

AGENCY FOR INTERNATIONAL DEVELOPMENT WASHINGTON, D. C. 20523 BIBLIOGRAPHIC INPUT SHEET	FOR AID USE ONLY <i>Batch #18</i>
---	---

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture	AM00-0000-G435
	B. SECONDARY Fisheries--Arkansas,USA	

2. TITLE AND SUBTITLE
Notes on the propagation of Chinese carps in Arkansas

3. AUTHOR(S)
Lin, S.Y.

4. DOCUMENT DATE 1974	5. NUMBER OF PAGES 8p.	6. ARC NUMBER ARC
--------------------------	---------------------------	----------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Auburn

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)

9. ABSTRACT

10. CONTROL NUMBER PN-RAA-995	11. PRICE OF DOCUMENT
12. DESCRIPTORS Adaptation Arkansas, USA Carp Chinese carp?	13. PROJECT NUMBER
	14. CONTRACT NUMBER CSD-2780 211(d)
	15. TYPE OF DOCUMENT

NOTES ON THE PROPAGATION OF CHINESE CARPS
IN ARKANSAS

By S. Y. Lin
Fish Culturist

I was invited to serve as consultant in the work of artificial propagation of Chinese carps - well known in China as domestic fishes - in the hatchery of J.M. Malone and Son Enterprises, Lonoke, Arkansas. The purpose of such propagation which involves four species, namely, the grass carp or white amur (Ctenopharyngodon idella), the silver carp or silver amur (Hypophthalmichthys molitrix), the bighead (Aristichthys nobilis) and the black carp (Mylopharyngodon piceus), is to provide abundant fingerlings for use in weed control in ponds, lakes and canals where fishes are raised for sport and water utilized for hydroelectric power and irrigation and also for use in a proposed project of sewer pollution control.

Grass carp was introduced into the United States in 1965 or earlier, but the silver carp, the bighead and the black carp were introduced by J.M. Malone and Son Enterprises for the first time in 1973 from Taiwan, China. These three species, under special agreement with the Fish and Game Commission of Arkansas State, were transferred to the State Hatchery in Lonoke in February, 1974 for further cultivation and propagation under the direction of Bill Bailey, Fisheries Biologist of the Fish and Game Commission.

The development of the sewer pollution biological control project by utilizing the pure plankton feeding fishes - the silver carp and the bighead - will become an important measure for environment improvement. It is hoped that the Environment Protection Agency of Federal Government and the environment authority of the State Governments would approve the project.

I arrived at Lonoke May 19 and continued to stay until June 8, 1974. During these three weeks I participated the activities of induced spawning, hatching of eggs and rearing of fry, all of which turned out to be a great success. The observations I made of the work are briefly described

as follows in the hope that they may serve as useful reference for the future management of the sewer pollution control project.

THE MALONE HATCHERY

This hatchery was originally built for minnow holding before being sent to market, but coincidentally it is remarkably fit for artificial propagation of the Chinese carps. There are two series of concrete troughs, one series consisting of eight troughs each measuring 19' X 5' X 18" and the other series of 12 each 16' X 4.5' X 18". An electrical pump is provided to obtain underground water at about 150 feet at a rate of about 400 gallons per minute for use in the hatchery. This water, rich in calcium, carbon dioxide and iron and after being adequately filtered and aerated to reduce the iron content to the minimum, is pure and free from contaminations especially with respect to disease carrying agents, insects and other kinds of predators. It has a pH value of about 7 and a temperature of 18°C which prove to be an excellent quality for hatchery work. A heater is installed to raise the water to a temperature of 22 to 23°C which is suitable for holding the spawners comfortably in the troughs, for hatching the eggs and for ^{rearing} the larvae and the fry. Standard hatching jars and aquariums 2' X 1' X 16" were used to hatch the eggs of the Chinese carps. After the eggs were hatched the larvae were transferred to a specially designed fine-mesh nylon box 7' x 4.5' X 12" suspended in a concrete trough to a depth of 11 inches.

The Malone Farm owns 800 acres of land most of which is devoted to rice cultivation. There are, however, ponds of 58, 35, 5 and 3.5 and several one and two acres solely reserved for the culture of grass carp spawners and fingerlings.

THE ARKANSAS STATE HATCHERY IN LONOKE

The essential features of the establishment of this State Hatchery is similar to the one of J.M. Malone and Son Enterprises, which functions also very satisfactorily.

METHODS AND PROCEDURE OF INDUCED SPAWNING

The method employed here for the induced spawning of the grass carp was developed in 1970 by Bill Bailey and was employed ever since in the last four or five years with great success. By following this method and procedure the Arkansas State Hatchery and the hatchery of J.M. Malone never failed in spawning their grass carp with hormone injection.

During my stay in Lonoke six female grass carp were injected with hormone to spawn and all resulted in perfect ovulation. With only one exception that due to somehow missjudged delay in stripping, the eggs had been free and become deteriorated for 2-3 hours in the ovaries and after ovulation most of them were not fertilized, all the females that ovulated at the precise moment produced viable eggs which were well fertilized and hatched at satisfactory rates. It was estimated that over six million eggs produced by the five females would possibly give rise to some 3 or 4 million fingerlings of 3 inches long in two or three months after hatching.

All the females weighing 20 to 25 lbs and the males 15 to 22 lbs were in excellent conditions when caught from the ponds and held in the troughs for more than two weeks, particularly the two females of Malone Farm exhibiting soft distended belly which indicated well developed eggs in the ovaries. The time chosen for carrying out the induced spawning extended from May 16 to June 7, 1974. This is considered appropriate for the propagation of the grass carp because the period corresponds to the natural spawning season that extends from the middle of May to the middle of June in a climate like Arkansas.

As a standard technique the first intramuscular injection was given at 9 or 10 p.m. with only chorionic gonadotropin 100 U.S.P. per lb of the fish dissolved in 2 cc of bacteriostatic water. Twenty four hours later about 9 or 10 p.m. in the next evening a second intramuscular injection with 850 U.S.P. of gonadotropin per lb of fish was again made. In the third evening at 9 or 10 p.m. a final injection with 1 mg/lb of dried carp pituitary gland powder dissolved in 2 cc of bacteriostatic water was given peritoneally by inserting the needle immediately behind the ventral fin. Immediately following this treatment given to the female a male was injected with 0.5 mg/lb of pituitary powder dissolved in 2 cc of bacteriostatic water. In the next morning at 6 a.m., that is about

8 hours after the third injection, the female was examined for any sharp change around the belly especially the part between the ventral fins and the anus. If the belly become conspicuously distended and soft, it indicates that the eggs have been turned loose and are ready to flow out with the application of some pressure to the belly. This usually does not happen until about 8:30 a.m. or 10 to 11 hours after the third injection in a water temperature 21-22°C. When it was ascertained that the female was ready to spawn within 30 minutes the water of the trough (16' x 4.5' X 16") that held the female and the males was lowered to about 8 inches in depth, and then 25 cc of quinaldine were dissolved in the water to tranquilize the fish. After about half hour when the male and female spawners became sluggish in movement and were unable to react to handlings, the female was taken out for stripping; the eggs should flow out from the ovaries smoothly and completely into a plastic basin where they were fertilized with milt from one or two males.

The various treatments given to the females of the grass carp and their results were summarized in the attached table.

As the same method used for artificial spawning of the grass carp could not be equally well applied to the silver carp and bighead, some techniques that were usually employed in China were modified to suit local conditions and adopted with success in Lonoke as shown in the same table.

The black carp weighing 6 to 10 lbs each were not yet fully mature for spawning this year.

There are several factors that contribute to the success of induced spawning of the grass carp. The first to be noticed is the availability of healthy and fully mature male and female spawners and the second is the practice of fractional administration of chorionic gonadotropin in intervals of 24 hours thus to provide time for preparing and stimulating the gonads to full maturity. After such stimulation the pituitary hormone evidently can accelerate the separation of the eggs and help absorb water into the ovaries to loose the eggs for ovulation. Once the eggs become completely free in the ovaries, ovulation should be made by stripping within 20 or 30 minutes. If stripping were delayed the

free ova would deteriorate very rapidly as shown in the third female which was stripped 2-3 hours too late and as a consequence only 5% of the eggs were fertilized although ovulation was complete. Thus the experience and being aware of the critical time for ovulation constitute the third condition for any successful artificial spawning of the grass carp. The fourth condition should be the constant temperature created to hold the spawners, to hatch the eggs and to rear the fry and it has been found that 22° to 24°C is most suitable for this work. Other factors such as the provision of adequate holding troughs for the spawners, injecting facilities including high quality of hormones, hatching equipment, larvae and fry rearing boxes, feeds and feeding are all indispensable in this type of fish fry industry.

As the Yangtze River regions of China have climatical conditions quite similar to Arkansas, where the spawning season of the grass carp, silver carp, bighead and black carp extends from May to July, it may be of interest to try out some of the commonly practiced methods in China:

- (1) For silver carp, bighead and grass carp one injection with 3 mg/kg of dried pituitary to have ovulation after 16-18 hours at 20-21°C and 14-16 hours at 22-23°C.
- (2) For silver carp one injection with 800 i.u. /kg of gonadotropin to achieve ovulation after 20 hours at 22°C and 18 hours at 24°C.
- (3) For grass carp and black carp 0.1 -0.5 mg/kg of dried pituitary and 100-120 i.u./kg of gonadotropin for the 1st injection and 2-4 mg/kg of dried pituitary plus 700-1000 i.u./kg of gonadotropin for the second injection. The interval is 12 hours at water temperature 22 - 23°C. Ovulation is expected 8 to 12 hours after the second shot.

HATCHING THE EGGS

At 22-23°C the eggs took 28-32 hours to complete hatching. The standard hatching jar and aquariums are adequate facilities. However an automatic system should be devised to collect the larvae and fry from the aquariums instead of siphoning.

REARING OF THE FRY

At the evening of the third day after hatching the larvae had

lost most of the yolk sac and would begin to feed. At this time nanoplankton should be made available to them. In the fourth day after hatching the fry now swimming horizontally would search vigorously for food. Plankton, especially zooplankton-rich-water from ponds or culture of plankton from concrete troughs with fertilizers and organic matter under plenty of sun light, should be brought in to feed the young fry; hard boiled egg yolks and purina feedstuff may be used as supplementary, but natural food should constitute at ^{least} 50% of the fry's diet in order to maintain their normal growth.

REFERENCES

- Bailey, William M. and Randy L. Boyd, 1970. A Preliminary Report on Spawning and Rearing of Grass Carp (Ctenopharyngodon idella) in Arkansas. Proc. 24th Annual Conference Southeastern Assoc. of Game and Fish Commissioners, pp. 560.
- Liu, S.Y., 1965. Induced Spawning of Chinese Carps by Pituitary Injection in Taiwan (A Survey of Technique and Application). JCRR Fisheries Series No. 5, 31 pages. Taipei, Taiwan, China.
- Yangtze Fisheries Institute, 1973. Techniques of Artificial Propagation of Chinese Domestic Fishes. Agriculture Press, Peking. 112 pages.

Results of Induced Spawning of Grass Carp, Silver
Carp and Bighead in Arkansas, May 16 to June 8, 1974

Species	Grass		carp				
Spawner (female)	1st	2nd	3rd	4th	5th	6th	7th
Station	S.H.	M.F.	M.F.	M.F.	M.F.	M.F.	S.H.
Wt.(lbs)	25	25	20	25	20	20	22
Water T ^o C	22	23	23	22	22	22	22
1st Injection							
Hormones	CHG	H	CHG	CHG	CHG	CHG	CHG
Dosage	100 USP per lb	20 mg CHG 2500 USP	100 USP per lb	100 USP per lb	100 USP per lb	100 USP per lb	100 USP per lb
Date	5/17/74	5/26	5/26	5/29	5/31	6/4	6/4
Time(hours)	22	6	22	22	22	21	22
2nd Injection							
Hormones	CHG	H	CHG	CHG	CHG	CHG	CHG
Dosage	850 USP	24 mg CHG 7500 USP	850 USP	850 USP	850 USP	850 USP	850 USP
Date	5/18	5/26	5/27	5/30	6/1	6/5	6/5
Time(hours)	22	12	22	22	22	21	22
3rd Injection							
Hormones	H	---	H	H	H	H	H
Dosage	1 mg/lb	---	1 mg/lb	1 mg/lb	1 mg/lb	1 mg/lb	1 mg/lb
Date	5/19	---	5/28	5/31	6/2	6/6	6/6
Time(hours)	22	---	22	22	22	21	22
Ovulation							
Date	5/20	5/26	5/29	6/1	6/3	6/7	6/7
Time(hours)	11	18-20	10:30	11	10:30	7	10:30
Degree of success	complete	few eggs	complete	complete	complete	complete	complete
Quantity (million)	1.2		1.5	1.5	1.5	1.2	1
Fertilization	Fair	nil	poor	good	excellent	good	good
Hatching (%)	50	nil	5	70	95	60	60
Cause of failure	late ovulation	H over-dosed, short interval injection	late ovulation				

Abbreviations: S.H., Arkansas State Hatchery; M. F., Malone Farm Hatchery; CHG, Chorionic gonadotropin; H., dried carp pituitary powder

Results of Induced Spawning (Continued)

Species	Silver carp		Bighead
Spawner (female)	1st	2nd	1st
Station	S.H.	S.H.	S.H.
Wt.(lbs)	12	12	15
Water T ^o C	22	22	22
1st Injection			
Hormones	CHG	CHG	CHG
Dosage	100 USP/lb	200 USP plus H 3 mg/kg	200 USP plus H 1.5 mg/kg
Date	5/31	6/3	6/4
Time(hours)	22	6	6
2nd Injection			
Hormones	CHG	CHG	CHG
Dosage	1800 USP/kg	200USP plus H 3mg/kg	200 USP plus H 2 mg/kg
Date	6/1	6/3	6/4
Ovulation			
Date	6/2	6/3	6/4
Time(hours)	6	20	20
Degree of success	complete	complete	complete
Quantity (thousand)	400	500	500
Fertilization	Good	good	good
Hatching(%)	70	95	90

Abbreviations: S.H., Arkansas State Hatchery; CHG, Chorionic gonadotropin; H., dried carp pituitary powder