inspection Date _____
Signed

Inspector _____ Inspection Time _____
Signed

Standards for Collection of Fees

1. The established standard fee for inspection services will be twenty four cents ($.24) per fish shipped as a result of the inspection effective January 1, 2000)and will increase to Twenty six cents ($.26) per fish shipped effective (January 1, 2001).

2. A check for the appropriate amount will be written, and made payable to the U.S. Fish & Wildlife Service. Check information will include the following: the Producer or Company's name, address, & phone number; the Producer representative's signature: the date; reference to transaction receipt for a specified number of fish

3. If no Certificate can be issued by the Inspector (Examples: failed inspection, no diploid controls, Coulter Counter malfunction, etc) a fee of $50 will be collected by the USFWS Inspector, from the Triploid Grass Carp Producer, to defray the trip cost.

4. The fee for failures will accelerate in a calender year The fee the first failure will be $50:the fee for the 2nd , 3rd, and 4th failure will be $100.00 and result in an investigation of the producers management practices. The fee for any further failure will be $200.00 and may warrant further actions or legal options by the U.S. Fish and Wildlife Service.

5. If the USFWS Inspector makes an Inspection/Certification trip, and for some unusual reason the work results in the Certification of less than 1500-fish, then the fee to be collected by the USFWS Inspector will be $50, or the number of fish shipped X $.24,($.26) (whichever is the greater amount).

6. Fees collected for Certifications will be held for seven days and then be deposited into separate Regional accounts as established by USFWS Washington Office and the Denver Finance Center.

6. The USFWS Inspector will retain the Producer's check for seven-days to allow for adjustments of any purchase order cancellation. A canceled order qualifies that same number of Certified triploid grass carp, to be available for another sale and shipment within the original "four working day period."

7. The USFWS Inspector will not credit accounts for Dead-on-Arrival fish. The Grass Carp Producer must assume the burden for safe shipping of the triploid grass carp.

8. The USFWS desires to retain a standardized statistically valid 120-fish sampling protocol. However, should a state or fishery program absolutely require that the number of fish to be sampled be increased (above the standard 120-fish sample), the fee for Inspection services will increase from 24-cents.($.26) to one dollar, per fish shipped.

Black Carp in Mississippi
Asian Carp Workshop - April 19, 2000 - St. Louis, MO

by
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I. History of Aquaculture Regulation in Mississippi & Previous experience with Black Carp (1993 - 1998)

June 11, 1964 - Title 69 Chapter 7 Section 501 of the Miss. Code of 1942 regarding Domestic Fish Farming is enacted.
"In recognition of the fact that domestic fish farming has become and important part of the agricultural economy of the stat, the legislature hereby determines and declares that whenever any of the statutes, laws or regulations promulgated pursuant thereto shall use any of the following terms, such terms so used and when used shall be deemed and construed to include within the common or statutory definition thereof, the following:

(a) The term "agriculture" or "agricultural pursuit" or any similar term shall include the cultivation, growing, harvesting and/or marketing of domesticated fish.

(b) The term "cultivated crop" shall include domesticated fish which are grown, managed or harvested on an annual, semiannual, biennial or short interval basis.

(c) The term "livestock" shall include domesticated fish which are grown, managed or harvested and/or marketed as a cultivated crop.

(d) The term "domesticated fish" shall be understood to mean any fish that are spawned, grown, managed, harvested and marketed on an annual, semiannual, biennial or short term basis, in privately owned water.

So, commercially raised fish are considered agriculture, an agricultural pursuit, a cultivated crop and livestock.

Until 1988 exotic species were not commercially cultured in Mississippi.

The Miss. Game & Fish Commission, then the Miss. Dept. of Wildlife Conservation (MDWC), allowed the culture of game fish for stocking private ponds.

A persistent fish farmer wished to culture tilapia but existing regulations and laws did not allow MDWC to issue such permits so we enacted the Mississippi Aquaculture Act of 1988 to regulate this industry. (Title 79 Section 22 of the MS Code of 1972, as amended).

This legislation was implemented by administrative laws known in Mississippi as Public Notices (PN). **PN 2802** stated that Aquaculture Permits **"will not apply to Fish Farmers whose products only include catfish or catfish products".**

The act also gave the MDWC the power to develop regulations for the Aquaculture industry and "Guidelines for Aquaculture Activities in Mississippi" **(Guidelines)** is published to implement the act.

Guidelines exempted the following from obtaining an Aquaculture Permit:

a. Culture of any currently recognized native aquatic plants, animals and nongame fish.
b. **Culture of catfish by the catfish industry, where initially catfish and catfish products are grown, farmed and processed for sale and no other species of aquatic plants or animals are cultured for sale.**
c. Culture and retailers tropical fish maintained in closed systems utilized by pet shops, hobbyists and their suppliers.
d. Culture of minnows by licensed minnow dealers (49-7-29).
e. Operation of pay fishing lakes.

Aquaculture Permits were required for the following culture activities:

f. **Culture of all nonnative aquatic plants and animals,** except those exempted.
g. **Culture of game fish** in Mississippi with the following exceptions:
    1. **Black basses, bream, crappie, flathead catfish, walleye and other members of the families Centrarchidae and Percidae cannot be produced and sold for food consumption** but can only be produced and sold for private recreational sportfishing waters only.
    2. Endangered, Threatened or Protected Species.
    3. Genetically modified aquatic plants and animals by means other than breeding or crossbreeding.

Channel catfish are classified as "nongame gross fish" in Mississippi.

Aquaculture permit #1 was issued to the persistent fish farmer in January 1988. Tilapia were permitted and screens on his outflow pipes were inspected prior to stocking fish.

May 1989 MDWC onsite inspection found that tilapia had escaped from the facility. MDWC allows farmer until August 1990 to solve escapement problem. Problem is not solved

and MDWC revokes farmers permit to culture tilapia. Farmer liquidates his stock of tilapia.

Feb 1991- MDWC personnel attempt to eradicate escaped tilapia with rotenone - 6 pickup truck loads of tilapia and one 5 gallon bucket of native fish are kill. Eradication fails due to inability to adequately disperse rotenone throughout the swampy oxbow discharge area.

1993 Legislative Session (January - April) - The persistent fish farmer lobbies to change the regulatory authority for aquaculture from Miss. Dept. of Wildlife, Fisheries & Parks to the Miss. Dept. of Agriculture & Commerce. He succeeds.

July 1, 1993 - Miss. Department of Agriculture & Commerce initiates their regulation of the commercial aquaculture industry.

March 23, 1995 - MDWFP review of Aquaculture Permit application for black carp sales by and Arkansas producer results in letter opposing the sale of black carp. **MDAC letter (3/23/95) to MDWFP letter of 3/14/95 states "but in the case of black carp, special concerns warrant 'triploid only' in addition to an approved filtering system. It is our understanding [that] black carp will in the future play a more significant role as a biological control for several disease carrying pests in both hybrid striped bass and catfish facilities."**

"Again in referencing the March 14th letter, your recommendations were not taken lightly but served as a catalyst for a more in-depth study to insure protection. Such study included phone conversations with other experts in and out of the State with the following conclusions:

* we will see more non-native species being cultured
* utilizing black carp as a biological control is going to increase
*escapement can be minimized with proper [the] filtering system
*sterility through triploid[y] will help insure containment"

cc: Drew Mitchell, USFWS

1996 Legislative Session -- The persistent fish farmer is permitted to culture largemouth bass. He desires to sell them for human consumption, which is illegal. A bill is introduced to allow this. The Miss. Dept. of Wildlife, Fisheries & Parks opposes this bill and informs B.A.S.S. Bass anglers mobilize and the bill is defeated. As a result and Aquaculture Task Force (ATF) is formed to explore the issue and craft suitable legislation that the industry, MDAC and MDWFP.

The persistent fish farmer cultures his bass "for stocking purposes" and MDWFP believes they were sold at the Fulton Fish Market in New York City.

May 1996 - MDWFP survey of state fish & wildlife agencies regarding the sale of game fish for human consumption.

Regulation of Aquaculture - 38 states - Game & Fish Agency

10 states - Agriculture Agency
2 states - Marine Agency

43 states allow the culture & sale of species whose historic range is outside of the continental US, Alaska & Hawaii. Tilapia is the most commonly cultured exotic species.

May 1996 - December 1996 - Interagency Aquaculture Task Force (ATF) meetings to draft culture of game fish for human consumption legislation and **revise *Guidelines***.

May 7, 1996 - ATF Meeting Notes - discussed whether the sale of bighead, black and grass carp should be restricted to only triploid fish
"the use of triploid fish is encouraged just in case they escape into the wild"
"In the production of carp, use triploid carp and confine them."

June 19, 1996 ATF Meeting Notes - yellow grub is a problem the use of black carp to consume yellow grub was discussed.
"Producers want use black carp to control yellow grub and also to be sold. Triploid is recommended when using carp because it is preferred as a safety measure."

October 1996 - **Risk Assessment Report Published by USGS**

"Black carp were purposely brought into the United States by an Arkansas fish farmer and a Mississippi Fish farmer during the early 1980's (Mike Freeze, personal communication, 1994)..."

At the time of publication, 2 private fish farms, one in Coahoma Co.(2,000 triploids) and another elsewhere (that once had diploids) were known to have imported diploid and triploid black carp from Arkansas.

"The American Fisheries Society recently passed a resolution asking government agencies to strictly prohibit the sale, possession and distribution of black carp, largely in part due t its potential to harm the native mussel fauna."

March 21, 1997 - Phone call from Dr. Jim Williams (USGS) to Dennis Riecke (MDWFP) regarding the release of diploid black carp from a Miss. fish farm. If the farm intends to cease operation, the fish need to be killed or purchased to prevent escapement. Williams wants local USFWS to purchase fish. Williams sends Risk Assessment Report to Riecke.

Phone call by Riecke to MDAC - 2 fish farms have triploid fish and one farm has diploid fish. A catfish farmer and a hybrid striped bass producer were known also to have stocked black carp. There are two ponds with black carp on the farm Williams is concerned about. One pond has a plugged drain and is not subject to draining and the other pond is dried up.

April 1, 1997 Riecke writes memo to MDAC, Williams, USFWS - Jackson office to document findings and concerns. Memo provide sections from USGS Risk Assessment Report and states **"the ATF should strongly consider prohibiting the presence of diploid black carp in Mississippi due to the high risk of establishment in the event of any release."**

May 14, 1997 - Phone call from black carp producer to MDWFP - producer received a call from a Mississippi fish farmer seeking information on how to spawn black carp.
"You have diploid grass carp and diploid bighead carp all over your state."
"Black carp in Mississippi have changed hands from those who were originally permitted to have them."
"You only have a handful of diploid black carp in Mississippi."
"Farmer who originally had the diploid black carp gave them to someone who is supposed to take them to another person who wants to spawn them. He just wants some black carp and instead of buying them he wants to spawn them.
Producer asks if diploid black carp are legal in Miss. MDWFP tells producer to have fish farmer call MDWFP.

Conclusion: Farmers are transferring fish.

May 14, 1997 - Phone call from Miss. fish farmer wanting to know if it is legal to obtain diploid black carp. He called MDAC and someone told him they were illegal. Riecke relates that diploids are legal but the sale and possession is being discouraged as MDAC, MDWFP, USGS have strong reservations about the escapement and spread of diploid black carp. Farm manager's boss told him to spawn black carp instead of buying triploids. He was told he needed 50/acre for snail control in hybrid striped bass production ponds. Riecke relates that he needs an MDAC permit prior to obtaining black carp and *Guidelines* may be revised to prohibit diploid black carp.

Conclusion: Farmer may have stocked fish prior to obtaining permit, he is unaware of permitting requirements.

May 30, 1997 - MDAC submits Administrative Procedures Filing Notice to Secretary of State for revision of ***Guidelines for Aquaculture Activities in Mississippi.***

Despite all previous discussions and concerns regarding the use of diploid black carp--- they are not prohibited.

MDWFP - submits comments to substantially revise *Guidelines* and ATF members agree to prohibit a host of species most of which are prohibited by Texas and Florida. **Black carp are not prohibited, as some fish farmers already possess them.**

The **revised** ***Guidelines*** (8/97) state that ---

Farmers raising non-native carp species shall do so in a responsible manner that excludes the possibility of escape. In the event that non-native species are released or escape from a permitted facility, the Miss. Dept. of Agriculture & Commerce shall notify the MDWFP as soon as possible.

If MDWFP determines that the presence of these non-native species could become or is detrimental to native fishes, MDWFP personnel may attempt to remove or eradicate all non-native species. All **costs necessary to effect removal or eradication will or may require reimbursement to MDWFP by the aquaculturist responsible for the release or escape, if proved to be the fault of the aquaculturist through neglect and/or mismanagement. The aquaculturist shall not be responsible for acts of nature and/or unforseen.**

Revised *Guidelines* establish a pilot game fish producer program allows 5 fish farmers to raise hybrid bream and hybrid black stripe crappie for human consumption.

Black Carp Ploidy Release Authorization Forms (1993-1997) sent to MDWFP by USFWS

November 24, 1993 -- 3,880 triploids to Nature's Catch sold by Hopper - Stevens Hatcheries, AR
August 11, 1995 -- 236 triploids to Eden Fisheries sold by Keo Fish Farm, AR
October 3, 1996 -- 75 triploids to Nature's Catch sold by Keo Fish Farm, AR
October 26, 1995 -- 2,500 triploids to Nature's Catch sold by Hopper - Stevens Hatcheries, AR
September 5, 1997 -- 450 triploids to Eden Fisheries sold by Hopper - Stevens Hatcheries, AR

II. The Current Crisis

August 20-25,1999 - MDWFP receives 5 Aquaculture Permit applications requesting black carp. Four are initial applications, 1 is a renewal application.

August 23, 1999 - Riecke calls MDAC to express MDWFP concern about permitting the stocking of black carp. Riecke will seek information from other fisheries biologists.

August 27, 1999 - Riecke calls Dr. Jim Williams (USGS) and discusses course of action.
Dr. Williams recommends the following:
1. Oppose any stocking of Black Carp.
2. If we cannot prevent stocking, absolutely insure that only triploid fish are stocked.
3. Require documentation that the fish are certified triploid. The Black Carp producers can provide this at shipment time.
3. The farmer must remove black carp from any location if flooding is imminent. Determine the flood frequency of the stocking location.
4. Ask prospective buyers to provide any scientific studies that prove Black Carp can reduce the

incidence of yellow grub. If such studies exist, they were done after the 1996 Risk Assessment Report. There is no hard evidence that Black carp control snail populations.

Snails live on vegetation around the edge of ponds. Black Carp will not be effective in reducing snail numbers. The fish are picky eaters and will not be able to feed on snails in the interior of densely vegetated areas. Black carp live at least 10 years.

August 27, 1999 - MDWFP Executive Director tells Riecke that a severe disease is about to break out in the Delta and farmers want to use Black Carp to eat snails in catfish ponds. They can control 80% of the snail population by applying lime to the pond banks. Chip Morgan of the Delta Council called and mentioned that Dennis Riecke should be consulted. Dr. Polles instructs Dennis to compile available information on Black Carp and provide it to him that day.

August 27, 1999 Phone call from Henry Folmar of the MS Dept. of Environmental Quality to determine the laws regarding importation of black carp.

August 27, 1999 Phone call from Mike Freeze of Keo Fish Farm in Arkansas to determine if Mississippi was going to allow both diploid fish and triploid fish in the state. Keo Fish Farm is only 1 of 4 providers of black carp fingerlings.

According to Mike Freeze about 2 weeks ago a severe infestation of yellow grub disease was responsible for the total mortality of 2 ponds around Belzoni. If the pond is infected you can expect total mortality in 14 days. Mike heard that Miss. catfish farmers would be requesting up to 600,000 black carp for stocking. Previously the market for these fish was very limited as they are used in research studies. The spawning season is in July and very limited numbers of triploid fish are available for sale. Mike indicated that there are diploid fish available for sale. His firm plans to induce spawning that day by injection with hormones. Ron & I discussed our concern with Mike that we did not want diploid black carp entering any Mississippi waters. We told him that our agency only comments on aquaculture permits and that the MS Dept. of Agriculture & Commerce is responsible for approval/denial of aquaculture permit applications. We instructed him to contact Gene Robertson, MS Dept. of Agriculture & Commerce, Aquaculture Permit Coordinator to determine whether they would permit stocking of diploid black carp. Evidently, Mike needs to know this as soon as possible so he can plan his production and stocking techniques. Most of the fish he has are fingerling size to 6".

Mike also related someone told him that diploid black carp had already been shipped to Mississippi. The fish were obtained from a producer outside of Arkansas.

August 27, 1999 Dennis receives phone call from David Wise, Fish Disease Specialist, MCES. The tentative identification of the disease organisms is Bolbophorus confusus
Tentative life cycle -- Pelican eats infected fish--- parasite matures in bird's mouth and releases trematode eggs into water when bird feeds --- free swimming larvae hatch from eggs and infect snails --- larvae multiply and progeny (cercaria) emerge and become free swimming again ---

cercaria burrow into fish, encyst and become metacercaria (grubs)--- fish is eaten by pelican and life cycle repeats.

The disease progresses rapidly in catfish. Deaths occur within 3 hours of infection & continue for 3-4 days. In controlled exposures all fingerlings died. "Stocker" size fish go anorexic and you can't bring them to market. Production sized fish are not as heavily infected, they stop feeding.

Five farms have tested positive. On one farm 28 of 32 ponds tested positive. Hydrated lime kills snails in the bank margins but farmers need biological control. Heaviest snail populations are along the bank margins. Only 5% of snails are releasing Bolbophorus confusus but there are many other diseases they are releasing also.

This disease was reported 3 years ago in Louisiana (Rusty Gaude`). It caused severe losses and was a contributing factor in the firm going out of business. They dried their ponds, stocked Black carp and now the disease is under control.

Hybrid striped bass producers are using Black carp to reduce yellow grub incidence.

Conclusions

- Some commercial channel catfish farmers are facing a serious disease. A panic situation exists.
- Many farmers probably don't realize that they need to obtain an aquaculture permit prior to stocking Black Carp since they believe they are exempted from the requirements of those regulations and they have used Grass Carp & Bighead carp (50-200 grass carp/acre in fingerling productions ponds) for years for algae control without obtaining a permit.
- There is a very limited supply of triploid Black Carp and probably an insufficient supply of diploids.
- Farmers are scared and desperate and will seek any ploidy of Black Carp they can purchase.
- Due to the current shortage, some Miss. fish farmers may want to import diploids and try to raise their own black carp for future stockings.
- By flooding and/or other means, Black carp will escape to the natural waters of the state.
- Eradication of Black carp from the natural waters of the state is impossible.
- Black carp will negatively impact several species of endangered turtles and mussels through competition and predation, respectively.

Legal Status in other states

Alabama - prohibited (Dr. James Williams)
Missouri - prohibited (Mike Freeze)
Texas - restricted in 1989, may be possessed there is documented evidence of possession prior to 1/25/90 (TPWD Regulations eff. 3/1/92)
Florida - restricted species, permit for possession.(39-23.008 F.A.C.)

Permits may be issued if the restricted species held outdoors may only be held in a water body that has the lowest point of the top edge of its levee, dike, bank, or tank at an elevation at least one foot above the 100 flood elevation.

Such water body shall nave no water discharge or shall be constructed with a fish barrier system designed to prevent the escape of adult fish, juvenile fish and fish eggs in the water effluent discharged from the permittee's property.

Such water body shall be inaccessible to the public at all times by being securely enclosed by fences with locked gates or by the presence of the permittee or his agents guarding such water body and forbidding public access to such water body.

Louisiana - restricted species, must prevent escape, ponds must be above 100 year flood elevation.

Legal Status in Mississippi & Relevant Regulations

After obtaining an aquaculture permit the only restriction on Black Carp is that it cannot be allowed to escape or be released into the natural waters of the state. (Aquaculture Guidelines)

In the event that non-native species are released or escape from a permitted facility, the Miss. Dept. of Agriculture & Commerce shall notify the MDWFP as soon as possible. If MDWFP determines that the presence of these non-native species could become or is detrimental to native fishes, MDWFP personnel may attempt to remove or eradicate all non-native species. All costs necessary to effect removal or eradication will or may require reimbursement to MDWFP by the aquaculturist responsible for the release or escape, if proved to be the fault of the aquaculturist through neglect and/or mismanagement. The aquaculturist shall not be responsible for acts of nature and/or unforseen occurrences such as floods, lightning, or sabotage.

Sec. 49-7-80 of the MS Code of 1972 (effective July 1998) prohibits any person from stocking, placing, releasing or causing the release into the public waters of the state any aquatic species with out first obtaining a permit from MDWFP.

"No person shall stock, place, release or cause to be released into any of the public waters of the state any aquatic species without first obtaining a permit from the Mississippi Department of Wildlife, Fisheries & Parks. No person shall release or cause to be released within this state, any

animal not indigenous to Mississippi without first obtaining a permit from the Mississippi Department of Wildlife, Fisheries & Parks. The department may issue or deny a permit after it completes a study of the species to determine any detrimental effect the species might have on the environment.

The department shall establish and maintain a list of approved, restricted and prohibited species and establish rules governing importation, possession, sale and escape of those species.

This section shall not prohibit the practice of catch and release of native fish species or the release of native bait species.

A person violating this section is guilty of Class I violation and, upon conviction, shall be punished as provided in Section 49-7-141."

September 2, 1999 - Interagency Meeting in Stoneville, MS

MDWFP Fisheries Division Recommendations - August 30, 1999

1. **Oppose any stocking of Black Carp in Mississippi**

2. **If #1 is not feasible, insist that MDAC only allow the use of certified triploid Black Carp, with the conditions - a, b, d & e listed below.**

3. **If #2 is not feasible, insist that MDAC only allow the use of diploid Black Carp for biocontrol of snails, with the conditions - a, c, d & e listed below.**

Conditions

a. **MDAC notifies all commercial catfish farmers in MS of the permitting requirement for stocking any non-native species.**

b. **Requires documented certification of triploidy of all Black Carp. Furnishes MDWFP a copy of documentation.**

c. **Issues separate permits for triploid Black Carp and diploid Black Carp to discourage transfer and sale of diploid fish to those previously granted a permit for triploid Black Carp.**

d. **Furnishes MDWFP with the following for each Black Carp Aquaculture Permit Application: Legal Description of Stocking Location(s), Ploidy of Black Carp, Number of Black Carp Stocked, Average Size of Black Carp Stocked, Name(s) of all water bodies from receiving water bodies downstream to public waters, Flood**

Frequency of the Stocking Location(s).

e. **Requires permittee to notify MDAC & MDWFP if any stocking location is flooded or of any water release other than by screened drain pipe.**

Discussed all aspects of the issue and much discussion was devoted to whether diploids or triploids would be allowed. Diploids are legal but MDAC personnel explained that as of that meeting they would recommend that only triploids be used.

The use of alternative fish species such as redear and freshwater drum was rejected because there was not a reliable supply in sufficient quantities. Triploid fish are twice as expensive as diploids and their supply is also low.

We discussed the following:

- the effect the disease has on fingerlings and adult fish, once the fish are infected the metacercaria encyst for life and the fish are not marketable.

-the use of hydrated lime, salt, copper sulfate and other chemicals to kill snails along the pond margins.

-the need for an integrated snail control program including the use of biological control.

-the need for diligent efforts to be successful in harassing pelicans off the ponds.

-the problems with using black carp and the requirements for stocking them.

-that some farmers want to import diploid black carp so they can raise and sell triploid black carp.

-that farmers need to be informed that they need to apply for a permit to stock black carp and that their outflow pipes must be screened to prevent escapement and their facilities need to be inspected for permit compliance prior to receiving black carp.

November 3, 1999 meeting at MDAC office in Jackson, MS

MDWFP distributes agency recommendations on the use of black carp dated November 2; NCDAFS and Parent Society resolutions on black carp, and USGS Risk Assessment report recommendations.

Mississippi Department of Wildlife, Fisheries and Parks (MDWFP)
Recommendations on the Use of Black Carp ----- November 2, 1999

1. **MDWFP is very concerned about the stocking of Black Carp in Mississippi because of the points contained in the American Fisheries Society Resolution** (Attachments A & B) **and the Risk Assessment on Black Carp Report** (Attachment C).

2. **MDWFP advocates an integrated program of snail control measures which may include the use of copper sulfate, lime, vegetation control and the stocking of certified triploid black carp. The US Fish & Wildlife Service will certify triploids under the Grass Carp Certification Act of 1995 if the state requires certification.** (Attachment D).

3. **MDWFP recommends that the stocking of diploid black carp be restricted to one year (until Fall 2000) and allowed only after triploid black carp are not commercially available.**

4. **MDWFP recommends that all agencies and industry groups take necessary actions to provide for sufficient supplies of triploid black carp by Fall 2000.**

5. **MDWFP recommends that all black carp producers be informed of the regulations governing the stocking of black carp in Mississippi.**

6. **MDWFP recommends all persons desiring to stock black carp have their facilities inspected by MDAC personnel for compliance with Section 6 of the** *Guidelines for Aquaculture Activities in Mississippi.* (Attachment E).

The catfish farmers had requested this meeting to discuss the use of diploid black carp. Their representatives were entrusted by the Board of Directors of the Catfish Farmers of America to do whatever was necessary to work with the regulatory agencies to stock diploid black carp. The attendance of MDWFP Executive Director, Dr. Sam Polles was specifically requested. He made the decision that we were not going to oppose another state agency (Miss. Dept. of Agriculture & Commerce). Thus our recommendations sought to accommodate the wishes of the catfish industry and MDAC.

Requiring farmers to use triploids posed the following problems:

-there are not enough triploids to meet the anticipated - but unspecified - demand and they are not large enough (3-4") to escape predation by catfish, need to stock 6-8" black carp.

-triploids are not being raised in Mississippi, inconvenience to get the fish from Arkansas.

- triploids are twice as expensive as diploids.

MDAC decided to accept MDWFP recommendation #3 - "MDWFP recommends that the stocking of diploid black carp be restricted on one year (until Fall 2000) and allowed only after triploid black carp are not commercially available.

MDWFP requested a letter specifying the number and size of black carp that are needed. (see Nov. 10, 1999 below).

Riecke told everyone that Mississippi would be blamed for allowing black carp stocking if they escape and they will escape and be as widely distributed as grass carp are now.

MDWFP personnel told everyone that the USFWS and conservation groups would "come in on this issue".

We either did not discuss the following or did so only very briefly:
1) Impacts of Black Carp on native fishes and mussels
2) Risk Assessment Potential
3) Use of native species to consume snails
4) Funding for research on other snail control strategies
5) Impossibility of eradication once a species escapes into natural waters

---

November 10, 1999 - MDWFP receives letter from Dr. Jimmy Avery stating that there is a shortage of triploid black carp in the appropriate size range. The National Warmwater Aquaculture Center is recommending an initial stocking rate of 10-20 black carp per acre in the minimum size range of 6-8 inches. Annual maintenance stockings of 10-20% would follow to offset natural mortality. The cost of purchasing triploid black carp is also prohibitive. Producing triploids raises the cost by 100-150% above the cost of producing diploids.

November 15, 1999 - MDWFP receives MDAC memos with black carp stocking requirements--

Farmers

1. Must apply for a permit.
2. Install a dual filter system with at least one filter visible (filter material must be one mesh size smaller than the fish).
3. Have filter system inspected by MDAC prior to stocking.
4. The permit will be issued.
5. MDAC will allow black carp to be stocked as follows:

a. Strongly recommend the use of triploid black carp.
b. Stock black carp that have gone through the triploid process but have not been certified or sorted.
c. Stock diploid black carp until December 31, 2000, if triploid or triploid processed fish cannot be found.

Black carp producers

1. Must receive a copy of a MDAC Cultivation/Marketing permit from all Mississippi farmers desiring to purchase black carp.
2. MDAC will allow black carp to be stocked as follows:

a. Strongly recommend the use of triploid black carp.

b. Stock black carp that have gone through the triploid process but have not been certified or sorted.

c. Stock diploid black carp until December 31, 2000, if triploid or triploid processed fish cannot be found.

3. Must notify MDAC of all black carp sales to Mississippi farmers.

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The University of Mississippi
Oxford • Jackson • Tupelo • Southaven

Department of Biology
University, MS 38677
U.S.A.
(662) 915-7203
Fax: (662) 915-5144

Dear Sir or Madam,

The American Fisheries Society, Mississippi Chapter at its 2000 meeting in Biloxi, MS unanimously passed the enclosed resolution regarding the use of black carp in the waters of the state Mississippi. The resolution, I believe, is self-explanatory.

I was asked by our membership to distribute the resolution to all interested parties. If additional information is needed or if I can be of any assistance in this matter please do not hesitate to contact me.

Sincerely,

Glenn R. Parsons

Dr. Glenn R. Parsons, President
American Fisheries Society, Mississippi Chapter
The Department of Biology
The University of Mississippi
University, MS 38677
bygrp@olemiss.edu
662-915-7479

American Fisheries Society
Mississippi Chapter

RESOLUTION PROTECTING NATIVE MOLLUSCAN BIODIVERSITY: ELIMINATION OF THE NONINDIGENOUS BLACK CARP, *Mylopharyngodon piceus*

WHEREAS, the black carp *Mylopharyngodon piceus* a large mollusk-eating fish from Asia, has been approved for use as a snail control agent in the state of Mississippi; and

WHEREAS, all such nonindigenous aquatic species invariably escape or are intentionally introduced into our streams and lakes, and such releases have often proved deleterious to native species; and

WHEREAS, the introduction and proliferation of the black carp has the potential for severely altering aquatic ecosystems; and

WHEREAS, our streams and lakes are the home to one of the largest and most diverse freshwater molluscan fauna in the world, many of which are threatened with extinction; and

WHEREAS, to prevent said extinction, it is imperative that propagation of the introduced black carp be prohibited to prevent intentional or accidental release into the waters of Mississippi; and

WHEREAS members of the Mississippi Chapter of the American Fisheries Society have technical and professional expertise in the areas of biology, ecology, and conservation of the fresh and marine waters of the state of Mississippi; and

WHEREAS in 1994, the parent organization of the American Fisheries Society adopted a similar resolution pertaining to the introduction of black carp at its 124th annual meeting at Halifax, Nova Scotia, therefore be it

RESOLVED, the Mississippi Chapter of the American Fisheries Society, assembled at its annual meeting on 17 February, 2000 in Biloxi, Mississippi urges the State of Mississippi to rescind the approval of black carp for snail control and to take immediate steps to eliminate all existing populations of the black carp now in Mississippi and to prohibit any future introduction of black carp into state waters.

Glenn R. Parsons, *President and Executive Officer*
Mississippi Chapter of the American Fisheries Society

3/4/00
Date

Chet F. Rakocinski, *President-elect and Executive Officer*
Mississippi Chapter of the American Fisheries Society

22 February 2000
Date

NASS
FACT FINDERS FOR AGRICULTURE
UNITED STATES DEPARTMENT OF AGRICULTURE

Census of Agriculture
NASS Press Release

National Agricultural Statistics Service
(800) 727-9540 nass@nass.usda.gov www.usda.gov/nass/

FEBRUARY 1, 2000

First Aquaculture Census Catches Nearly $1 Billion in Sales

The Nation's first census of aquaculture revealed interesting facts–and confirmed some expectations–about one of agriculture's fastest growing sectors. The 1998 Census of Aquaculture, conducted by the U.S. Department of Agriculture, National Agricultural Statistics Service (NASS), provides a wide variety of data relating to methods of production, sources of water, sales and sale outlets, cooperative agreements and contracts, sizes of operation based on sales, and aquaculture distributed for restoration or conservation purposes.

This special census provided the first detailed picture of the aquaculture industry and revealed that:

- Mississippi topped the sales charts, capturing nearly 30 percent of the $978 million dollars of domestic aquaculture produced in 1998.
- Arkansas, Florida, Maine, and Alabama came in second through fifth, respectively, in sales.
- Food fish (e.g., catfish, trout, salmon, tilapia, hybrid striped bass, etc.) accounted for about two-thirds of the aquaculture sales and just under half of the farms producing aquaculture.
- The value of aquacultural products sold continues to grow, jumping over twenty percent in the last year: sales totaled $807 million in 1997, then rose to $978 million in 1998.
- Food fish growers showed average sales of $387 thousand dollars per farm in 1998.

The census of aquaculture contains information about food fish, baitfish, mollusks, crustaceans, ornamental fish, sport/game fish, algae and sea vegetables, and other fish and aquacultural products. To discover the wealth of aquaculture and other agricultural statistics available from NASS, including hundreds of commodity production and price reports, or to review a full catalog of NASS products and services, visit the NASS Home Page at www.usda.gov/nass/. The 1998 Census of Aquaculture, 1997 Census of Agriculture reports, State and County Profiles, Highlights, and a slide show presenting *Quick Facts* are accessible by clicking "Census of Agriculture." For other information, e-mail nass@nass.usda.gov or call 1-800-727-9540. To order a printed copy of any NASS report, call the NASS Order Desk at 1-800-999-6779.

Catfish: Number of Operations, Water Surface Acres Used for Production, and Total Sales, by State

State	Number of Operations on Jan 1		Water Surface Acres Used for Production During Jan 1 - Jun 30		Total Sales	
	1999	2000	1999 [1/]	2000	1998 [1/]	1999
	Number		Acres		1,000 Dollars	
Alabama	250	255	21,300	22,100	61,485	71,124
Arkansas	170	170	31,000	35,000	56,263	70,582
California	53	46	2,000	2,400	7,561	7,647
Florida	25	22	340	390	*	1,110
Georgia	55	60	1,050	990	1,335	1,263
Illinois	14	14	270	250	814	952
Kansas [2/]	14		170		196	
Kentucky	21	25	235	200	1,254	1,209
Louisiana	98	94	13,700	13,500	28,554	32,434
Mississippi	400	405	105,000	110,000	307,229	294,103
Missouri	35	40	1,600	1,860	1,908	2,854
North Carolina	40	44	1,170	1,200	2,197	2,088
Oklahoma [2/]	13		320		351	
South Carolina	15	19	800	760	1,890	1,041
Tennessee [2/]	25		290		308	
Texas	51	49	1,620	580	*	1,777
Other States					3,964	
Total	1,279	1,243	180,865	189,230	475,309	488,184

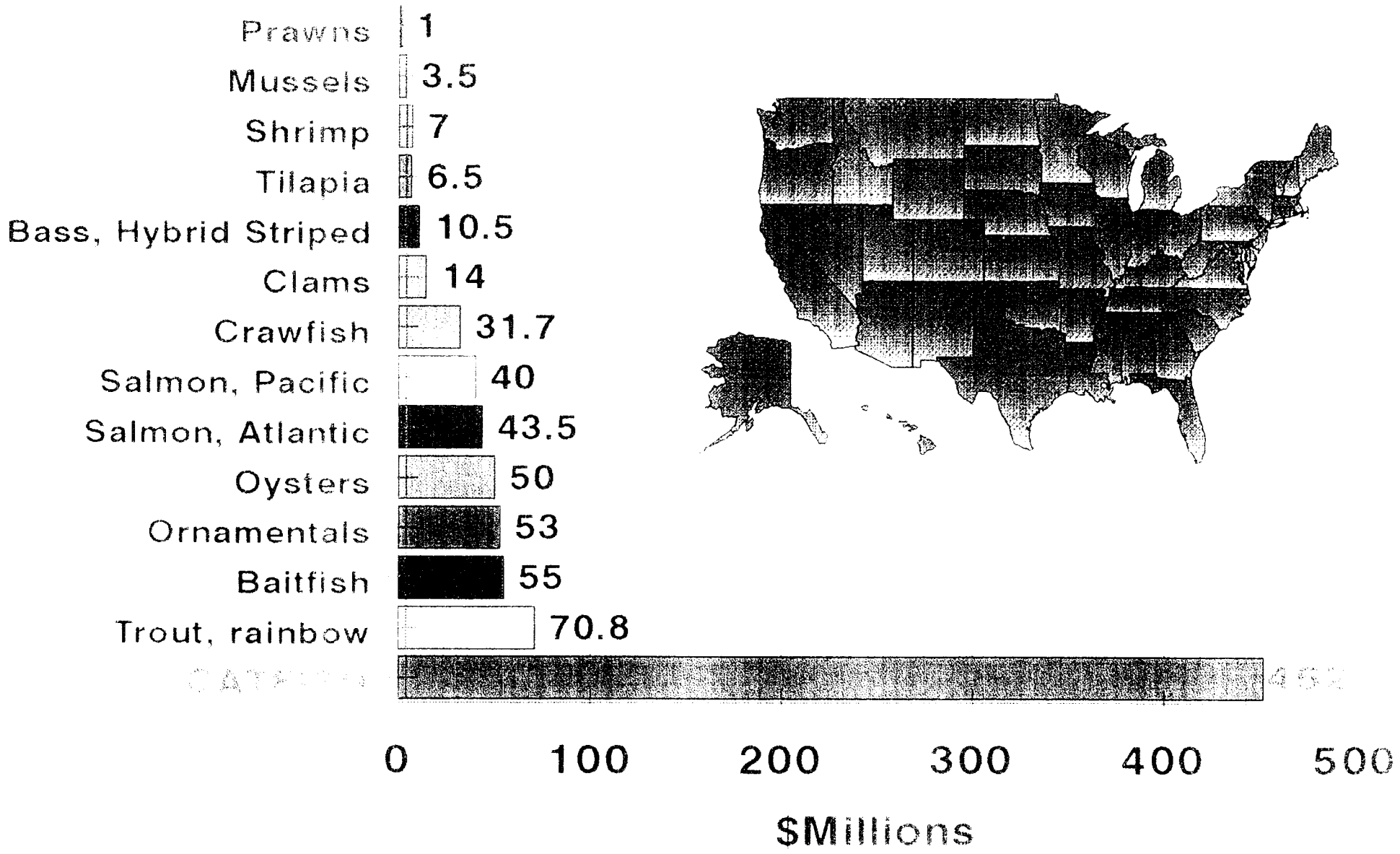
* Included in Other States to avoid disclosure of individual operations.

[1/] Revised.

[2/] Estimates discontinued for 2000.

Thomas L. Gregory
State Statistician

Barbara W. Odom
Agricultural Statistician

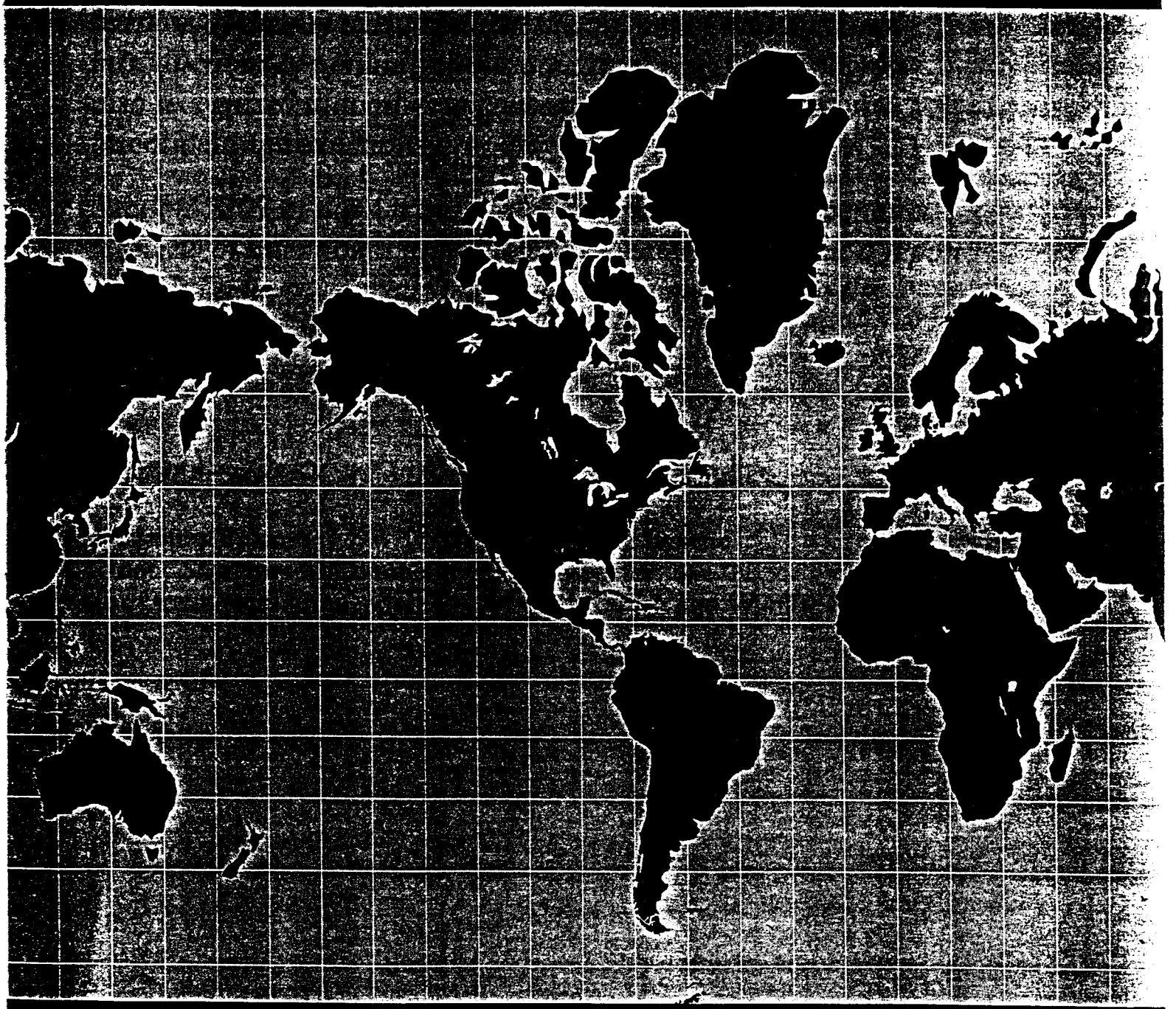


Estimate provided by the Joint Subcommittee on Aquaculture

Source: Fish Farming Experimental Laboratory, Stuttgart, AR

REPORT TO CONGRESS

Findings, Conclusions, and Recommendations of the Intentional Introductions Policy Review



AQUATIC NUISANCE SPECIES TASK FORCE

MARCH 1994

EXECUTIVE SUMMARY

THE ISSUE

Nonindigenous aquatic species have been and continue to be a source of socio-economic benefits and costs to many sectors of American society and a threat to the maintenance of biological diversity. Despite this significance, nonindigenous species issues in general are vastly underrecognized.

Nonindigenous species are used extensively in research, biocontrol, the aquarium industry, public and private aquaculture, and public fisheries management. Hundreds of species are imported by the aquarium industry on a regular basis for resale or as broodstock for domestic production. Much of marine aquaculture on the Pacific Coast is based on the nonindigenous Pacific oyster. Fisheries management in many States has involved the use of nonindigenous species. Pacific salmon, for example, are not indigenous to the Great Lakes but form the basis of a large recreational fishery.

Despite these benefits, there are risks associated with intentional introductions of nonindigenous species. In the context of this report, the definition of "intentional introduction" encompasses more than deliberate stocking activities. It includes escapes from aquaculture or aquarium facilities and activities such as dumping of baitfish and home aquarium species. Such introductions may lead to the decline of indigenous species through predation or competition for resources. Introduced species may alter habitat affecting human activities and those characteristics of the habitat on which indigenous species depend. If not properly screened, introduced organisms may carry serious pathogens or parasites. Local adaptations of wild stocks may be genetically based, and an inadequately considered introduction may affect their viability. Such risks are as likely to be associated with intentional introductions as with unintentional introductions.

THE FRAMEWORK

Primarily in response to the introduction of zebra mussels into the Great Lakes, Congress enacted the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (Act). Zebra mussels probably were unintentionally introduced via ballast water, and the major focus of the Act is to set up a framework to reduce the risk of unintentional introductions and to monitor and control nonindigenous aquatic nuisance species. The Act establishes an interagency Aquatic Nuisance Species Task Force (Task Force) responsible for developing a framework to address the problem of nonindigenous aquatic nuisance species. The Act also contains specific provisions for controlling zebra mussels and a mandate that the Coast Guard promulgate regulations to prevent further ballast water introductions into the Great Lakes. Several Federal agencies have been involved in zebra mussel control activities. The Coast Guard ballast water management regulations became effective on May 10, 1993.

Section 1207 of the Act mandates that the Task Force conduct an Intentional Introductions Policy Review. The purpose of the review is to provide Congress with recommendations for "reducing the risk of adverse consequences associated with intentional introductions of aquatic organisms." This report is the product of that review. The policy review process involved a broad spectrum of potentially affected entities and benefitted greatly from their diverse views and approaches to these complex issues.

Two central concerns of the Task Force that reflect this complexity are: 1) the need to make ecologically credible decisions, and 2) the need to strike a balance between greater risk reduction and accommodating current activities and economies that depend on the use of nonindigenous species. Because of the difficulty in extirpating established aquatic species if they should become nuisance species, the Task Force has adopted the principle of adequate review before an introduction takes place. The Task Force concluded that: 1) to the maximum extent possible, decisions should be based on ecosystem considerations, and 2) the recommendations should

generally apply only to new introductions. The first is consistent with the language of the Act and emphasizes the extent of shared ecological and evolutionary history rather than a jurisdictional boundary as the appropriate scale upon which biologically meaningful decisions should be based. The second represents a useful compromise between risk reduction and existing economic dependencies. The goal of both is to avoid creating situations that could lead to further establishment of nuisance species.

THE RECOMMENDATIONS

In general, the recommendations promote education, cooperation, and accountability. Further, because prevention is key to risk reduction, most of the recommendations center around the decision-making process. The involvement of private industry and public organizations is essential to the effective implementation of Task Force recommendations.

General

For the recommendations in this report to be implemented effectively, both agency funding authorizations and appropriations must be consistent with the level of activity required by Congress in the authorizing statute, and requested in the President's budget.

Education and Extension

1A. Federal agencies should support the development of education and extension programs that promote or enhance: 1) general awareness of nonindigenous species issues, 2) understanding of the risks associated with introductions and how to minimize them, 3) understanding and enforcement of existing authorities, and 4) the preferred use of indigenous species.

1B. Federal agencies should support and facilitate the coordination of a national network of clearinghouses for educational materials and other nonindigenous species information that would support the educational efforts presented in recommendation 1A.

Research

2. Federal agencies should support research that enables: 1) better understanding of the risks associated with introductions and how to minimize them, 2) identification of specific pathogens and parasites and methods of determining if proposed introductions are specific pathogen-free, 3) the use of indigenous species, and 4) more effective education and extension (i.e., evaluating the efforts made under recommendation 1A).

Existing Authority

3A. Ongoing uses of nonindigenous species should be evaluated by their respective funding or permitting agencies (State or Federal) to determine their potential effects on indigenous species and adjusted as feasible to minimize risks.

3B. Appropriate Federal agencies should more closely examine proposed *new* introductions to determine whether they constitute major actions with significant effects on the human environment and, if so, more fully and consistently employ the NEPA process in their considerations of proposed introductions. These same agencies should ensure that their NEPA guidance procedures reflect this concern.

3C. Appropriate Federal agencies should formalize their compliance procedures to fully implement Executive Order 11987 and within one year of publication of this Report to Congress, submit to the ANS Task Force a report of what steps have been taken to achieve compliance.

3D. Federal agencies should not provide financial assistance for *new* introductions of aquatic nonindigenous species (plant or animal) *unless* the proposed introduction is consistent with EO 11987 and other existing or new Federal authorities (e.g., Endangered Species Act, NEPA, and the recommended permit system [see 4A below] when developed).

3E. Improvements in Federal activity that should be taken under the Lacey Act include:

1) expediting the injurious species listing process;

2) fostering compliance with interstate commerce clauses of the Lacey Act by maintaining

and making available to all interested entities information on State lists (approved, restricted, prohibited) and regulatory requirements;

3) establishing a list of Federally approved and prohibited species to facilitate quick decisions on those species;

4) [under the Lacey Act or other appropriate authority], initiating a review system for all other species not so listed; and

5) making an effort to identify pathogens and parasites of concern.

3F. The appropriate Federal agencies should: 1) expedite the listing process for noxious weeds, 2) develop the required undesirable plant management programs, and 3) encourage the use of Federal-State-private partnerships in developing the authorized control and prevention programs.

Prohibitions and Enforcement

The Task Force makes no specific recommendation under this option other than increased attention to the enforcement of existing authorities.

Permit Systems

4A. Establish a Federal permitting system for imports from outside the United States to provide a credible review of proposed *new* introductions of nonindigenous aquatic organisms.

4B. The USDA Animal and Plant Health Inspection Service (APHIS), the Fish and Wildlife Service, and the National Marine Fisheries Service should establish a joint permit review process. Congress should take appropriate legislative action recommended by the Administration to authorize the agreed-to process.

Protocols and Environmental Assessments

5. The ICES Code of Practice or other acceptable protocols should be used as a tool to evaluate introductions.

Interjurisdictional Decision Methods

6A. State and Federal officials should solicit review and approval from existing or newly developed interjurisdictional panels regarding new introductions that may affect the resources of multiple jurisdictions.

6B. Interjurisdictional panels should serve as a forum for the sharing of nonindigenous species information; for the coordination, where desirable, of State laws; and for the development of regional policy.

6C. Interjurisdictional nonindigenous species consultations should include representation from affected parties, i.e., Federal, State, Tribal, public and private interests and, where appropriate, the international community.

Model State Code

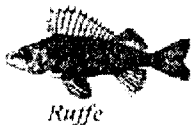
7. State legislative bodies should, in consultation with appropriate State agencies and other interested entities, enact comprehensive legislation to deal with nonindigenous species issues.

Good Business Practices

8. Where such codes do not already exist, private industry trade associations in consultation with the appropriate State and Federal agencies (and other interested entities), should develop Codes of Good Business Practices that promote continued commercial operation in a manner that is compatible with the conservation of natural ecosystems.


Zebra Mussel


Japanese Shore Crab


Ruffe


Rusty Crayfish


Purple Loosestrife

ANS Task Force

Dedicated to the prevention and control of aquatic nuisance species

and many, many more...

What is the Aquatic Nuisance Species (ANS) Task Force? The Task Force is an intergovernmental organization dedicated to preventing and controlling aquatic nuisance species, and implementing the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. The Task Force, co-chaired by the US Fish and Wildlife Service and National Oceanic and Atmospheric Administration, was established to coordinate governmental efforts related to nonindigenous aquatic species in the United States with those of the private sector and other North American interests. The Task Force consists of seven Federal agency representatives and 10 ex officio members. The other Federal agencies are the US Environmental Protection Agency, the US Coast Guard, the Assistant Secretary of the Army for Civil Works, the US Department of Agriculture, and the US Department of State. (List of ANSTF Members)

Thousands of nonindigenous species have been introduced in to the United States as a result of human activities. In the past decade, several harmful nonindigenous aquatic species such as the zebra mussel, ruffe and Asian clam have been unintentionally introduced into the United States with substantial immediate financial and ecological effects.

In response to the rapidly spreading zebra mussel infestation and other concerns about nonindigenous aquatic species introductions, the Nonindigenous Aquatic Nuisance Prevention and Control Act (Act, 16 USC 4701-4741) was enacted in 1990 and amended by the

National Invasive Species Act of 1996. It provides an intergovernmental mechanism for the development of a cooperative national program to:

- reduce the risk of or prevent the unintentional introduction and dispersal of nonindigenous aquatic species that may be nuisances;
- ensure prompt detection of the presence of and monitor changes in the distribution of nonindigenous aquatic species; and
- control established aquatic nuisance species in a cost-effective, environmentally sound manner.

For more details see the Aquatic Nuisance Species Program adopted by the ANS Task Force.

Please email any comments you have about the website or information you would like to share.

Thanks to the U.S. Environmental Protection Agency for developing this Web site.

ANS Task Force

Nonindigenous Aquatic Nuisance Prevention and Contol Act

SEC. 1202. AQUATIC NUISANCE SPECIES PROGRAM.

(a) IN GENERAL.--The Task Force shall develop and implement a program for waters of the United States to prevent introduction and dispersal of aquatic nuisance species; to monitor, control and study such species; and to disseminate related information.

(b) CONTENT.--The program developed under subsection (a) shall--

(1) identify the goals, priorities, and approaches for aquatic nuisance species prevention, monitoring, control, education and research to be conducted or funded by the Federal Government;

(2) describe the specific prevention, monitoring, control, education and research activities to be conducted by each Task Force member;

(3) coordinate aquatic nuisance species programs and activities of Task Force members and affected State agencies;

(4) describe the role of each Task Force member in implementing the elements of the program as set forth in this subtitle;

(5) include recommendations for funding to implement elements of the program; and

(6) develop a demonstration program of prevention, monitoring, control, education and research for the zebra mussel, to be implemented in the Great Lakes and any other waters infested, or likely to become infested in the near future, by the zebra mussel.

(c) PREVENTION.--

(1) IN GENERAL.--The Task Force shall establish and implement measures, within the program developed under subsection (a), to minimize the risk of introduction of aquatic nuisance species to waters of the United States, including--

(A) identification of pathways by which aquatic organisms are introduced to waters of the United States;

(B) assessment of the risk that an aquatic organism carried by an identified pathway may become an aquatic nuisance species; and

(C) evaluation of whether measures to prevent introductions of aquatic nuisance species are effective and environmentally sound.

(2) IMPLEMENTATION.--Whenever the Task Force determines

(2)

that there is a substantial risk of unintentional introduction of an aquatic nuisance species by an identified pathway and that the adverse consequences of such an introduction are likely to be substantial, the Task Force shall, acting through the appropriate Federal agency, and after an opportunity for public comment, carry out cooperative, environmentally sound efforts with regional, State and local entities to minimize the risk of such an introduction.

(d) MONITORING.--The Task Force shall establish and implement monitoring measures, within the program developed under subsection (a), to--

(1) detect unintentional introductions of aquatic nuisance species;

(2) determine the dispersal of aquatic nuisance species after introduction; and

(3) provide for the early detection and prevention of infestations of aquatic nuisance species in unaffected drainage basins.

(e) CONTROL.--

(1) IN GENERAL.--The Task Force may develop cooperative efforts, within the program established under subsection (a), to control established aquatic nuisance species to minimize the risk of harm to the environment and the public health and welfare. For purposes of this Act, control efforts include eradication of infestations, reductions of populations, development of means of adapting human activities and public facilities to accommodate infestations, and prevention of the spread of aquatic nuisance species from infested areas. Such control efforts shall be developed in consultation with affected Federal agencies, States, Indian Tribes, local governments, interjurisdictional organizations, and other appropriate entities. Control actions authorized by this section shall be based on the best available scientific information and shall be conducted in an environmentally sound manner.

(2) DECISIONS.--The Task Force or any other affected agency or entity may recommend that the Task Force initiate a control effort. In determining whether a control program is warranted, the Task Force shall evaluate the need for control (including the projected consequences of no control and less than full control); the technical and biological feasibility and cost-effectiveness of alternative control strategies and actions; whether the benefits of control, including costs avoided, exceed the costs of the program; the risk of harm to non-target organisms and ecosystems, public health and welfare; and such other considerations the Task Force determines appropriate. The Task Force shall also determine the nature and extent of control of target aquatic nuisance species that is feasible and desirable.

(3) PROGRAMS.--If the Task Force determines in accordance

(3)

with paragraph (2) that control of an aquatic nuisance species is warranted, the Task Force shall develop a proposed control program to achieve the target level of control. A notice summarizing the proposed action and soliciting comments shall be published in the Federal Register, in major newspapers in the region affected, and in principal trade publications of the industries affected. Within 180 days of proposing a control program, and after consultation with affected governmental and other appropriate entities and taking into consideration other comments received, the Task Force shall complete development of the proposed control program.

(f) RESEARCH.--

(1) PRIORITIES.--The Task Force shall, within the program developed under subsection (a), conduct research concerning--

(A) the environmental and economic risks and impacts associated with the introduction of aquatic nuisance species into the waters of the United States;

(B) the principal pathways by which aquatic nuisance species are introduced and dispersed;

(C) possible methods for the prevention, monitoring and control of aquatic nuisance species; and

(D) the assessment of the effectiveness of prevention, monitoring and control methods.

(2) PROTOCOL.--Within 90 days of the date of enactment of this Act, the Task Force shall establish and follow a protocol to ensure that research activities carried out under this subtitle do not result in the introduction of aquatic nuisance species to waters of the United States.

(3) GRANTS FOR RESEARCH.--The Task Force shall allocate funds authorized under this Act for competitive research grants to study all aspects of aquatic nuisance species, which shall be administered through the National Sea Grant College Program and the Cooperative Fishery and Wildlife Research Units. Grants shall be conditioned to ensure that any recipient of funds follows the protocol established under paragraph (2) of this subsection.

(g) TECHNICAL ASSISTANCE.--The Task Force shall, within the program developed under subsection (a), provide technical assistance to State and local governments and persons to minimize the environmental, public health, and safety risks associated with aquatic nuisance species, including an early warning system for advance notice of possible infestations and appropriate responses.

(h) EDUCATION.--The Task Force shall, with the program developed under subsection (a), establish and implement educational programs through Sea Grant Marine Advisory Services and any other available resources that it determines to be appropriate to inform the general public, State governments, governments of political subdivisions of States, and industrial and recreational users of aquatic resources in connection with matters concerning the identification of aquatic nuisance species, and control methods for such species, including the prevention of the further distribution of such species.

(i) ZEBRA MUSSEL DEMONSTRATION PROGRAM.--

(1) ZEBRA MUSSEL--

(A) IN GENERAL.--The Task Force shall, within the program developed under subsection (a), undertake a program of prevention, monitoring, control, education and research for the zebra mussel to be implemented in the Great Lakes and any other waters of the United States infested or likely to become infested by the zebra mussel, including--

(i) research and development concerning the species life history, environmental tolerances and impacts on fisheries and other ecosystem components, and the efficacy of control mechanisms and means of avoiding or minimizing impacts;

(ii) tracking the dispersal of the species and establishment of an early warning system to alert likely areas of future infestations;

(iii) development of control plans in coordination with regional, State and local entities; and

(iv) provision of technical assistance to regional, State and local entities to carry out this section.

(B) PUBLIC FACILITY RESEARCH AND DEVELOPMENT.--The Assistant Secretary, in consultation with the Task Force, shall develop a program of research, technology development, and demonstration for the environmentally sound control of zebra mussels in and around public facilities. The Assistant Secretary shall collect and make available, through publications and other appropriate means, information pertaining to such control methods.

(C) VOLUNTARY GUIDELINES.--Not later than 1 year after the date of enactment of this subparagraph, the Task Force shall develop and submit to the Secretary voluntary guidelines for controlling the spread of the zebra mussel and, if appropriate, other aquatic nuisance species through recreational activities, including boating and fishing. Not later than four months after the date of such submission, and after providing notice and an opportunity for public comment, the Secretary shall issue voluntary guidelines that are based on the guidelines developed by the Task Force under this subparagraph.

(2) DISPERSAL CONTAINMENT ANALYSIS.--

(A) RESEARCH.--The Administrator of the Environmental Protection Agency, in cooperation with the National Science Foundation and the Task Force, shall provide research grants on a competitive basis for projects that--

(i) identify environmentally sound methods for controlling the dispersal of aquatic nuisance species, such as the zebra mussel; and

(ii) adhere to research protocols developed pursuant to subsection (f)(2).

(B) AUTHORIZATION OF APPROPRIATIONS.--There

(B) are authorized to be appropriated to the Environmental Protection Agency to carry out this paragraph, $500,000.

(3) DISPERSAL BARRIER DEMONSTRATION.--

(A) IN GENERAL.--The Assistant Secretary, in consultation with the Task Force, shall investigate and identify environmentally sound methods for preventing and reducing the dispersal of nonindigenous nuisance aquatic species between the Great Lakes-Saint Lawrence drainage and the Mississippi River drainage through the Chicago River Ship and Sanitary Canal, including any of those methods that could be incorporated into the operation or construction of the lock system of the Chicago River Ship and Sanitary Canal.

(B) REPORT.--Not later than 18 months after the date of enactment of this paragraph, the Assistant Secretary shall issue a report to the Congress that includes recommendations concerning--

(i) which of the methods that are identified under the study conducted under this paragraph are most promising with respect to preventing and reducing the dispersal of aquatic nuisance species; and

(ii) ways to incorporate those methods into ongoing operations of the United States Army Corps of Engineers that are conducted at the Chicago River Ship and Sanitary Canal.

(C) AUTHORIZATION OF APPROPRIATIONS.--There are authorized to be appropriated to the Department of the Army, to carry out this paragraph $750,000.

(4) CONTRIBUTIONS.--To the extent allowable by law, in carrying out the studies under paragraphs (2) and (3), the Administrator of the Environmental Protection Agency and the Secretary of the Army may enter into an agreement with an interested party under which that party provides in kind or monetary contributions for the study.

(5) TECHNICAL ASSISTANCE.--The Great Lakes Environmental Research Laboratory of the National Oceanic and Atmospheric Administration shall provide technical assistance to appropriate entities to assist in the research conducted pursuant to this subsection.

(j) IMPLEMENTATION.--

(1) REGULATIONS.--The Director, the Secretary, and the Under Secretary may issue such rules and regulations as may be necessary to implement this section.

(2) PARTICIPATION OF OTHERS.--The Task Force shall provide opportunities for affected Federal agencies which are not part of the Task Force, State and local government agencies, and regional and other entities with the necessary expertise to participate in control programs. If these other agencies or entities have sufficient authority or jurisdiction and expertise and where this will be more efficient or effective, responsibility for implementing all or a portion of a control program may be delegated to such agencies or entities.

(k) REPORTS.--

(1) Not later than 12 months after the date of enactment of this Act, the Task Force shall submit a report describing the program developed under subsection (a), including the research protocol required under subsection (f)(2), to the Congress.

(2) On an annual basis after the submission of the report under paragraph (1), the Task Force shall submit a report to the Congress detailing progress in carrying out this section.

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Biological Summary of Black Carp*

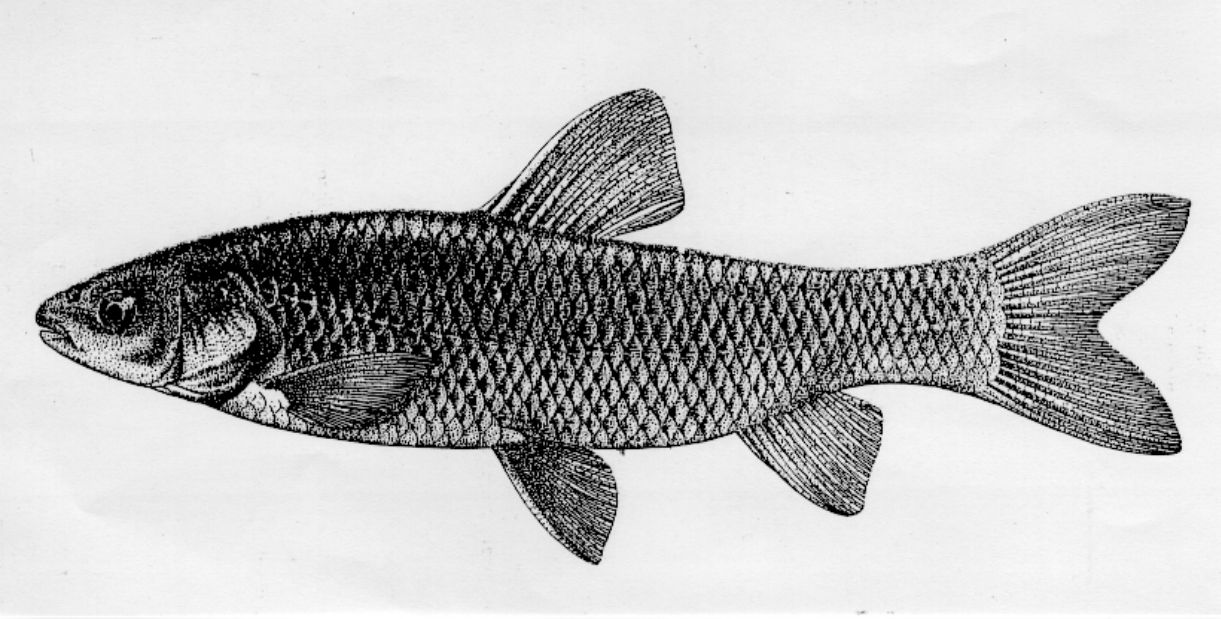

Photo from Lin 1991

(*Mylopharyngodon piceus).*

Identification: Black carp are remarkably similar to grass carp in overall body shape and believed to be the largest of the Chinese carps (Bardach et al. 1972). It has been reported to weigh as much as 70 kg with lengths exceeding 1.8 m, but the average size in its native range is 15 kg and roughly 1m in length (Nico and Williams 1996). Its head is pointed slightly, more so than that of a grass carp, with a flattened anterior portion. The mouth is small, toothless, oblique and located in the pointed region of the head with the upper jaw extending slightly beyond the lower (Lin 1991). The eyes are medium in size and centered on each side of the head. The scales are large with 39-45 in a complete and slightly decurved lateral line and 4-7 scales above. The base of the dorsal fin is slightly anterior of the pelvic fins and located closer to the base of the caudal than the tip of the snout. Dorsal fin rays number 3 unbranched and seven branched rays, the pectoral fin rays number 1,16, anal with 3,8 and the caudal fin is deeply emarginate with equal lobes. (Nico and Williams 1996)[1] (Lin 1991). Black carp are molluskivoirous and therefore possessing a strong masticating apparatus paired with specialized pharyngeal teeth. These develop within one month of hatching and number 4/5 in one row with a masticator (Lin 1991) and are described as massive, smooth and molar-like. The gill rakers are short, 1/5th the length of the filaments and sparse with roughly 15-21 in the first arch (Nico and Williams 1996). The coloring of the fish varies from brown to blackish and grading to a bluish-grey or nearly white belly. The fins are darker than the body and most often described as black or brownish-black with lighter hues at the base (Lin 1991) (Nico and Williams 1996).

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[1]Author noted inconsistency in data for scale and fin ray counts, thus, an average of the data set was used.

Distribution: The native range of the black carp includes most major Pacific drainages of eastern Asia to include Eastern Russia, China and northern Vietnam (Fuller et.al 1999). Black carp were imported into the United States in the early 1970's. Currently the only known escape into U.S. waters occurred in Missouri in April of 1994 where roughly 30 black carp escaped an aquaculture facility when high waters of the Osage river flooded culture ponds (fig 1). There has been no documentation of natural reproduction to date. Currently seven states and Mexico are known to have black carp in either research or aquaculture facilities. Those states are: Arkansas, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma and Texas (Nico and Williams 1996).

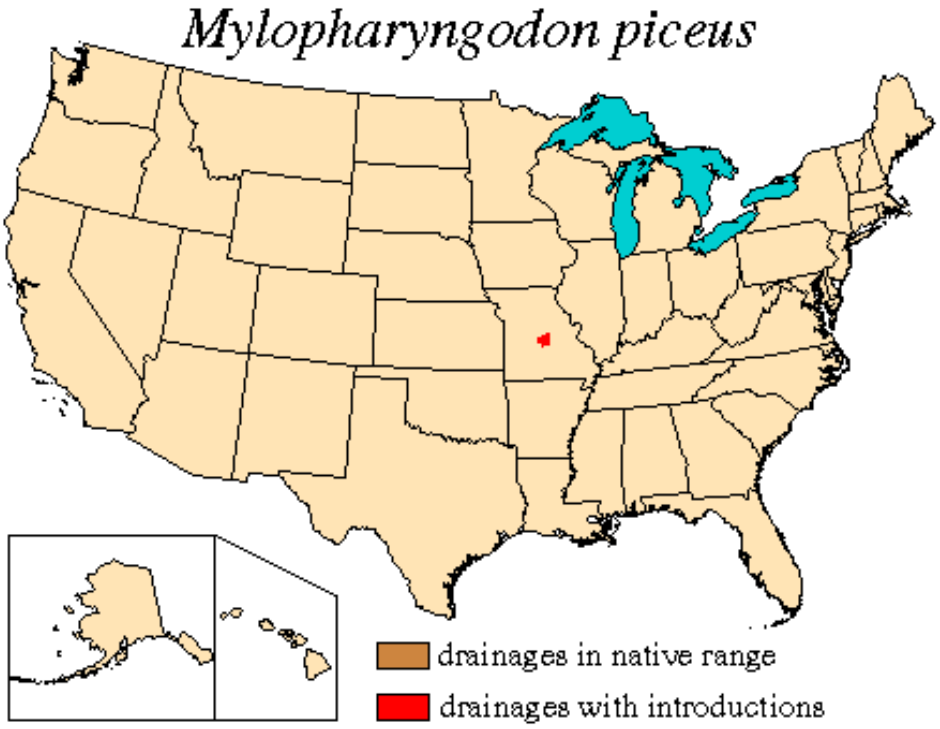

Figure 1. From Nico and Fuller 1999

Reproduction: Black carp spawn in large rivers much like other Asian carps, however, the spawning period seems to be slightly later, has a longer duration and occurs at greater depths. Spawning also occurs during more moderate flooding or receding flood waters as opposed to a sudden rise. Optimal spawning conditions require ample food and temperatures of 26-30 C (Lin 1991).

Black carp mature later than other Asian carp species. Age at maturity is dependant on latitude, diet and habitat. Most black carp reach maturity in 6-11 years, with females maturing about one year later than males. Maturity has been documented in as little as three years or as much as 11. Size at maturity is generally about 1 m and 15 kg for females and slightly less for males at 88 cm and 10 kg (Lin 1991) (Nico and Williams 1996). The brood is large with relative fecundity from 74.6 eggs/gram of body weight in a 13.3 kg female to 99 eggs /gram of body weight in a 34 kg

female (about 3.4 million eggs) (Lin 1996). The eggs are bathypelagic and 5-7 mm in diameter after absorption and hatch 35 hours post fertilization (Lin 1991) (Nico and Williams 1996).

Feeding Ecology: Adult black carp primarily occupy benthic habitats, and can tolerate dissolved oxygen levels as low as 2 mg/l. Larval fry and juvenile fish occupy shallower habitats in conjunction with their food requirements. Optimal feeding temperatures of black carp range from 25-30 C. They have been documented to cease feeding at temperatures of 3 C. and can die at 0.5 C. or above 40 C. (Lin 1991).

Fry, 7-9 mm. in length, feed on protozoa, rotifers and nauplii after hatching. The diet begins to include daphnids and *Cyclops* after about the second week post hatch or at a length of 10-12 mm. At 13-17 mm, the diet also includes larger daphnids and minute benthos. The pharyngeal teeth are completely developed by the time the fish reaches 30 mm and the fish begin feeding on a larger variety of benthos, insect larvae and organic detritus (Lin 1991). As the fish grows its masticating apparatus and pharyngeal teeth become stronger, its diet entails more and larger prey.
Adult black carp prey heavily on mollusks in general, but will also take other "shelled" invertebrates such as crustacions. Species of mollusks taken vary with geography and fish gape, but usually include, gastropods, unionids and bivalves (Nico and Williams 1996).

Ecological Impacts: The black carp is currently the only species of Asian carp that has had a formal risk assessment completed (Nico and Williams 1996).

Due to the specialized feeding ecology of the black carp and it's ability to obtain great size it can potentially threaten the existence of snails and mussels in the Mississippi river basin and elsewhere. Endemic mollusks have managed to persist in the presence of native molluskivoirs such as freshwater drum *Aplodinotus grunniens* and redear sunfish *Lepomis microlophus.* Drum and redear are gape limited and therefore cannot prey on larger species. The gape of a 500 mm. black carp is 25mm.(Nico and Williams 1996) and proportionally increases as the fish grows. It's ability to prey on larger mussels directly threatens those which rely on longevity or size for reproduction and recruitment. Furthermore, the great strength of the masticating apparatus could allow black carp to take thicker shelled mussels than that of native molluskivoirs.

Black carp host many parasites, flukes, fungal, bacterial and viral diseases which could infect sport, food or threatened and endangered fish species. Largely due to their diet, they are either intermediate hosts or immune to the effects of many parasites which use mollusks as intermediate hosts. Black carp are known to host at least 22 known and two unnamed parasites, six bacterial and two viral diseases. Epizootiological studies have revealed 11 infectious diseases of various origins common in black carp (Nico and Williams 1996).

References:

Bardach J. E., J. H. Ryther, and W. O. McLarney. 1972. Aquaculture: The farming and husbandry of freshwater and marine organisms. Wiley-Interscience, New York.

Fuller, P.L., L. G. Nico, and J. D. Williams. 1999. Nonindigenous fishes introduced into inland waters of the United States. American Fisheries Society, Special Publication 27, Bethesda, Maryland. 96 pp.

Lin, Z. 1991. Pond fisheries of China. Pearl River Fisheries Institute of the Chinese Academy of Fisheries Sciences. Pergamon Press. Elmsford, New York. 17-20 pp.

Nico L. G., and J. D. Williams. 1996. Risk assessment on black carp (Pisces: Cyprinidae). Final Report to the Risk Assessment and Management Committee of the Aquatic Nuisance Species Task Force. U.S. Geological Survey, Biological Resources Division, Gainesville, Florida.

Nonindigenous Aquatic Species [www.nfrgc.gov] Gainesville, FL: Leo Nico, 1997. [17 June 1999] available from Internet: [http://nas.er.usgs.gov/fishes/accounts/cyprinid/my_piceu.html]

* Summary compiled by Jeff Finley, USFWS, Columbia Fishery Resources Office from cited references, October, 1999. jeff_finley@fws.gov, 573/876-1911

Biological Summary of Bighead Carp *

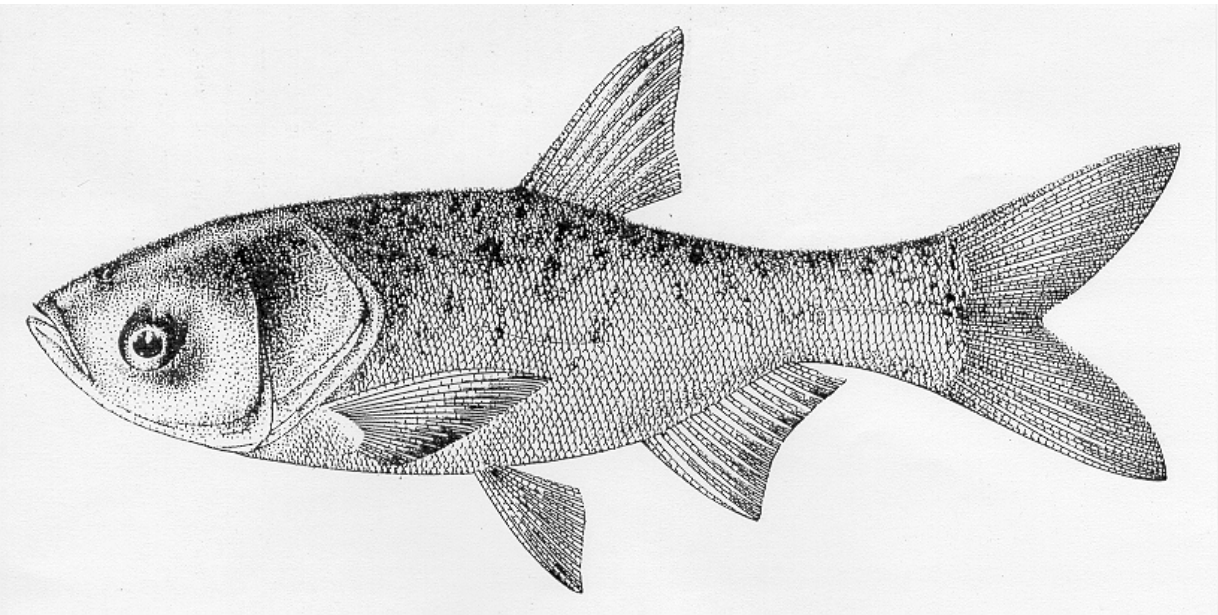

Photo from Lin 1991

(*Hypophthalmichthys nobilis).*

Identification: The bighead carp is a large, heavy-bodied fish that attains the length of more than 70 cm and 40 kg (Fuller et. al. 1999). Its head is scaleless and exceptionally large encompassing nearly 1/3 of the total body length. The mouth is large, toothless, sub-superior and upturned (Lin 1991). The eyes are located far foreword and low on the head well below the axis of the body. Its body is covered with small scales having roughly 99 to 120 in a complete, decurved lateral line and 26 to 28 scale rows above (Lin 1991) (Pflieger 1997). The gill rakers are long and slender or comb-like and closely spaced and the pharyngeal teeth number 4-4. The ventral surface is keeled from the vent to the pelvic fin insertion. Young specimens lack rigid spines. Older fish possess a heavy, rigid, non-serrated dorsal spine and a less developed spine at the base of the anal fin. Soft fin rays number 8 in the dorsal and 13 to 15 in the anal fin (Robison and Buchanan, 1988). Its head, dorsal surface and fins are slate grey in color with silver, often blotched with black, sides that fade to a white or yellowish belly (Linn 1991)(Pflieger 1997).

Distribution: Bighead carp are native to Asia. Since their introduction to the United States in the 1973 (Pflieger 1997), nearly every state in the lower Mississippi river basin and several states outside the basin, have reported catching bighead carp. These states are, Alabama, Arizona, California, Colorado, Florida, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Missouri, Mississippi, Ohio, Oklahoma, Tennessee, Texas and West Virginia (fig 1) (Nico and Fuller 1999). Its distribution is a result of stocking aquaculture facilities and their subsequent escape. Bighead carp are known to school and occupy the upper to middle layers of water. They favor large rivers and depend on their velocity, spring rise and temperature regimes to spawn (Lin 1991). They are extremely hardy and readily adapt to many temperate freshwater environments. This species ultimate potential range in North America is unknown.

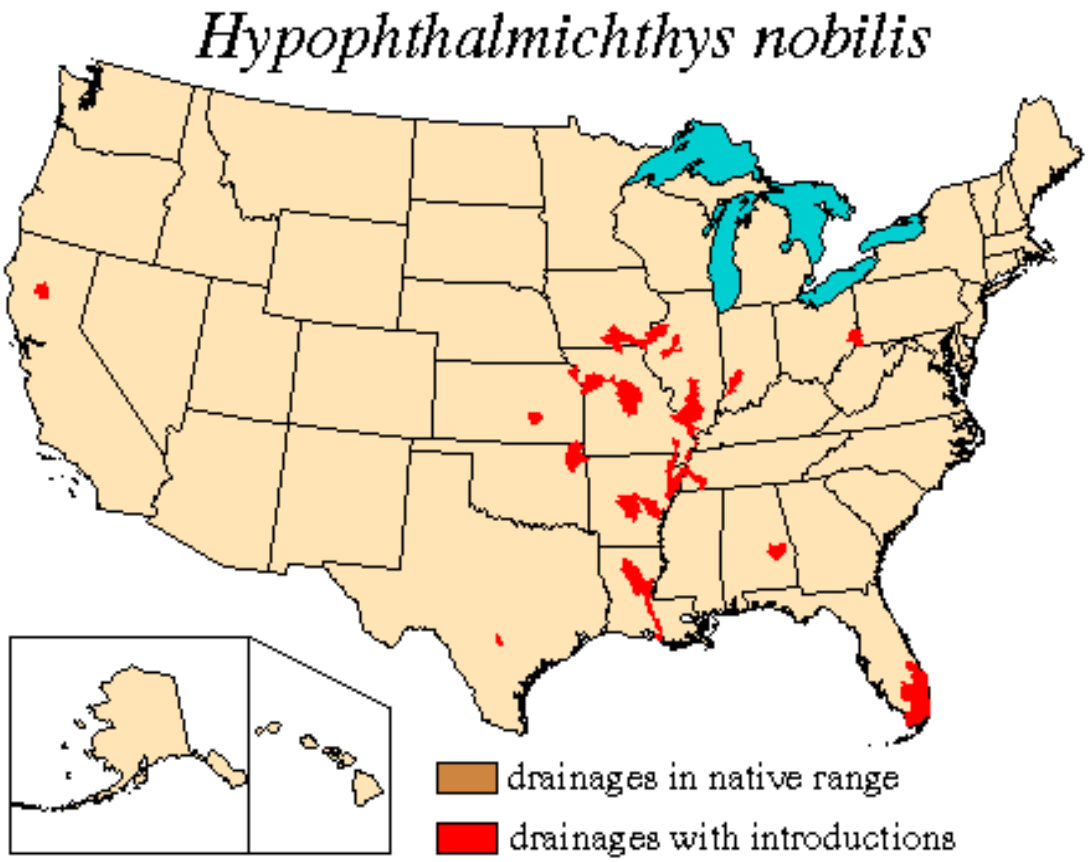

Figure 1. From Nico and Fuller 1999

Reproduction: Spawning in their native range is known to occur during a large rise in water levels. Two types of spawning grounds are described by Lin 1991; canyon and river valley types. Canyon type occurs in channels with water depths of up to 40 m and velocities ranging from 1.3-2.5 m/sec. River valley type occurs in river meanders, sand bars and rocks extending into the river. Bighead carp will not spawn in water temperatures below 18 C. or above 30 C. (Lin 1991).

In native riverine habitats, females reach sexual maturity in as little as three years with a body weight of 7-10 kg, males in two years with a body weight of 5-8 kg. Relative fecundity of native fish has been recorded as 70.9 eggs/gram of body weight in a 19.3 kg female, and increases with body size to 111.1 eggs/gram of body weight in a 31.2 kg female (approx. 3.5 million eggs). The eggs are non-adhesive, green to slightly yellow in color and are 4-6 mm in diameter after absorption. Fertilized eggs are slightly heavier than water and drift semi-suspended until hatching. Eggs hatch in as little as 18 hours in 29 C. water and as long as 60 hours in 18 C. water (Lin 1991).

Feeding Ecology: Five ontogenic shifts in feeding ecology of bighead carp were summarized by Lazareva et al. (1977) in fish less than one year of age. Larval fish begin to feed on phytoplankton and infusoria in the first stanza, then shift to protococcaceans, diatoms, blue green algae and *Rotaria* eggs. By the third stage they begin to target zooplankton exclusively, feeding on *Rotaria* and cyclopoidid nauplii. They shift to larger zooplankton in the fourth stage consuming copepodite stages of cyclopoidid, cladocerans and chironomid larvea, and *Cyclops, Monia,* and chironomid larvae in the fifth stage. Lazareva et al. further noted that in yearling and year 2 fishes the main food source was detritus constituting 87-97% of the gut contents. It is believed that the minor role to zooplankton in the diet of bighead carp fingerlings found by Lazareva et al. (1977) are a result of low concentrations of zooplankton found within experimental ponds (Aguirre and Poss 1998).

By the second year the fish are roughly 65 cm in length. Their outer gill rakers number about 680 on the first arch, averaging 6-7 gill rakers in every mm of gill arch. The raker spacing is 68-85 microns (Lin 1991) or roughly the same spacing as that of the paddlefish *Polyodon spathula* (Rudolph and Hales 1981). Bighead carp have a large suction volume, fast growth rates and voracious appetites enabling them to decimate concentrations of zooplankton quickly. When zooplankton concentrations are low, they become more opportunistic, feeding on phytoplankton, detritus and its associated bacteria. Chemical cues given off by planktonic concentrations prompt the fish to begin feeding accordingly (Dong and Li, 1994).

Ecological Impacts: A risk assessment for this species has not been completed, but a Biological Synopsis was prepared by Jennings (1988). The extent of potential impacts of this species in the North America is not adequately known (Fuller et.al. 1999). It has been hypothesized that bighead carp will have significant negative impacts on food availability for many larval fish, adult filter feeding fish and native mussels (Laird and Page 1996). In addition, numerous larval and juvenile bigheads compete with native riverine fishes for resources in the already limited backwater and nursery habitats of the Mississippi river basin. Furthermore, bighead carp are known (Jennings 1988) to host a multitude of disease causing agents. They include the following: two bacteria, one fungi, 22 protozoa, six trematoda, three cestoda, and three copepoda species, who's impact on the native fauna have not yet been assessed. The ability for this fish to threaten, compete and potentially displace native riverine species, at all life stages, is clearly evident.

References:

Dong, S., D. Li. 1994. Comparative studies of the feeding selectivity of silver carp *Hypophthalmichthys molitrix* and bighead carp *Aristichthys nobilis.* Journal of Fish Biology 44:621-626.

Fuller, P.L., L. G. Nico, and J. D. Williams. 1999. Nonindigenous fishes introduced into inland waters of the United States. American Fisheries Society, Special Publication 27, Bethesda, Maryland.

Jennings, D. P. 1988. Bighead carp (*Hypophthalmichthys nobilis)*: a biological synopsis. U.S. Fish and Wildlife Service Biological Report 88(29).

Laird, C. A., and L. M. Page. 1996 Non-Native fishes inhabiting the streams and lakes of Illinois. Illinois Natural History Survey Bulletin 35(1):1-51

Lazareva, L. P., M.O. Omarov, A.N. Lezina. 1977. Feeding and growth of bighead, *Aristichthys nobilis* in the waters of Dagestan. Journal of Ichthyology 17 (1): 65-71.

Lin, Z. 1991. Pond fisheries of China. Pearl River Fisheries Institute of the Chinese Academy of Fisheries Sciences. Pergamon Press. Elmsford, New York. 10-14 pp.

Nonindigenous Aquatic Species [www.nfrgc.gov] Gainesville, FL: Leo Nico and Pam Fuller, 1997. [17 June 1999] available from Internet: [http://nas.er.usgs.gov/fishes/accounts/cyprinid/hy_nobil.html]

Nonindigenous Species in the Gulf of Mexico Ecosystem [www.ims.usm.edu/~musweb/invaders.html] Ocean Springs, MS: Windsor Aguirre and Stuart G. Poss, 1998. [16 June 1999] available from Internet: [www.ims.usm.edu/~musweb/nis/Hypophthalmichthys_nobilis.html]

Pflieger, W. L. 1997. The Fishes of Missouri. Missouri Department of Conservation, Jefferson City. 126 pp.

Robison, H. W., and T. M. Buchanan. 1988. Fishes of Arkansas. The University of Arkansas Press. Fayetteville. 535 pp.

Rudolph A. R., and D. C. Hales. 1981. Feeding of Paddlefish, *Polydon spathula.* Copeia 1981(2): 441-445

* Summary compiled by Jeff Finley, USFWS, Columbia Fishery Resources Office, from cited references, October, 1999. jeff_finley@fws.gov, 573/876-1911

Biological Summary of Grass Carp*

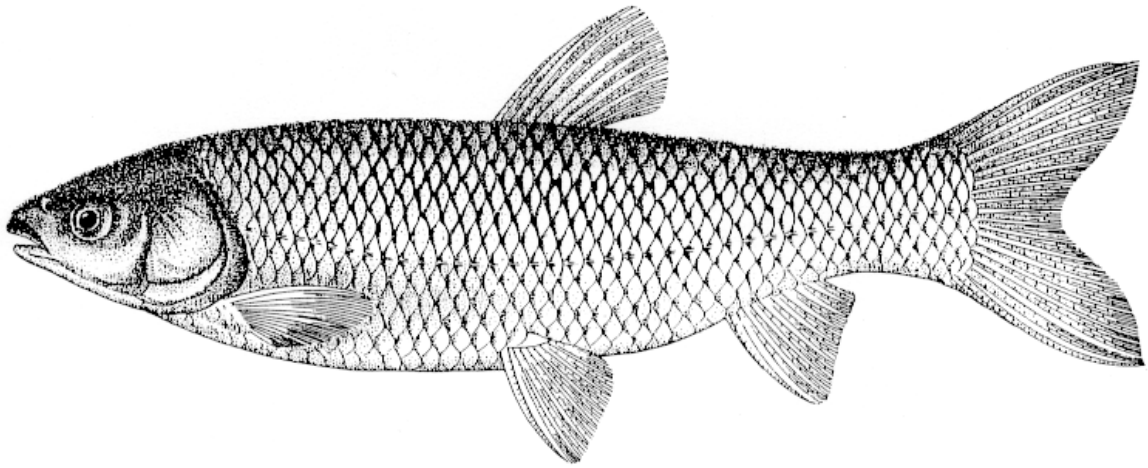

Photo from Lin 1991

(*Ctenopharyngodon idella).*

Identification: Grass carp are a large, thick bodied, silvery colored fish. They are reported to weigh up to 37 kg (100 lbs) (Pflieger 1997) and attain lengths of more than 1.6 m. (over 5 feet) (Bowman 1998). The head is slightly flat, with a sub-inferior mouth and a shorter, lower jaw. The eyes are moderately small and centered on either side of the head. The scales are large with 39-45 in a complete, slightly decurved lateral line. There are 6-7 scales below the lateral line and 9-11 above (Lin 1991). The anal fin is closer to the caudal than in native cyprinids, with its distance going 2 ½ times or more into the distance between the anal fin insertion to the tip of the snout. The fin rays number 3,7 in the dorsal, 3,8 in the anal, 2,14 in the pectoral and 1,8 in the ventral. The gill rakers are short and sparse. The pharyngeal teeth are comb-like at the apex with deep parallel grooves in the principal rows. The teeth are mutually inserted which enable them to grind and cut grasses with the bony pad of the basioccipital. The dental formula is 2,4-4,2 (Lin 1991) (Pflieger 1997). Its life colors are blackish or olive-brown, grading to brassy or silvery-white on sides and belly. Scale pockets on the back and sides are outlined by dusky pigment, giving a crosshatched effect. (Pflieger 1997).

Distribution: The native range of grass carp is as far north as the Amur River of eastern Russia and China, south to the West River of southern China, and has been introduced to many countries in Asia, Europe and America (Fuller et. al. 1999).
Grass carp were first imported to the United States in 1963 and documented released into open waters in Arkansas occurred shortly after. By the early 70's there were reports of grass carp in the Mississippi and Missouri rivers (Pflieger 1975). This fish is currently reported in every state in the U.S. with exception of Alaska, Rhode Island, Maine, Vermont and Montana (fig 1) (Nico and Fuller 1999). This large introduced range is due to the use of this species in scattered research projects, stocking by various agencies for biological control of aquatic vegetation, interstate transport and release, escape from aquaculture facilities and dispersal from introduced sites (Fuller et.al. 1999).

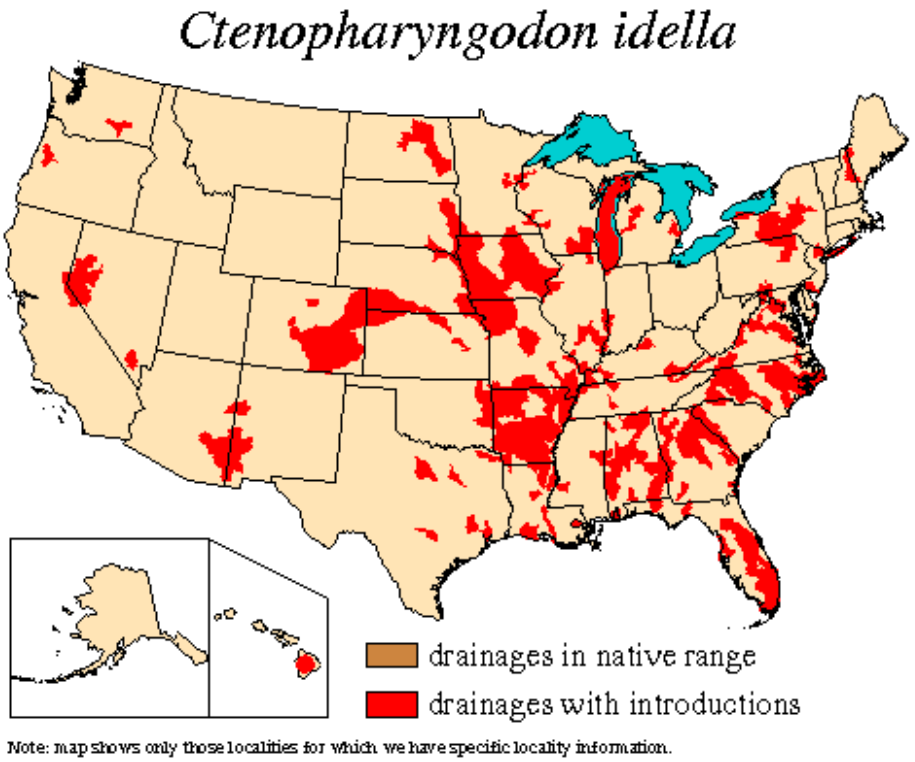

Figure 1. From Nico and Fuller 1999

Reproduction: Grass carp grow at a remarkable rate prior to sexual maturity. Body size can increase as much as a 45% in one month. The greatest increase in length is during the first and second year with weight increasing most in the third year and growth slowing after the fifth year. Growth to sexual maturity varies with latitude, water quality and food conditions. Females mature in 3-6 years. Males in the same conditions will usually mature one year later.

Spawning in the Amur river, takes place in the early summer (June-July) with a rapid rise in water levels of at least 20cm and temperatures of 17-19 C. Spawning has been documented in the Russia's Ili river in 1972 and 1973 after a rise in water levels and an increase in turbidity. Water temperatures were at 18.7 C. and 23.5 C. with the peak spawning occurring when temperatures were 19.5-19.9 C. (Poss, 1998). Relative fecundity can be as high as 118.1 eggs/gram of body weight in a 10.5 kg female (approximately 1.24 million eggs) (Lin 1991).

There has been extensive work done in the United States and abroad on sterilizing grass carp. Many methods to eliminate natural reproduction of introduced grass carp have been researched. The most widely accepted method is triploidy. Triploids have larger erythrocytes and nuclei than diploids which make them fairly easy to separate. These fish are functionally sterile. They will not fully develop gonads and are therefore rarely able to spawn with diploids (Poss 1998). The techniques used to induce triploidy are not always effective, therefore the only means to guarantee 100% triploidy is to check every individual (Fuller et.al. 1999).

Feeding Ecology: Three days after hatching, fry are about 7 mm long and the gill rakers number 8-9. Fry feed on rotifers, nauplius of copepods and other zooplankton. At 10-11 mm, the pharyngeal teeth are clawlike, with four bigger and two smaller and embedded in flesh. The intestine is 70-80% of the body length. At 18-24 mm., the gill rakers number 13 and the pharyngeal teeth are formed as in the adult. It feeds additionally on larger water fleas, chironomus, plant fragments and other benthos. By 30-100 mm. the intestine is 180-200% of the body length, and the pharyngeal teeth have developed considerably to cut higher plants, consequently the fish shifts to a more herbivorous diet. At 100 mm or larger, grass carp have 18-19 gill rakers and fully formed pharyngeal teeth, comb-like at the apex, and mutually inserted enabling them to cut and grind grasses with the bony pad of the basioccipital. The intestine is 230-260% of the body length and it feeds chiefly on aquatic vegetation. (Lin 1991)

Ecological Impacts: Grass carp populations in the Mississippi river basin have increased dramatically in size and range since their introduction. They are very effective in controlling aquatic vegetation in many environments, but may be devastating to native fauna. The consequences of stocking are complex and dependant on various aspects of the ecosystem. Grass carp negatively impact invertebrates (e.g. crayfish) and other fishes through interspecific competition and habitat loss and produce significant changes in the composition of macrophyte, phytoplankton and invertebrate communities. They interfere with reproduction, decrease habitat and refugia for other fishes. Grass carp consume vast quantities of vegetation, yet only process about half of what is ingested. The remaining material is expelled, leading to eutrophication through algal blooms and eventually oxygen depletion. Organisms requiring limnetic habitats and food webs based on phytoplankton tend to benefit from the presence of grass carp, however, those requiring a littoral habitats and food chains based on macrophyte and attached algae and invertebrates, will suffer. The removal of vegetation also eliminates food sources, shelter and spawning substrates for native fishes. Research on the effects of grass carp is extensive but, there are numerous contradictory results concerning the interactions of grass carp with other species.(Fuller et. al.1999)

Grass carp, like other Asian carp, are hosts to various parasites and diseases which may be communicable to native fishes. Grass carp are suspected to have been the source of the Asian tape worm, *(Bothriocephalus opsarichthydis)* introduction to the U.S. and the cause of infecting the endangered woundfin *(Plagopterus argentissimus)* by way of the red shiner *(Cyprinella lutrensis)* (Fuller et. al. 1999).

To combat the spread of unwanted grass carp, many states have adopted policies and regulations to control their stocking. Many states no longer permit the import of diploid grass carp, although triploids are allowed. The sterility of triploids has also been questioned. Apparently there is no documentation on the viability of eggs from a triploid female and the milt from tripliod males has been successful in fertilizing diploid eggs (Fuller et. al. 1999). Perhaps this is one reason the states of Alaska, Oregon, Montana, North Dakota, Minnesota, Texas, Wisconsin, Michigan, Massachusetts, Vermont, Maine, Maryland and Rhode Island prohibit the import of all grass carp. This is in contrast to the states of Hawaii, Iowa, Kansas, Missouri, Oklahoma, Arkansas, Mississippi and Alabama who have no restrictions the sterility of grass carp and do not require a permit to stock. The remaining states have varying degrees of restriction. These regulations

usually include the following: the use of verified triploids, for use in public waters only and requiring a permit (Nico and Fuller 1999). There are many undocumented and illegal introductions, which combined with dissimilar state regulations can contribute to natural reproduction. In addition, grass carp have been documented to migrate up to 1700 km (Poss 1998) in a single season, therefore further complicating the efforts of states which ban their import.

References:

Bowman, D. 1998. Monster Fish Caught in Chicago Park Pond, Great Lakes Basin News, Great lakes Basin Publications, Elmhurst IL.

Fuller, P.L., L. G. Nico, and J. D. Williams. 1999. Nonindigenous fishes introduced into inland waters of the United States. American Fisheries Society, Special Publication 27, Bethesda, Maryland. 58-61 pp.

Lin, Z. 1991. Pond fisheries of China. Pearl River Fisheries Institute of the Chinese Academy of Fisheries Sciences. Pergamon Press. Elmsford, New York. 14-17 pp.

Nonindigenous Aquatic Species [www.nfrgc.gov] Gainesville, FL: Leo Nico and Pam Fuller, 1999. [6 July1999] available from Internet: [http://nas.er.usgs.gov/fishes/accounts/cyprinid/ct_idell.html]

Nonindigenous Species in the Gulf of Mexico Ecosystem [www.ims.usm.edu/~musweb/invaders.html] Ocean Springs, MS: Stuart G. Poss, 1998. [16 June 1999] available from Internet: [www.ims.usm.edu/~musweb/nis/Ctenopharyngodon_idella.html]

Pflieger, W. L. 1975. The Fishes of Missouri. Missouri Department of Conservation, Jefferson City. 129pp.

Pflieger, W. L. 1997. The Fishes of Missouri. Missouri Department of Conservation, Jefferson City. 113 pp.

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Biological Summary of Silver Carp*

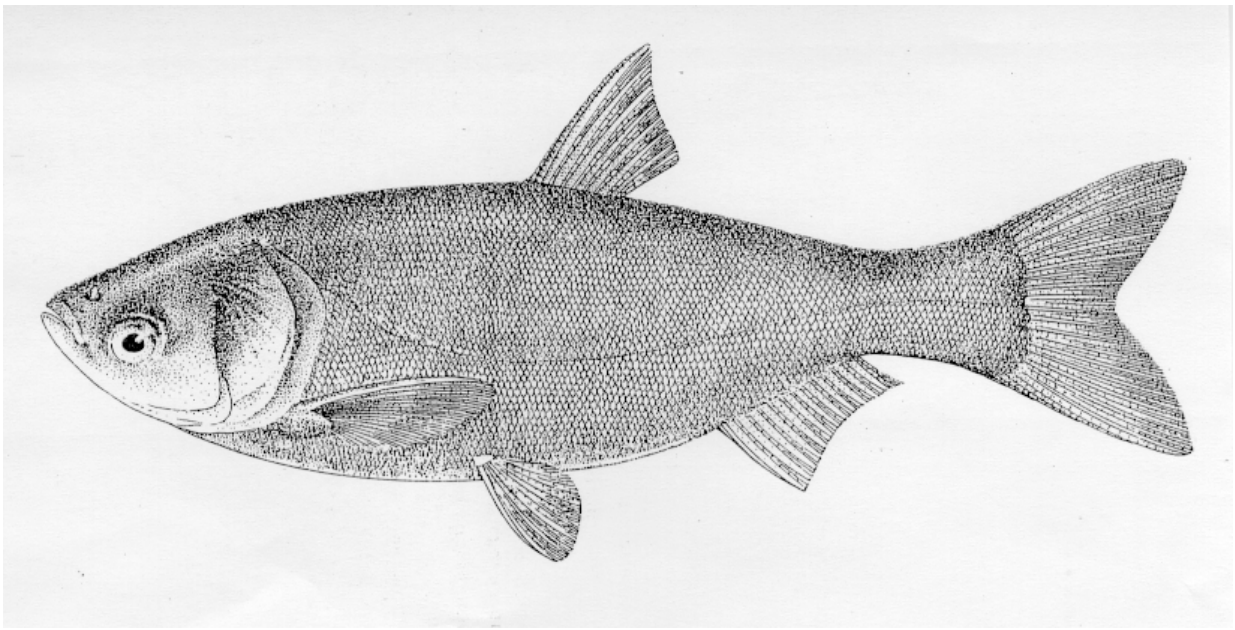


Photo from Lin 1991

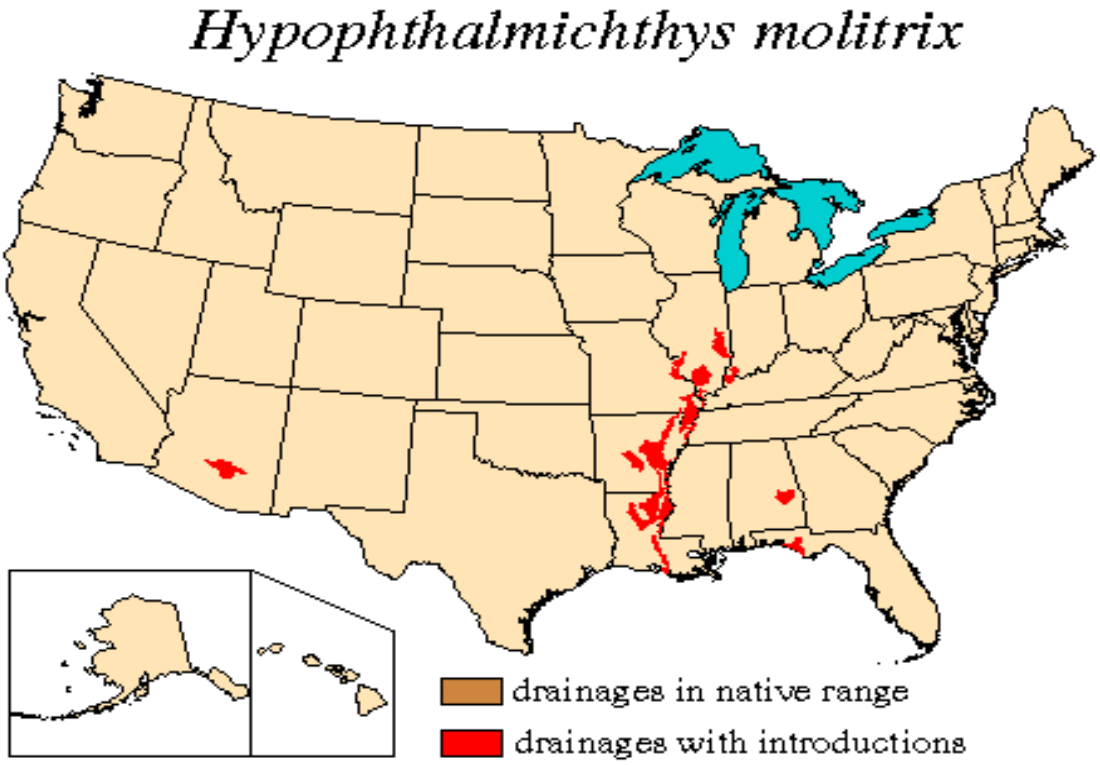
(Hypophthalmichthys molitrix)

Identification: The silver carp is very similar to the bighead carp. It is a large, deep bodied fish reaching a maximum size of about 1 m and 30 kg (Aguirre and Poss 1998) (Lin 1991). Its head is moderately large and broad, encompassing just less that 1/3 of the body size (Pflieger 1997). The mouth is large, sub-superior, toothless with an upturned lower jaw (Lin 1991). The eyes are moderately large and located below the axis of the body. The fish's body is covered with small scales having roughly 83-125 in a complete, decurved lateral line and 26 to 27 scale rows above (Lin 1991) (Pflieger 1997). Fin spines are absent in smaller specimens, whereas, large specimens have a hard stiff pectoral spine with fine serrae on its posterior margin. Dorsal and anal fin spines are less developed and the dorsal fin originates behind the pelvic fin insertion. There are 8 dorsal rays and 12-13 anal rays. The first gill arch of the silver carp is fused into a sieve or sponge-like apparatus with pharyngeal teeth numbering 4-4. The ventral surface is entirely keeled from the vent to the opercular isthmus (Robison and Buchanan). The sides are uniformly silver in color. The head and dorsal surface have slate grey shading with white to a silvery white belly (Pflieger 1997) (Lin 1991).

Distribution: Silver carp are native to several major Pacific drainages in eastern Asia from the Amur River of far eastern Russia and south throughout much of eastern China to the Pearl River, possibly including northern Vietnam (Fuller et.al., 1999). Imported simultaneously with the bighead carp in 1973, silver carp have successfully expanded to much of the Mississippi River basin as well many states outside the basin. These states include: Alabama, Arizona, Arkansas, Colorado, Florida, Illinois, Indiana, Kansas, Kentucky, Louisiana, Missouri and Tennessee. The

first confirmation of natural reproduction occurred in Illinois, 1995 (Pflieger 1997). Silver carp inhabit the upper and middle layers of water. They use large rivers to spawn and to overwinter. Larval fish growth and feeding in preparation for overwintering takes place in lakes and river bays. Currently its distribution seems to be more restricted than that of bighead or grass carp. (fig 1), however, any limitation to their potential range is not yet known.

Figure 1. From Nico and Fuller 1999



Reproduction: Spawning habitats of silver carp are less well known than those described for bighead carp in Lin 1991. Silver carp respond to spawning cues of a sudden rise in water levels and warm water temperatures. The optimal spawning temperature is 22-28 C., however, they will spawn in water ranging18-30 C. (Lin 1991).

Population structure of mature fish varies by river in the native range. Females reach maturity in three to four years with a body size of 70-92 cm and 7-14 kg. Males reach maturity at 66-88 cm and 5-13 kg. Silver carp migrate to spawning habitats and await a sudden rise in water levels. Once a rise occurs and velocity increases, they release eggs and milt. Relative fecundity of native fish has been recorded as 94.5 eggs/gram of body weight in a 6.4 kg female, and increases with body size to 177.7 eggs/gram of body weight in an 11 kg female (approx. 1.9 million eggs). The eggs are non-adhesive, green to slightly yellow in color and are 4-6 mm in diameter after absorption. The eggs are slightly heavier than water and will drift semi-suspended until hatching. Eggs hatch in as little as 18 hours in 29 C. water and as long as 60 hours in 18 C. water (Lin 1991).

Feeding Ecology: Newly hatched fry are 7-9 mm in body length with an intestine 50-60% of the body length and 8-9 gill rakers formed into a cylindrical projection. During this stage, the fry feed on rotifers, nauplius of copepods and other zooplankton. At 4-5 days and 11-13 mm, fry begin to grow saw-toothed, lateral protuberances and the anterior portion of the intestine turns around forming a loop. The fry begin to feed on phytoplankton in addition to zooplankton by 8-12 days post hatch. It's body length is now 18-23 mm and the intestine has formed several loops. The number of gill rakers increases and develops rapidly to form the filtering apparatus. The intestine now comprises 90-110% of the body length. The first gill arch has completely formed into the spongy sieve-like membrane by the time the fish has reached 30mm in length (Lin1991).

Silver carp in Asia are known to grow very rapidly. A yearling fish can weigh up to 1 kg, a two year old fish 2-3 kg and three year old fish 4-5 kg. Adult fish (around 65 cm) have 12-13 gill rakers in every mm of the first gill arch (over 1,700) separated by a space of about 34 microns. The intestine is nearly seven times the length of the fish. Due to the modified gill structure, the fish filters primarily phytoplankton with zooplankton as a secondary food item at a ratio of 248:1. Silver carp feed on organic detritus and associated bacteria as well, indicating they may be as opportunistic as bighead carp.

Ecological Impacts: The silver carp has the potential to negatively impact many native species because it feeds on plankton, the primary food source for mussels, larval and several adult fishes (Fuller et.al., 1999). Silver carp are known to thrive in particular habitats such as lakes which receive backwater flooding (or are otherwise connected to large rivers), river pools, reservoirs and tributary streams, moreover, those habitats that have higher productivity than mainstream rivers. Interspecific competition through feeding between silver carp and endemic fishes in these select habitats appears to be the greatest threat. The large rivers may be threatened as well, knowing that these habitats are used for spawning and possibly displacing native fish. The extent of their potential impact and ultimate distribution in the Mississippi river basin is still largely unknown.

References:

Fuller, P.L., L. G. Nico, and J. D. Williams. 1999. Nonindigenous fishes introduced into inland waters of the United States. American Fisheries Society, Special Publication 27, Bethesda, Maryland. 81 pp.

Lin, Z. 1991. Pond fisheries of China. Pearl River Fisheries Institute of the Chinese Academy of Fisheries Sciences. Pergamon Press. Elmsford, New York. 5-10 pp.

Nonindigenous Aquatic Species [www.nfrgc.gov] Gainesville, FL: Leo Nico and Pam Fuller, 1999. [17 June 1999] available from Internet: [http://nas.er.usgs.gov/fishes/accounts/cyprinid/hy_molit.html]

Nonindigenous Species in the Gulf of Mexico Ecosystem [www.ims.usm.edu/~musweb/invaders.html] Ocean Springs, MS: Windsor Aguirre and Stuart G. Poss, 1998. [16 June 1999] available from Internet: [www.ims.usm.edu/~musweb/nis/Hypophthalmichthys_molitrix.html]

Pflieger, W. L. 1997. The Fishes of Missouri. Missouri Department of Conservation, Jefferson City. 125 pp.

Robison, H. W., and T. M. Buchanan. 1988. Fishes of Arkansas. The University of Arkansas Press. Fayetteville. 534 pp.

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NUISANCE NOTES

Spring, 2000 *Western Update, No. 10*

ASIAN CARP INFORMATION AND MANAGEMENT WORKSHOP APRIL 19-20TH - ST. LOUIS, MO

An Asian Carp Information, Monitoring and Control Workshop will be held on April 19-20, 2000, in St. Louis, MO. The goals of the workshop are; review current information on life history and distribution, review aquaculture uses and environmental impacts, review State and Federal policy and regulations related to exotic fishes and develop and discuss management and control options for reducing natural resources impacts of selected Asian carp species. Holiday Inn Westport (314)434-0100, 1973 Craigshire St. Louis, MO. A block of rooms has been reserved at the rate of $69.00 + Tax. Please make reservations by March 29, 2000. Registration required by April 1, due to limited space and materials. To register contact, Linda Drees at linda_drees@fws.gov or Jim Milligan jim_Milligan@fws.gov

WASHINGTON BALLAST WATER MANAGEMENT AND ANS COORDINATING COMMITTEE LEGISLATION

Washington State introduced two important bills into session this year. The first, Senate Bill 6293, an act relating to ballast water management includes a number of elements which will add value to the national program. These include; Regulation of domestic voyages (except Columbia River and local British Columbia waters);July 2002 treatment requirement for unexchanged ballast water; Placement of ballast water treatment on an equal policy level as open ocean exchange; Use of Coast Guard / IMO report forms; Ballast water monitoring; Development of a mobile pilot treatment system; and Development of ballast water discharge standards. The second bill which was passed in legislative session called for the creation of a state interagency Aquatic Nuisance Species Coordinating Committee. The Committee plans to meet this year. For more information on either bill contact Scott Smith at 360-902-2724.

STATE UPDATE

ALASKA Increased requests from public on ANS issues. State ANS plan being developed in 2000. WRP State Contact Bob Piorowski (907465-6150).

ARIZONA State Invasive Species Workshop held and state plan being developed. State WRP Contact Larry Riley, AGFD (602-789-3258)

CALIFORNIA CALFED has developed draft strategic and implementation plans on invasive species. Both documents are currently under review. Contact Kim Webb CALFED 209-946-6400 X311. State WRP Contact Randy Brown CA Dept of Water Resources (916)227-7531.

COLORADO The Colorado Divisions of Wildlife and Parks and Outdoor Recreation are collaborating to send an informational flyer about zebra mussels to approx. 125,000 registered boaters. The flyer describes z.m. problems and gives information on cleaning boats. State WRP Contact Chuck Loeffler CDOW (303)291-7451).

GUAM The Department of Agriculture and Division of Aquatic and Wildlife Resources has a policy in place banning the import of certain aquatic species, including nuisance species. DAWR also retrieves/accepts nuisance species when requested by the public. WRP Contact Michael W. Kuhlmann (671-734-3942).

HAWAII WZMTF Contact Myron Isherwood, Department of Agriculture Fax (808-973-9613).

IDAHO WZMTF Contact Bill Horton, Idaho Fish and Game Department (208-334-3791).

KANSAS Kansas Wildlife and Parks (KWP) is participating in a Minnesota Sea Grant Program boater education survey. The survey is part of nationwide survey to ascertain level of knowledge of recreational boaters on aquatic nuisance species. State WRP Contact Tom Mosher 316-342-0658.

MONTANA Montana Department of Wildlife and Parks is working with the Department of Agriculture to develop a state wide invasive species management plan. New Zealand Mudsnail monitoring and outreach efforts underway. WZMTF Contact Tim Gallagher, (406-444-2448).

NEBRASKA Great Plains Z.M Workshop hosted by NE Game and Parks Commission held March 8-10 Contact Steve Schainost NGP(402-471-5443).

NEVADA State WRP Contact Jon Sjoberg, NDW (702-486-5127).

NEW MEXICO The New Mexico Dept. of Game and Fish(NMDGF) conducted a statewide cray fish inventory of major perennial drainages. A statewide inventory on conservation status of unionid mussels will be completed 2001. WRP Contact Brian Lang, NMGFD (505-827-4628).

NORTH DAKOTA State WRP Contact Terry Steinwand North Dakota Game and Fish Department (701-328-6313).

OKLAHOMA.The Tulsa District of the ACOE participated in the Grand Lake Association public awareness effort on zebra mussels. Held seminars and conducted tv and radio interview. WZMTF Contact Everett Laney, USACOE (918-669-7411).

OREGON The Board of Higher Education has approved proposal creating the Center for Lakes and Reservoirs. Contact Andrew Schaedel OR Dept. Environment.

SOUTH DAKOTA Z.M. Information packets sent to marina and bait shop owners in southeastern SD by S D Game, Fish and Parks(SDGFP). Inventory of Lake Sharpe to determine extent of Eurasian watermilfoil infestation. WRP Contact Dennis Unkenholz-605-733-6770 SDGFP.

TEXAS TX Parks and Wildlife Dept(TPWD) initiating 1st statewide management strategy. Guide to Identification or Harmful or Potentially Harmful Fishes, Shellfishes and Aquatic Plants Prohibited in Texas published. State WRP Contact Bill Harvey 512-389-4394.

UTAH Utah Invasive Species Work Group is developing a traveling display on invasive species for use at public events. The exotic Daphnid Daphnia lumholtzi identified in Willard reservoir. Contact Randy Radant, Utah Division of Wildlife Resources (801-538-4812). Utah ANS Website **www.nr.state.ut.us/dwr/ans.htm**

WASHINGTON The WA State Highway Patrol began inspecting commercially hauled boats for z.m. at port of entry stations in Nov. 1999. WRP Contact Scott Smith WDFW (360-902-2724).

WYOMING WRP Contact Mike Stone, WGFD (307-777-4559).

PACIFIC STATES MARINE FISHERIES COMMISSION The PSMFC with funding from the Bonneville Power Administration (BPA), is undertaking actions to address the aquatic nuisance species (primarily zebra mussels) threat to the Columbia River Basin. Contact Stephen Phillips PSMFC (503) 650-5400.

TRIBAL CONTACTS

INLAND TRIBES Contact Michael L. Durglo, Jr. (406-675-2700)*

ALASKA NATIVES Contact Adelhe c Hermann, AL Board Member of NAFWS (907-246-8332)*

COASTAL TRIBES Contact Derrick Tobba (360-651-4480)*

Several western tribes are currently involved in exotic weed removal efforts through the Bureau of Indian Affairs. These eradication and control programs include exotic wetland and intertidal weeds on tribal Reservations.

PROVINCIAL CONTACTS

ALBERTA Contact Rob Burland, Alberta Environmental Protection (403-382-4015)

BRITISH COLUMBIA Contact Gary Caine, British Columbia Fisheries (250-897-7545) - Fisheries and Oceans is developing models to predict dispersal of non-indigenous species from ballast water disposed in Juan de Fuca Strait. Experiments are being carried out to determine the effect of a new technology, the Velox Ballast Water Treatment System on mortality of invertebrate larvae.

MANITOBA In the summer and fall of 1999, the Manitoba Purple Loosestrife Project (MPLP) conducted a survey of general knowledge of ANS in Manitoba using modified 100th Meridian survey forms. Approximately 60, 0000 biocontrol agents were released in 1999 against purple loosestrife. Performance monitoring at previous biocontrol release sites indicate close to 100% control from 1-4 years post release. Contact Wendy Rally, Manitoba Environment, (204) 834-8146. Contact Dwight Williamson, Manitoba Dept of the Env. (204-945-7030).

SASKATCHEWAN Contact Rick Sanden, Saskatchewan Department of Environment and Resource Management (306-787-7812).

FEDERAL UPDATE

U.S. FISH & WILDLIFE SERVICE ANS coordinators are available to provide technical assistance to state, federal, and private interests in regard to ANS Region 1 (CA,OR,WA,ID, NE,HI) -Denny Lassey, Portland, OR (503-230-5973), Region 2 (TX,NM,OK,AZ) - Bob Pitman, Albuquerque (505-248-6471), and Region 6 (MT,WY,UT,CO,ND,SD,NE,KS) - Linda Drees, Manhattan, KS(785 539-3474X20). Sharon Gross, Natl ANS Coord, Arlington, VA.703-358-1718

BUREAU OF RECLAMATION The Bureau of Reclamation **WZMTF homepage can be accessed at http:/www.usbr.gov/zebra/wzmtf.html**. The **Western Regional Panel on Aquatic Nuisance Species Page can be accessed at http://www.wrp-ans.org** Contact Tracie Greene (303-445-2205).

NATIONAL BIOLOGICAL SERVICE **Southeastern Biological Science Center** The Center maintains a nonindigneous aquatic species geographic information system and current zebra mussel location maps. World Wide WEB server (**http://www.nfrcg.gov**) or contact Amy Benson (904-378-8181).

SEA GRANT OR and WA Sea Grant Programs produced a fact sheet on Chinese mitten crab, created an interactive ANS classroom game called "Alien Invaders. Contact Paul Heinowitz with OR Sea Grant (503-722-6718) or Nancy Lerner with WA Sea Grant (206-616-8403). The National Sea Grant College Program NY Sea Grant maintains a aquatic nuisance species information clearinghouse and publishes an information review, *Dreissena polymorpha*. Contact Charles O'Neill, Jr. (716-395-2638). MN Sea Grant has created a boat inspection video entitled Stop Exotics, Clean Your Boat Contact Doug Jenson (218-726-8712). CA Sea Grant continues to host series of ballast water education workshops throughout west coast. The first volume of the biannual newsletter "Ballast Exchange" was districuted. Contact Jodi Cassell CA Sea Grant(550-671-7553)

U.S. ARMY CORPS OF ENGINEERS The Corps continued monitoring for zebra mussels at Columbia River Basin projects in 1999. Monitoring at the four lower Columbia River mainstem dams was expanded to include veliger sampling during the summe.r Contact Jim Athern (503-808-3935).The Tulsa District assisted the OK Grand Lake Association with a two day public awareness effort on zebra mussels. Conducted two 1-hour seminars each day and a live 30-minute radio show. Interviews provided on zebra mussels to several newspapers and TV station Spring density count for ZM will be conducted on 13 March when R.S. Kerr lock on the Arkansas is dewatered for maintenance Contact Everett Laney (915-669-7411)

U.S. COAST GUARD The Interim Final Rule implementing NISA's Voluntary National Guidelines was published on May 17, 1999 and took effect on July 1, 1999. Information on the Coast Guard's Ballast Water Program can be found at **www.uscg.mil/hq/g-m/mso4/First.htm** Contact J.Koster 510-437-2956

PUBLICATIONS

1. **ANS Digest** provides information on "many aspects of the aquatic nuisance species problem including, policy and management issues, current research efforts, and descriptions of specific species." Contact *ANS Digest*, Spring Hill Center, 725 County Road Six, Wazata, MN 55391 (612-449-0092)
2. **STOP EXOTICS, Clean Your Boat.** This humorous 11-minute videotape, featuring John Ratzenberger (a.k.a Cliff Clavin from the TV show Cheers), shows the simple steps boaters across the country can take to prevent the spread of invasive aquatic exotic species. With his likable know-it-all style, he teaches watercraft users how to take a couple extra minutes to clean their boat, sailboat, or personal watercraft based on the five basic principles for exotics-free boating. Cost: $10 each; $8 for 10 or more. Minnesota Sea Grant. Contact Doug Jenson (218-726-8712)
3. **Guide to Identification of Harmful or Potentially Harmful Fishes, Shellfishes and Aquatic Plants Prohibited in Texas**(TPWD)contact Bob Howells(TPWD) at 210-866-3356.
4. **The West Coast Ballast Water Outreach Project** can be accessed at **http://ballast-outreach-ucsgep.ucdavis.edu**

MEETINGS

Alaska ANS and Ballast Water Workshop - March 23 & 24th, 2000, Anchorage, AK 0 Contact Laura Zabkar 907-262-9663

Western Aquatic Plant Management Society Meeting - March 28-30th, 2000, Bozeman, MT - Contact Ron Crockett 360-892-9884

Aquatic Nuisance Species Task Force Meeting - April 3-5,2000 Miami, FL. Contact Sharon Gross - 703-358-2025

Asian Carp Information and Management Workshop - April 19-20th, 2000, St. Louis, Missouri, Contact Jim Milligan - 573-876-1911X102

Western Regional Panel on ANS Fall Meeting - Sept. 26-27th, 2000 in Oakland, CA. Linda Drees -785-539-3474X107

FOR MORE INFORMATION OR TO CONTRIBUTE INFORMATION TO "NOTES", CONTACT LINDA DREES,USFWS (785-539-3474X107)

Nuisance Notes is published in the fall and spring. Linda_Drees@fws.gov

TCI Quality Control Program

Seafood Safety Tips

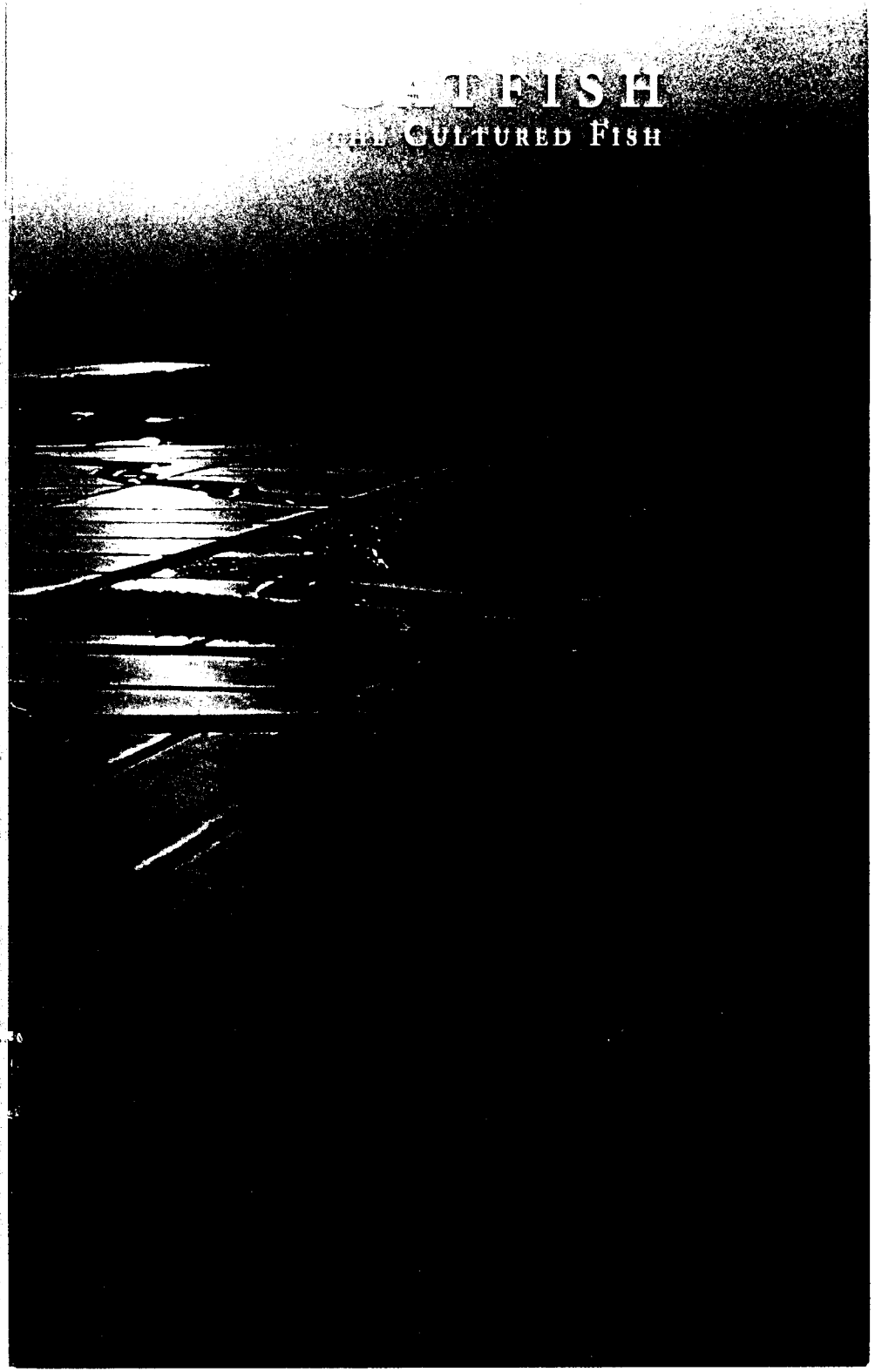
While seafood is a delicious and nutritious meal choice, nothing is more important than making a safe fish purchase. The following tips should help you select the best seafood:

- ✔ Fresh fish has no fishy odor.
- ✔ Fish fillets should be moist with no drying or browning around the edges.
- ✔ Frozen fish packages should be undamaged and the fish should have no freezer-burn, off-color or be covered with ice crystals.
- ✔ Fish should be kept wrapped and stored in the coldest part of the refrigerator.
- ✔ Fresh fish should be used within two days of purchase.
- ✔ Fish is ready to eat when the flesh is opaque and flakes easily.

In 1994, the Food and Drug Administration (FDA) mandated a Hazard Analysis Critical Control Points (HACCP) regulatory system for the seafood industry to prevent food safety problems before they occur. This system, which places responsibility for product safety on individual manufacturers and distributors, was nothing new to the farm-raised catfish industry. For nearly a decade, the industry has been independently executing its own quality control program. In 1987, TCI contracted with the United States Department of Commerce (USDC) to conduct weekly inspections of farm-raised catfish processing plants. Only when the catfish have passed both stringent taste tests at the ponds and the USDC inspections at the processing plants can they carry the "Certified Processors" seal confirming that they have met the highest standards set by TCI.

The Catfish Institute
118 Hayden Street
P.O. Box 247
Belzoni, MS 39038

Photography: Lou Manna

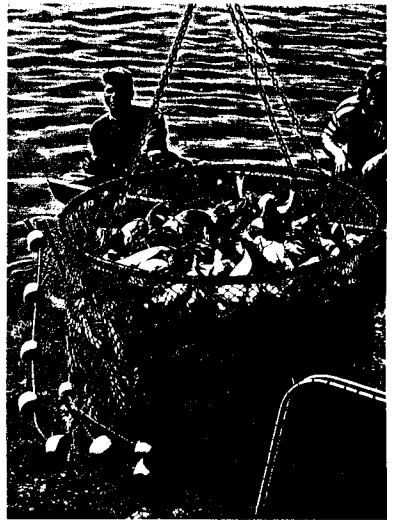


From Fingerlings to Fillets

Producing catfish in nature is a team effort — after the female lays the eggs, the male guards them until they hatch. In order to replicate the natural fanning motion made by the male catfish's tail, farm-raised catfish producers place rotating metal blades in each hatchery bin to provide oxygen to the developing eggs.

Producing great-tasting genuine U.S. farm-raised catfish begins with the selection and mating of mature catfish. Once the eggs are laid and fertilized, they are collected and taken to special hatcheries designed to replicate the natural environment. The eggs hatch after seven days, and the young catfish are called "sac fry" because of the attached yolk sacs which supply their food. As the food sacs are depleted, the catfish begin to swim and are moved to special ponds where they grow into fingerlings. When the fingerlings are about four-to-six inches long (the size of an index finger), they are placed in the catfish ponds.

After 18 months or when the fish reach about one and a half pounds each they are harvested with seines (large weighted nets) and loading baskets, then taken alive to processing plants in aerated tank trucks. Once they reach the plants, the whole production process takes less than 30 minutes, making genuine U.S. farm-raised catfish among the freshest fish available. You can buy farm-raised catfish as whole fish, steaks, fillets, strips and nuggets as well as marinated and pre-breaded or pre-cooked in frozen dinners and entrees. And because farm-raised catfish are harvested year-round and shipped either on ice or individually quick frozen (IQF), they are readily available in grocery stores and fine restaurants nationwide.

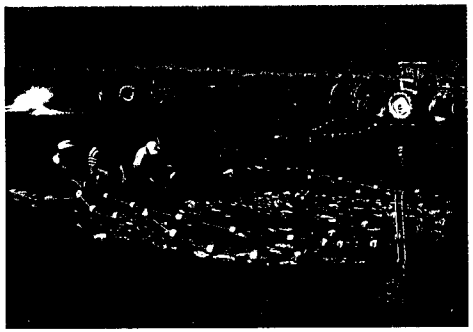


San Francisco chef and restaurateur Elka Gilmore is a big fan of genuine U.S. farm-raised catfish. "As a chef, my first priority is taste. With farm-raised catfish, you can always count on its consistently great flavor."

The Real Beauty Is In The Taste

What's so special about farm-raised catfish? Well for one thing, it has a consistently mild flavor and firm texture that makes it one of the most versatile fish on the market. Enjoy it blackened, steamed or poached, grilled, barbecued, baked or broiled. But farm-raised catfish's appeal goes beyond taste — it is a lean fish and an excellent source of protein. It also offers a quick and delicious meal in a flash (cooking time is approximately 10 minutes per fillet) and there's no fishy odor.

Catfish the Cultured Fish



One of the primary reasons for the farm-raised catfish industry's success is The Catfish Institute (TCI), an association of catfish farmers, processors and feed manufacturers based in Mississippi, Arkansas, Alabama and Louisiana. About 95 percent of the nation's farm-raised catfish is raised in these four states, where catfish ponds cover approximately 140,000 acres. Since 1986, TCI has been changing perceptions of and creating demand for farm-raised catfish. But TCI's contributions to the industry's success go much further than that. TCI was the first in the seafood industry to develop and implement a quality control program — monitored by the United States Department of Commerce — to ensure a consistently high quality product. And now TCI is forging ahead with the exportation of farm-raised catfish into Europe.

Aquaculture. The dictionary calls it the science of raising water-based animals in a controlled environment. The government calls it the fastest growing segment of U.S. agriculture. And consumers call it a great way to produce one of the tastiest and highest-quality fish around: genuine U.S. farm-raised catfish.

The premiere aquaculture success story, catfish is the number one farmed finfish in America. More catfish is produced in the U.S. on a yearly basis than all other farmed-fish combined, and overall production has increased 80 fold since 1970. What's more, consumers are eating more catfish every year, with U.S. per capita consumption doubling since 1985. No longer seafood's poor country cousin, farm-raised catfish has become one of the country's most popular and versatile foods.

Farm-Raised Catfish with Tangy Orange Sauce

Ingredients:

2 lbs. genuine U.S. farm-raised catfish fillets

Sauce:

1/4 cup orange juice
2 tablespoons vegetable oil
2 tablespoons light soy sauce
1/8 teaspoon pepper
1 tablespoon lemon juice
1 clove garlic, minced

Directions:

To make the sauce, combine all sauce ingredients in a bowl. Brush farm-raised catfish fillets with sauce mixture. Place fish on lightly oiled grill (4 inches above hot coals). Grill for 5 minutes, brushing frequently with sauce. Turn and grill for 5 minutes longer or until fish flakes when tested with a fork. Also excellent when broiled. Serves 8.

Farm-Raised Catfish Fingers with Three Sauces

Ingredients:

- cups yellow cornmeal
- teaspoon chili powder
- Salt to taste
- teaspoon oregano
- cups milk
- egg
- Vegetable oil
- genuine U.S. farm-raised catfish fillets

Directions:

In a bowl, combine first four ingredients. Beat together milk and egg. Cut catfish into thick sticks. Dip sticks into milk mixture, then in cornmeal. Heat oil to 350°F. Fry sticks in small batches, drain. Serve immediately with sauces. Serves 8.

Sauce suggestions: fresh or commercially prepared salsa, honey-mustard sauce or herb mayonnaise.

The Difference is in The Details

There's nothing as spectacular as the sight of the 140,000 acres of farm-raised catfish ponds that have made Mississippi, Louisiana, Alabama and Arkansas the largest catfish-producing states in the U.S.

One of the main differences between farm-raised and wild catfish is their living conditions. Farm-raised catfish are raised in a quality-controlled environment of clay-based ponds filled with pure fresh water pumped from underground wells. The rectangular-shaped ponds, averaging 10 to 20 acres each, are built above ground from the rich southern soil by constructing levees, or embankments, that are then filled with four-to-six feet of water.

Another notable distinction between farm-raised and wild catfish is what—and how—they eat. Farm-raised catfish are fed a "gourmet diet" of puffed, high-protein food pellets (a mixture of soybeans, corn, wheat, vitamins and minerals) that give them a mild, almost-sweet taste. And because the food pellets float, farm-raised catfish feed at the top of the water, unlike wild catfish which eat at the bottom.