

## **Genetically Engineered Fish Under Development**

### **Fish engineered with Insect genes:**

A genetically engineered Striped Bass is being developed in the US with insect genes. The experiments are still in early stages, but researchers hope the fish will have greater disease resistance. What long term effect disease resistant farmed fish would have when they get into the natural fish population is completely unknown but one guess is that they will further out-compete the natural population. The scenario whereby the fish may carry disease whilst being disease resistant is just one of the concerns that would have to be addressed.

### **Fish engineered with Human genes:**

In China and the United States, experiments using human growth hormone genes in carp are being conducted. Carp genetically engineered with genes from humans and other species of fish have shown 150% growth. They have also tolerance of low oxygen levels. Tolerance of low oxygen levels may permit genetically engineered fish to survive in rivers too polluted for normal fish.

Similar experiments are taking place in India, where Human Growth Hormone genes are being inserted into the Indian Major Carp for increased growth. Fish engineered with growth hormones often develop deformities in the head and jaw as a result of unnaturally fast tissue growth. As a result, fish genetically engineered with growth hormones are often unable to swim or feed properly. Many individuals and religious organisations are likely to have ethical concerns about the use of human genes in fish.

### **Fish species being tested worldwide, as quoted in various scientific papers and media reports:**

20 species are listed below. This list has been compiled thanks to various scientific papers and media reports.

- Abalone
- Catfish
- Arctic Char
- Common Carp
- Indian Major Carps
- Flounder
- Goldfish
- Halibut
- Loach
- Lobster
- Japanese Medaka (this was the type used in the Trojan gene experimental model)
- Atlantic Salmon
- Pacific Salmon such as Chinook and Coho
- Shrimp
- Striped Bass
- Tilapia
- Turbot
- Cutthroat Trout
- Rainbow Trout
- Zebra fish

**Some GE fish (or aquatic GMOs or transgenic species) being tested for use in aquaculture:**

(From the report - GENETICALLY MODIFIED ORGANISMS AND FISHERIES, by - Jacques Diouf, FAO Director-General 7 March 2000)

Species	Foreign gene	Desired effect and comments	Country
Atlantic salmon	AFP AFP salmon GH	Cold tolerance Increased growth and feed efficiency	United States, Canada United States, Canada
Coho salmon	Chinook salmon GH + AFP	After 1 year, 10- to 30-fold growth increase	Canada
Chinook salmon	AFP salmon GH	Increased growth and feed efficiency	New Zealand
Rainbow trout	AFP salmon GH	Increased growth and feed efficiency	United States, Canada
Cutthroat trout	Chinook salmon GH + AFP	Increased growth	Canada
Tilapia	AFP salmon GH	Increased growth and feed efficiency; stable inheritance	Canada, United Kingdom
Tilapia	Tilapia GH	Increased growth and stable inheritance	Cuba
Tilapia	Modified tilapia insulin-producing gene	Production of human insulin for diabetics	Canada
Salmon	Rainbow trout lysosome gene and flounder pleurocidin gene	Disease resistance, still in development	United States, Canada
Striped bass	Insect genes	Disease resistance, still in early stages of research	United States
Mud loach	Mud loach GH + mud loach and mouse promoter genes	Increased growth and feed efficiency; 2- to 30-fold increase in growth; inheritable transgene	China, Korea, Rep.
Channel catfish	GH	33% growth improvement in culture conditions	United States
Common carp	Salmon and human GH	150% growth improvement in culture conditions; improved disease resistance; tolerance of low oxygen level	China, United States
Indian Major carps	Human GH	Increased growth	India
Goldfish	GH AFP	Increased growth	China

Abalone	Coho salmon GH + various promoters	Increased growth	United States
Oysters	Coho salmon GH + various promoters	Increased growth	United States
<b>FISH TO OTHER LIFE FORMS</b>			
Rabbit	Salmon calcitonin-producing gene	Calcitonin production to control calcium loss from bones	United Kingdom
Strawberry and potatoes	AFP	Increased cold tolerance	United Kingdom, Canada

Note: The development of transgenic organisms requires the insertion of the gene of interest and a promoter, which is the switch that controls expression of the gene.

AFP = anti-freeze protein gene (Arctic flatfish).

GH = growth hormone gene.