COAXING FISH TO BREED

DRUG–HORMONE KIT READY FOR COMMERCIALIZATION

The article on page 4 describes efforts to provide artisanal aquaculturalists in the Third World with better strains of fish. Such genetic improvement requires "closed" gene pools — ones that aren't constantly being altered by the addition of fish from wild stocks. If fish farmers are to rely on the new strains, then government and private hatcheries must be able to supply them regularly with young fish at a low cost. The article below describes a new technology that will help to ensure such supplies.

GERRY PORTER

A fish breeding kit developed by Canadian and Chinese researchers that will make aquaculture less expensive and more efficient is ready for commercialization.

The kit is based on research by Dr Richard Peter of the University of Alberta and Prof. Lin Haoren of Zhongshan University of Guangzhou (formerly Canton), China. It uses drugs and synthetic hormones to solve an age-old problem of fish farmers — the reluctance of fish to breed in captivity.

"In aquaculture where fish are raised generally at quite high densities," explains Dr Peter, "they don't have the proper environmental cues for reproduction to occur naturally."

The scope of the problem can be seen in the Chinese example. With a 3000-year history of aquaculture, Chinese fish farmers cultivate more than 10 million hectares of ponds, rivers, and paddies. In 1984, they produced about 185 million tonnes of freshwater fish. In Guangzhou province, cultured carp are the main source of animal protein.

A perennial problem had been the time-consuming process of collecting enough fry and fingerlings from rivers, streams, and lakes to stock the ponds. But since 1958 the Chinese have induced spawning by injecting the mature fish with either the hormone HCG (human chrorionic gonadotropin) — found in the urine of pregnant women — or extracts from the pituitary glands of carp. These materials, however, have poor shelf lives and are difficult to obtain. At a single large hatchery in China, as many as 80 000 carp are killed annually to provide extracts for brood stock spawning.

"That is a lot of people involved in the whole production and a lot of fish they have to sacrifice," says Dr Peter.

Canadian researchers, including Dr Peter, traced the hormone back to the brain. They determined that a hormone produced there, leuteinizing hormone-releasing hormone (LHRH), induces the pituitary gland to produce another hormone, gonadotropin, which in turn stimulates the sex organs of male and female fish.

Dr Peter was working at trying to induce ovulation in goldfish, close relatives of carp, by using synthetic "analogues" or modified LHRH. But he wasn't successful using the analogue alone.

"The significant breakthrough was the work by a graduate student in my lab," says Dr Peter. The student discovered that another brain chemical, dopamine, was inhibiting the release of gonadotropin. From that basic idea, Dr Peter and his researchers explored a whole range of drugs to determine which acted best as a "dopamine antagonist".

"When we found that out, we went back to trying to induce ovulation in goldfish first of all, and found that it worked very nicely."

Prof. Lin Haoren met Dr Peter in 1979 and spent 1980 and 1981 working in Dr Peter's lab on regulation of gonadotropin secretion. It was after Prof. Lin returned to China that the dopamine connection was discovered.

With support from IDRC, Dr Peter and Prof. Lin initiated a three-year cooperative project in 1984 to test the method on Chinese carp. "It became very realistic then to apply this system to various Chinese carp to confirm that this inhibitory dopamine system existed in a wider range of species," said Dr Peter. Back in his own lab, Prof. Lin "did some nice basic work to demonstrate this."

Prof. Lin tested grass carp, common carp, mud carp, loach, and bream. Results showed that injections of LHRH analogue alone increased levels of gonadotropin in the blood, but were relatively ineffective in inducing ovulation. But injections of LHRH analogue *and* the dopamine antagonist, a drug called pimozide, at the same time resulted in a higher rate of ovulation.

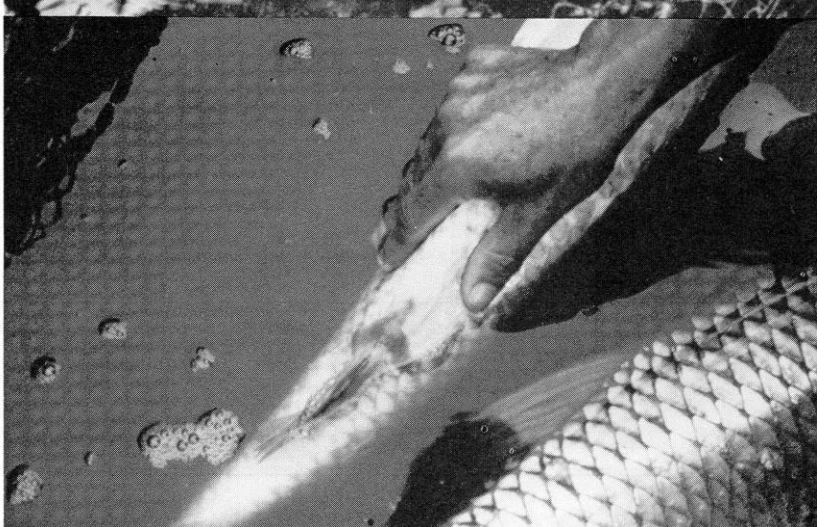
"We've taken the research to the point where we've demonstrated the different dosages you have to use for the drug," said Dr Peter. "Lin Haoren has set up field trials in fish hatcheries. That's very important because in addition to demonstrating that you can do this with large numbers of fish, having the cooperation from fish hatcheries really is the key to acceptance of the procedure. The fish farmers don't want to risk losses of their brood stock."

The kit will consist of a vial of LHRH analogue, a vial of dopamine antagonist, and saline solution, along with the syringes necessary for giving the two injections in rapid succession.

"I think this new method will greatly simplify the whole procedure," says Dr Peter. "The compounds are very stable and very predict-

Top to bottom: Zhongshan University technician in Guanzhou, China, holds specimen of one of several species of carp whose reproductive cycles have been brought under control; student working on project shows vial of hormone solution ready for use; hormone is injected into carp; eggs are squeezed from a grass carp 10 hours after injection.

Photos: Andrew McNaughton / IDRC



able. So it will change a lot of the work habits on fish farms." He adds that it is important "to market the kit at an affordable price."

A major advantage of the method is that the brood stock need only be handled once to inject them with the two substances. With other techniques, two handlings are required, increasing the risk of damage to the fish or disease.

For many fish farmers, low cost and convenience will be the main attraction of the method. "A lot of fish farms in China and elsewhere don't have the luxury of having other farms to raise carp to kill to make a pituitary extract. They have to buy it," says Dr Peter.

"We have tested this thing out on African catfish which is becoming more popular in China. The technique has actually been used in commercial production of catfish fry in Europe. It's being used for carp fry production in Poland, and it's been tried on the loach which is becoming commercially important in China. And I'm getting calls from U.S. breeders of aquarium fish."

The system, he says, will be particularly valuable in the tropics, where fish grow fast because of the warm waters and where millions of people are in need of protein-rich foods of high quality. ■

Gerry Porter is a Canadian freelance writer based in St. John's, Newfoundland.