Blue Revolution

Introduction

- since 1950, there has been a 100 percent increase in demand of fish
- world consumption of aquatic proteins is predicted to rise to 155 million tons
- however, traditional fisheries can only provide up to 100 million tons
- actions must be done to meet up with the demand

Definition

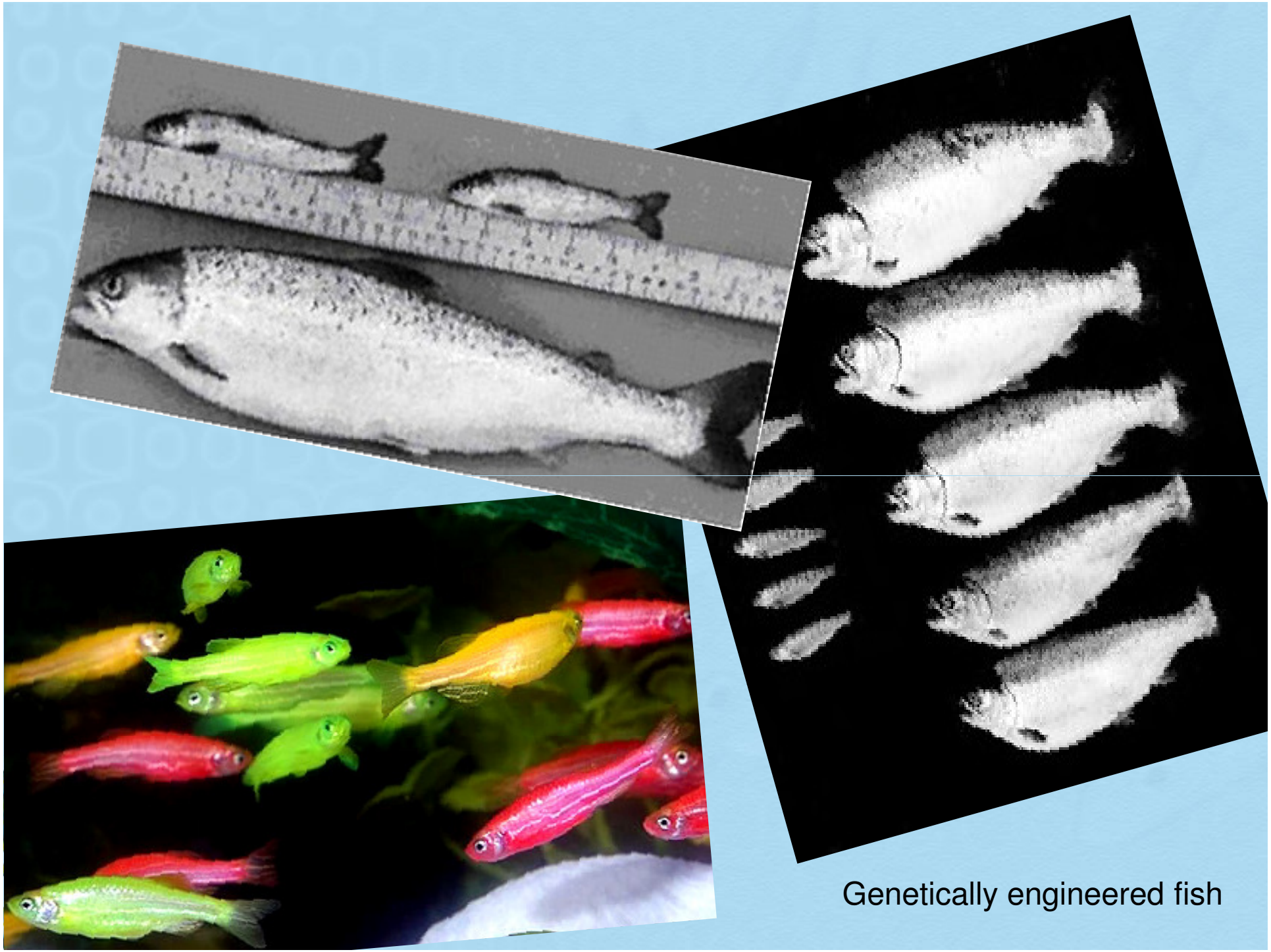
- the water equivalent of the green revolution
- Overfishing leading to worldwide decrease in wild stocks
- movement aimed at increasing drastically the global food production using aquaculture
- Aquaculture: refers to all forms of active culturing of aquatic animals and plants, occurring in marine, brackish or freshwaters to increase the production of food above the level that would be produced naturally

Introduction

- an attempt to protect marine life and to ensure sufficient seafood for the present and future generation
- Removal of unwanted plants and animals
- Improvement of these species by crossbreeding and selection
- Increase of nutrient availability by the use of fertilizers and feeds
- Integrated fish farming (fish farming combined with agriculture, animal husbandry and irrigation) leading to higher production and net profit

- usage of fish hatcheries to supply farms and enhance livestock – a more “traditional method”
- the world has now advance into the second stage of the revolution
  - genetic engineering
  - Splicing genes from one fish species to another


fish farming (hatchery)



Genetically engineered fish

- medicine and vaccines are used to improve the health and nutrition of the fish
- developed ways to increase/improve:
  - Fertility of fish
  - Growth rate
  - Resistance to diseases

Case study - Singapore

- Singapore has developed its very own super sea bass
- hatched in the research tanks of the Agri-Food and Veterinary Authority's (AVA) Marine Aquaculture Centre (MAC) on St John's Island
- Improved sea bass are / have:
  - a survival rate of up to 80 per cent
  - twice as hardy
  - able to grow up to 15 per cent faster, reaching market size (about 500g) in under six months

Taken from the Straits Times, Oct 05, 2007

Fish Farming

- freshwater fish are most commonly cultivated in North America and Europe
- Most commonly cultivated fish:
  - Trout
  - Catfish
  - Carp

- fish grown under brackish-water conditions are much lesser
- located in Northern Europe, America and New Zealand
- commonly cultivated fish include:
  - Trout
  - Salmon

Fish Farming

- various species of fish are grown in agriculture, using a variety of cultivation systems
  - Confinement in artificial ponds
  - In cages set into larger bodies of water (e.g. sea)
- fish are fed with a nutritious diet to maximize growth rate
- carefully harvested and processed when fish become mature

fish farming in cages

Benefits

- anticipated that the world would not have to face shortage of fish supplies in the next 3 decades
- access to a large production of nutritious, high-quality foods
- Populations of fish can be very productive (fish are cold-blooded; they divert little energy to maintain their body temperature, hence a large proportion of their food can be converted into their growing biomass)
- High quality animal protein for human consumption

- Fish produced in pond can be controlled, selected species can be raised
- Effective Land use (Land that is too poor or too costly can be suitably prepared)

Concerns raised

- habitat destruction (e.g. mangroves) and water diversions that disrupt aquatic ecosystem
- waste water from the pond pollutes the sea
- salt water from the fish farms may seep into the ground, causing an increased salinity which damages water supply and surrounding agriculture land

algae on Carter's Beach originated from activities at the fish farm nearby


Close up view

- many farmers have been displaced from their lands to make way for aquaculture
- flow of salt water to the rice-fields reduces farm output
- fishermen's catch is greatly reduced
- rural households located near the fish farms face severe water problems


nearby salmon infested with lice
due to fish farming

Case Study - Bangladesh

- thousands of farmers have suffered from the invasion of their farms by aquaculture owners
- destruction or damage to their rice crops by seepage of salt water from the shrimp ponds
- shrimp owners have been buying up the farms very cheaply, rendering them landless

- estimation of 300,000 people being displaced from their farmlands by aquaculture in the Stakhira region alone
- disputes between farmers and aquaculture owners have led to violent clashes, with the death of at least two villagers to date.
  - Jaber Ali, was killed by a bomb attack arranged by shrimp farm owners.

Case Study - Malaysia

- several thousand fishermen suffered huge decline in catching fish due to:
  - Clearing of mangroves
  - River pollution caused by aquaculture ponds

- Rice Fish Culture:
- Phillipines, Japan, Indonesia (traditional rice farming methods have been refined over centuries). Addition of fish culture to rice production is an additional management consideration for farmers.
- Additional food and income
- Control of molluscs and insects which are harmful to rice
- Reduced risk of crop failure
- Continued flooding of the paddy and rooting activity of fish help control the weeds.
- Fish stir up soil nutrients making them available for rice.

Disadvantages

- Pesticide use must be restricted
- Require more water
- Fish produced in the system often too small and total production is lower than what could be produced in a pond of equal rice
- Rice production is seasonal, fish harvested at the same time makes marketing a difficult job.

Future of Fish Farming

- Biotechnology to Aquaculture

a) Transgenics: introduce desirable genetic traits into the fish to make hardier stock. Fish that are larger, grow faster, more efficient in converting their feed into muscle, resistant to disease, tolerant to low oxygen levels in water, tolerant to freezing temperature. Some species of fish make a protein that allows itself to survive in the Arctics. This ‘antifreeze’ gene has been transplanted into other species of fish so that they can also survive in very cold waters.

- Growing fish that are longer and heavier- various types of growth hormones to fish (dip the fish in solution containing the hormone), but transgenic fish naturally produce the right amount of growth hormone to speed the growth, cost effective and pass on this trait to generation.

Technical and Environmental Concerns of Fish Farming

- Fish Meal (by product of fish processing is used because of its high quality and protein content, common protein source for many fish diets)
- Disadavantages:

a) It is expensive, any cheaper alternative protein source would be welcome

b) Byproducts of wild fish, wild stock are declining, at the same time fish farming is on the rise, demand for a fish meal is ever increasing.

c) Use of fish meal in aquaculture cause other problems: level of P far beyond

The optimal growth in fish. Excess P goes into water causing problems such as eutrophication or excess algae growth.

d) Alternative plant based protein has the potential to address the problem of P in pollution, since plants do not contain high levels of P. Use of plant based protein (biotechnology) could take off the pressure from wild fish stocks.

e) Some potential fish meal replacements like distillers, byproducts, pulse crops, canola, wheat are already being used to some extent in feed for aquaculture.