Chief cause for change of fish phenotypic traits:

Fishing gear selectivity

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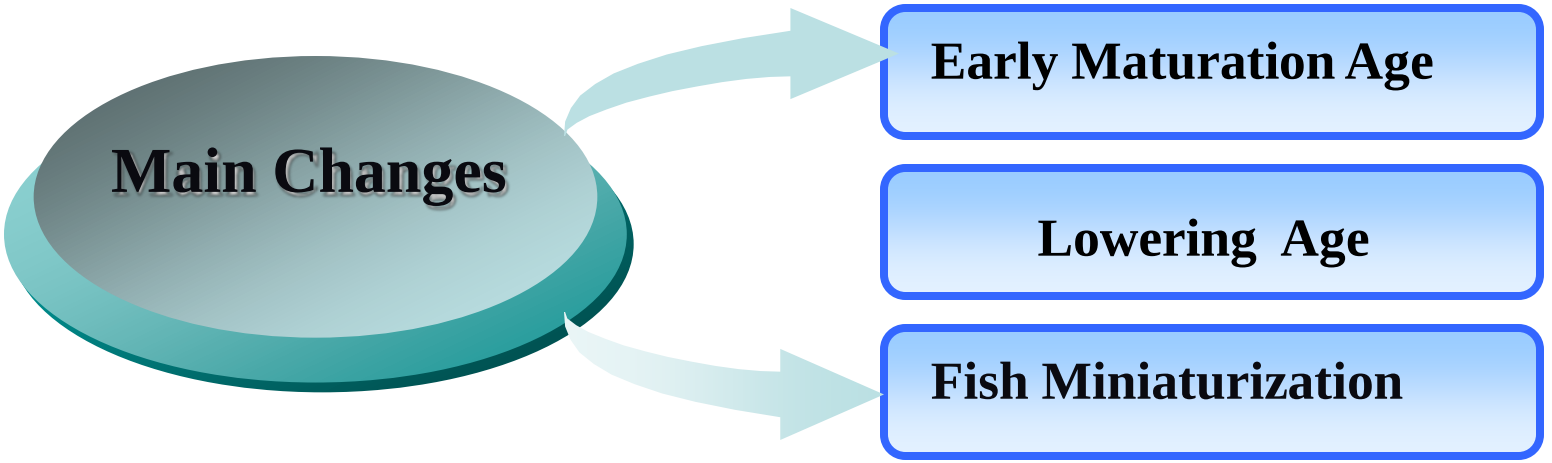
Outline

1. Background
2. Causes for change of fish phenotypic traits
3. Selectivity effects fish phenotypic traits
4. Further research

Background

In the recent years, there have been great changes in the phenotypic traits of exploited fish populations.



Fish miniaturization

Fish Miniaturization

- **Community Miniaturization**
- **Population Structure Miniaturization**
- **Individual Miniaturization**

Community miniaturization

Fish community miniaturization is the change of the dominant population in a certain area.

Population structure miniaturization

The miniaturization of population structure refers to the increase of the young fish in number and the reduction of the older fish.

Individual miniaturization

Individual miniaturization means that the body length and weight of fish of the same series and the same age have gradually decreased.

The main focus of this paper is the individual miniaturization of fish. Fig.1

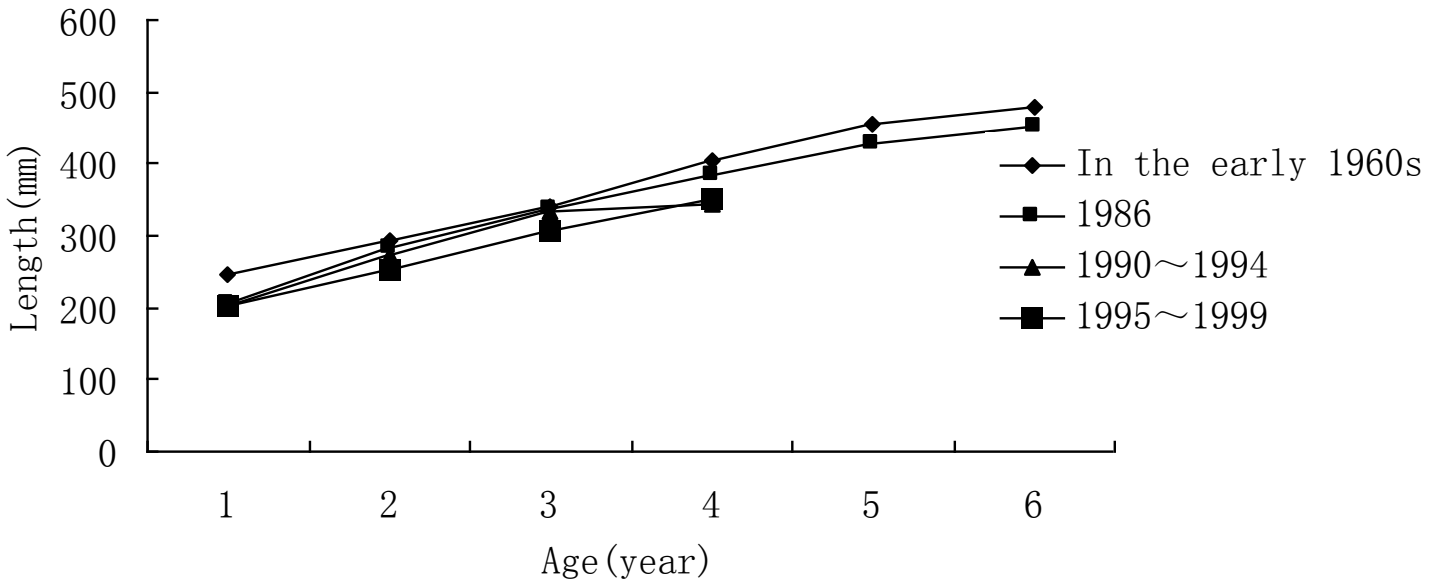


Fig.1. The age-snout-vent length of hairtail in the East China sea

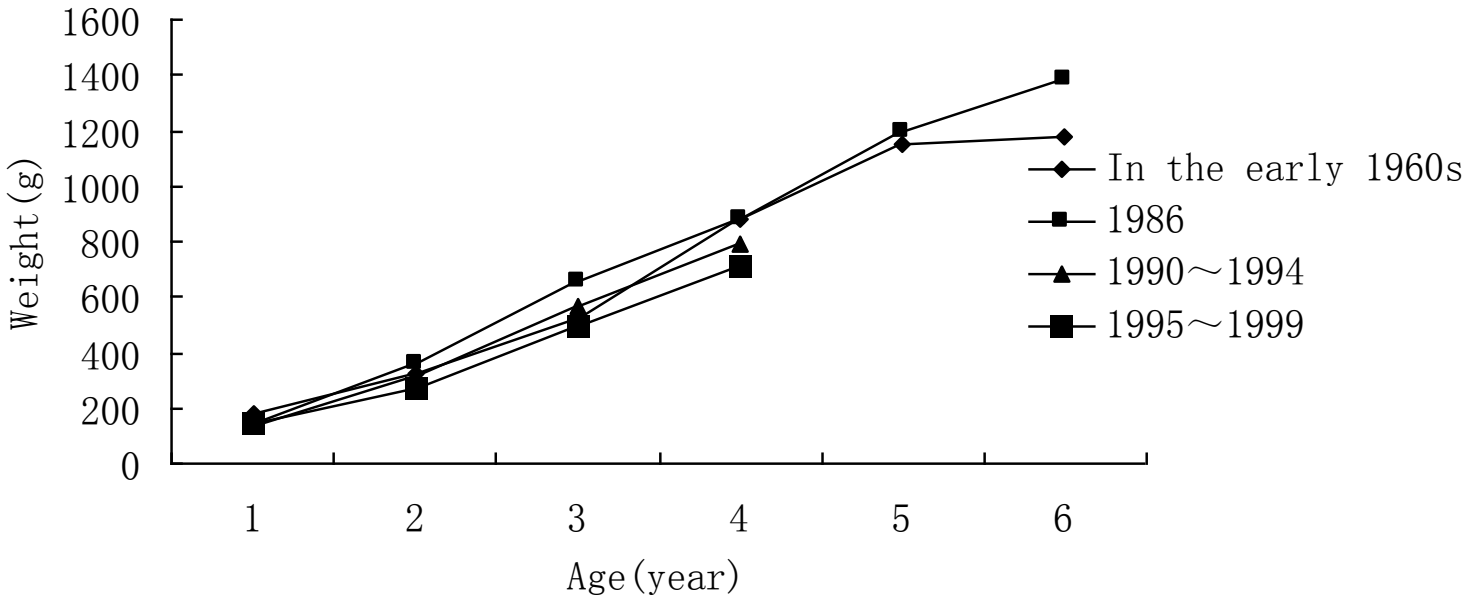


Fig.2 The age-weight of hairtail in the East China sea


Why?

Miniaturization researches

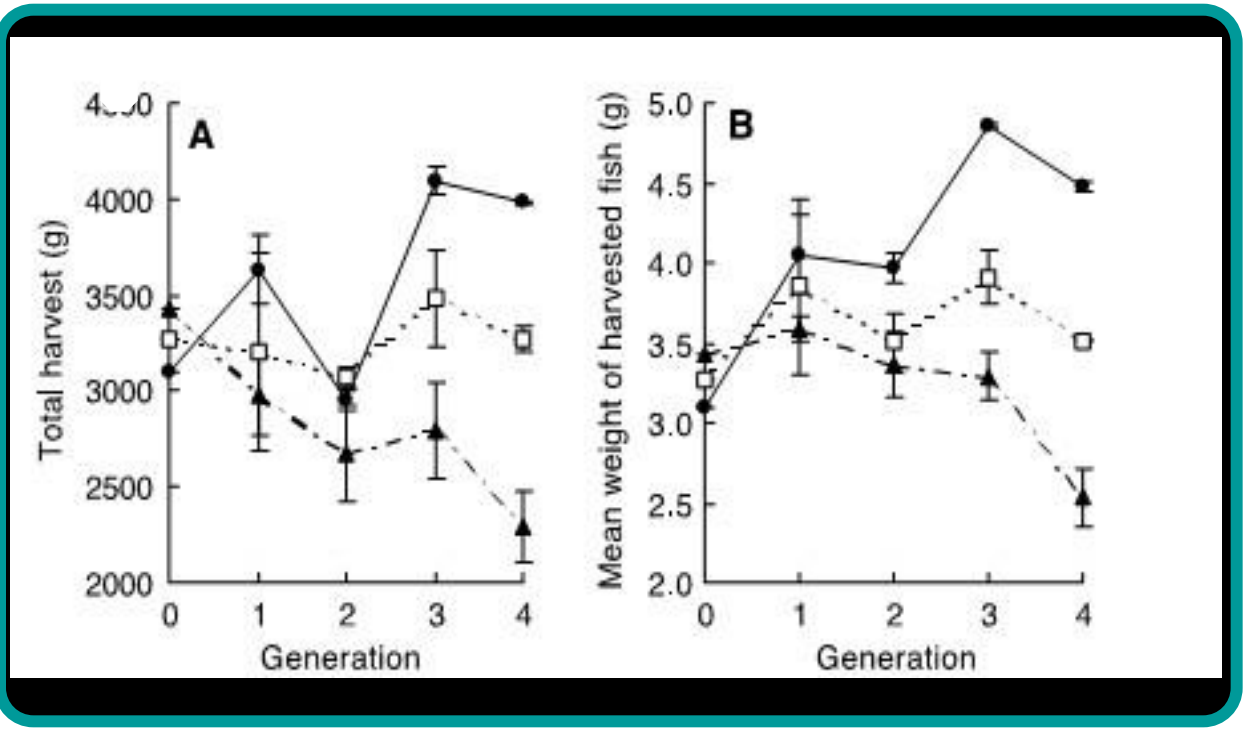
- **Research on the growth traits of *silver* in laboratory.**

  (Conover, 2002)

- **Simulation methodology was implemented in research of phenotypic traits. (Liang, 2005)**

- **Others**

Sustaining Fisheries Yields Over Evolutionary Time Scales



Large-harvested: populations start with highest total yield and mean weight but then declined.

Small-harvested: populations start with low yield and then increased.

Fig.3 Trend in weight harvested

- These shifts were caused by selection of genotypes with slower or faster rates of growth.
- Management tools that preserve natural genetic variation are necessary for long-term sustainable yield.

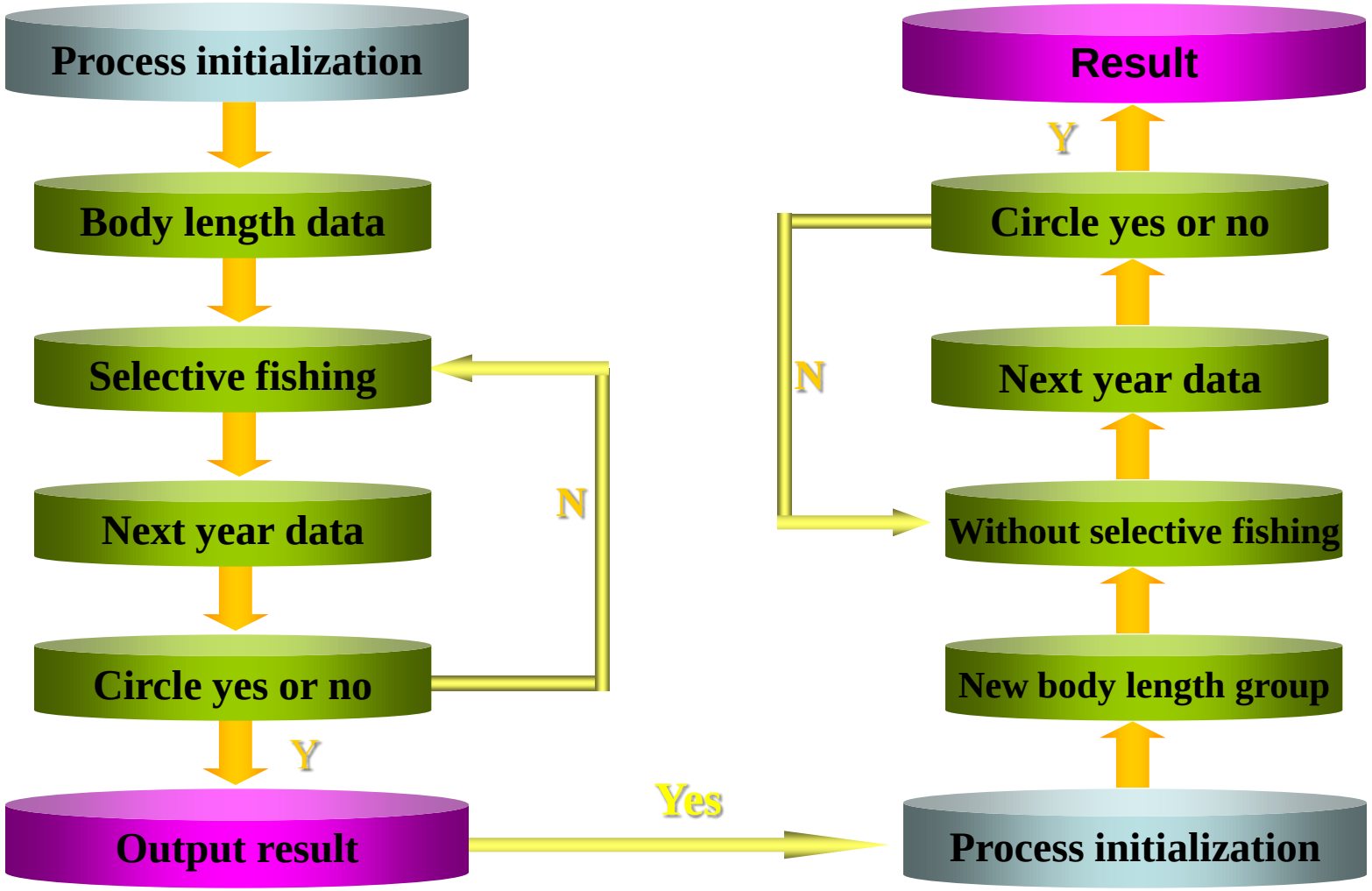
Fishing gear selectivity affects fish phenotypic traits

Fishing gears cause various selections on fish. The main selective object is the body length of a certain trait.

long period selective fishing was the main cause for the phenotypic traits in the fishing industry by different parameters:

trawl selectivity on phenotypic traits of fish population;
gillnet selectivity on phenotypic traits of fish population.

Flowchart of the program



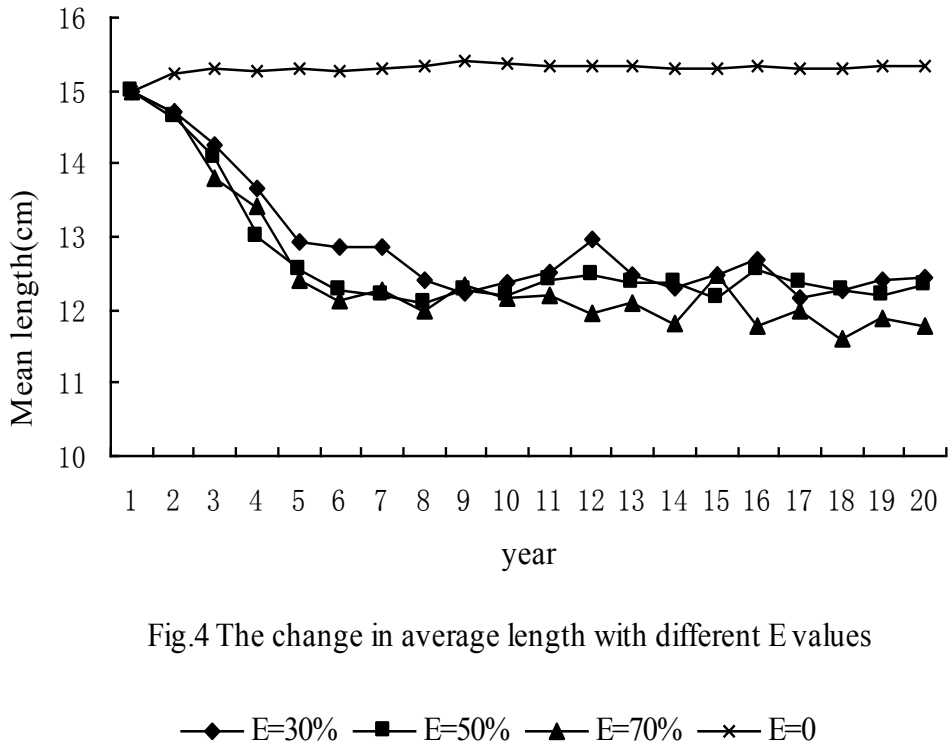


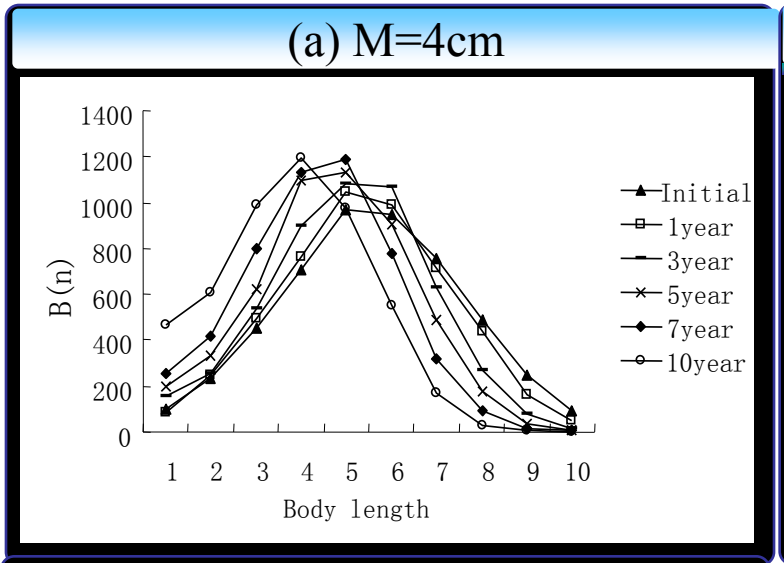
Fig.4 The change in average length with different E values

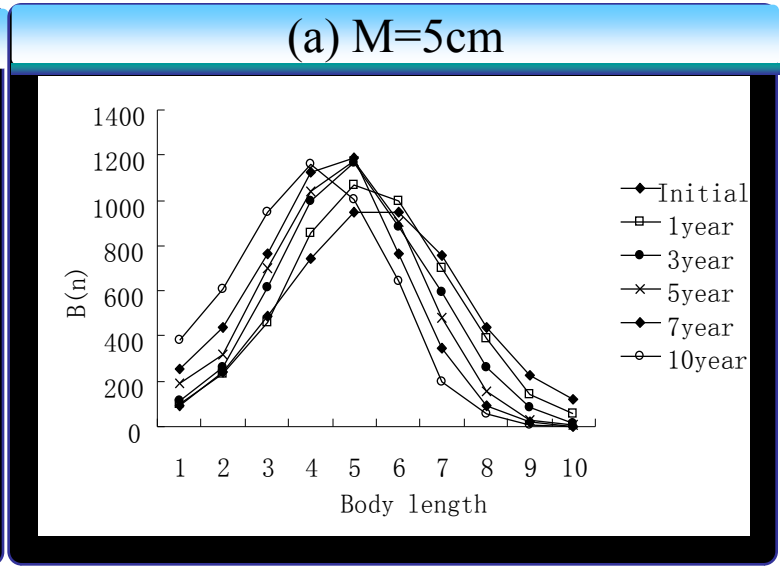
Fig.4 When trawls are used to capture fish, the mean length of the population reduces.

Meanwhile the more intense the capture is, the faster the reduction of the mean fish body length. When E comes to 50% and 70% and after 6 to 7 years' capture, the mean fish body length falls to the bottom line.

- **This depends on the interaction between the body length of the population and the size of the trawls mesh. The mean body length cannot restore the original stage without fishing.**

Trawl mesh selectivity of phenotypic traits





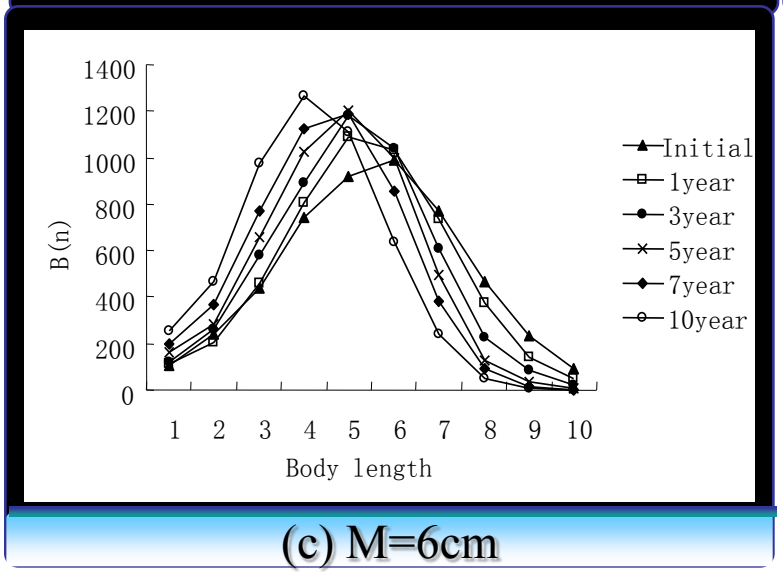
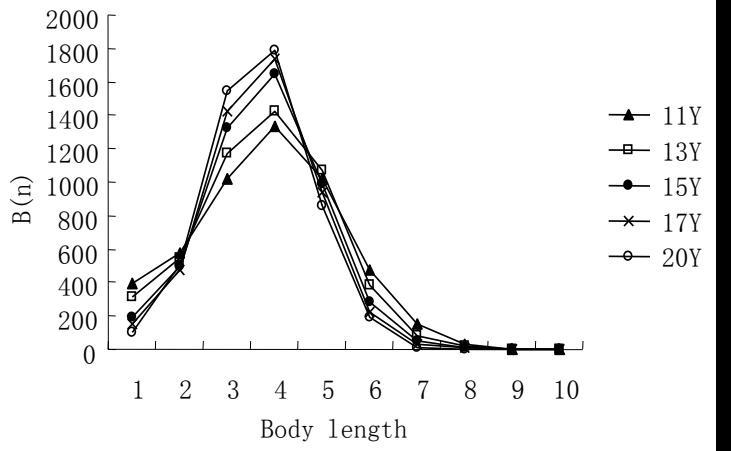


Fig.5 **The change of body length under the different Ms by fishing**

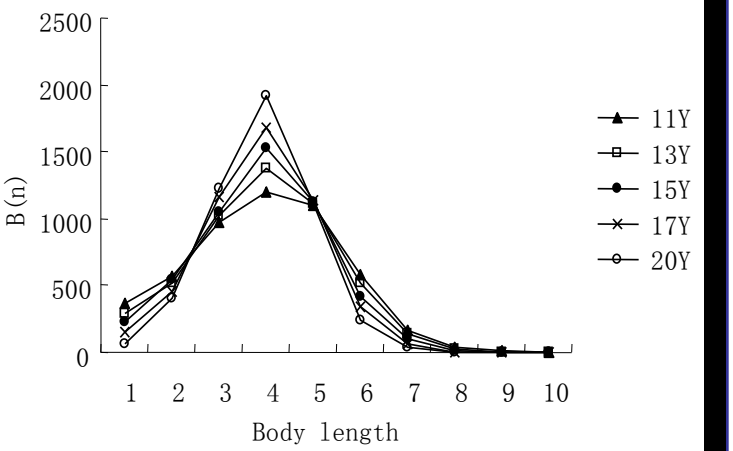
(zhenlin Liang, 2008)

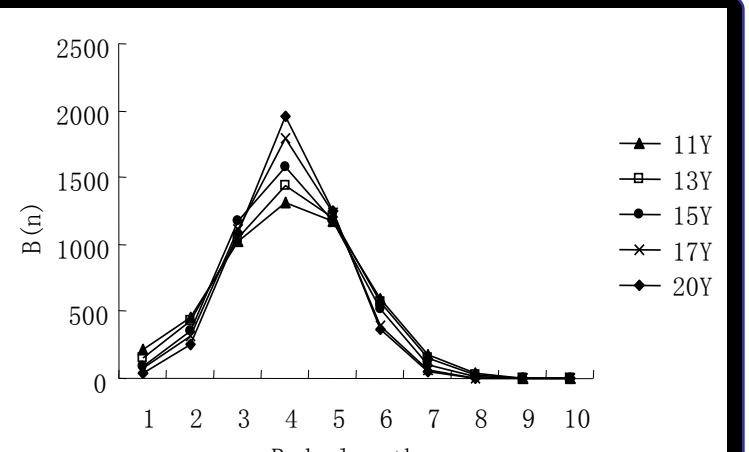
Trawl mesh selectivity of phenotypic traits

(a) M＝4cm



(b) M＝5cm





(c) M＝6cm

Fig6.**The change of body length under the different Ms without fishing**

(zhenlin Liang,2008)

Gillnet mesh selectivity of phenotypic traits

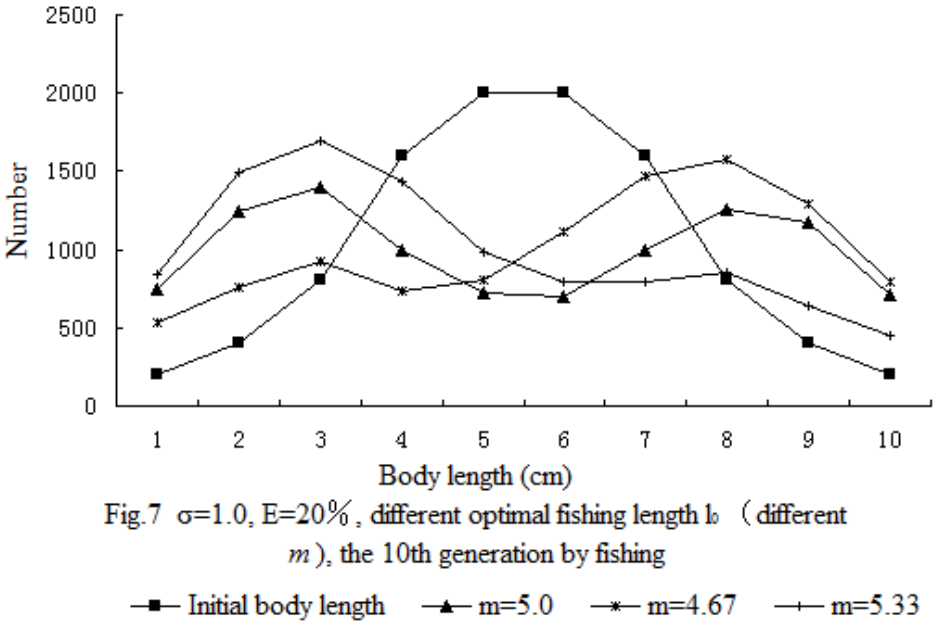


Fig.7 σ=1.0, E=20%, different optimal fishing length l_0 (different m), the 10th generation by fishing

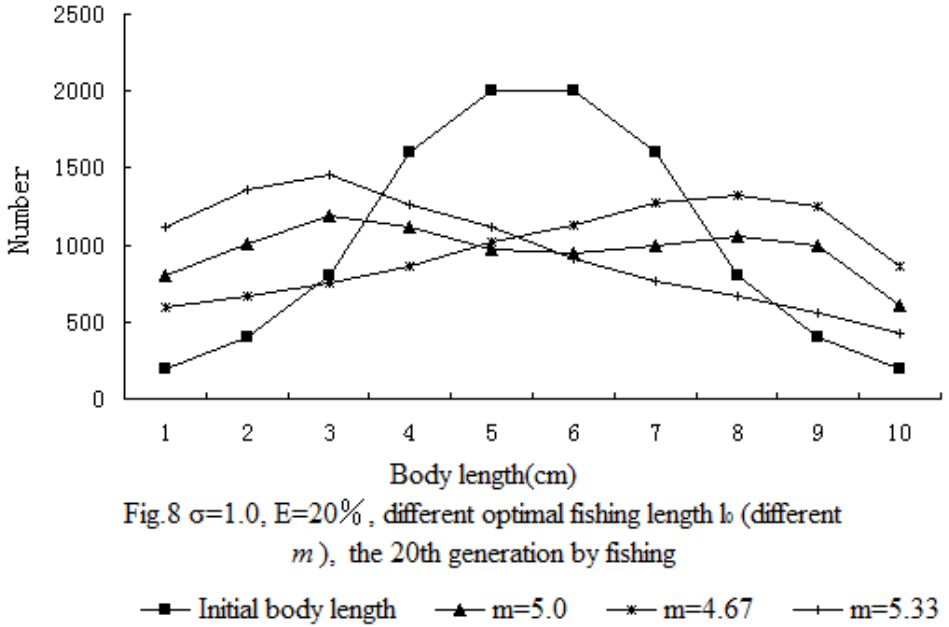


Fig.8 σ=1.0, E=20%, different optimal fishing length l_0 (different m), the 20th generation by fishing

1. The body length of population reduces due to the sustained fishing stress.

2. Furthermore, the change of phenotypic traits for the whole group can not be reversed.

3. The body length of the population without fishing comes close to the mean length year by year, which accords with biological traits.

Further Research

- Orientation of phenotypic gene of fish
- Research on heritability of fish population
- Environmental stress that affects phenotypic traits of fish. (Ecological experiment)
- Fishing stress that affects the phenotypic traits of fish. (Ecological experiment and simulation)

Further Research

- The concept of fishery management

(We can catch the large ones and leave the small ones.)

- different age composition——age juvenile
- the same age
  - miniaturization
  - early sexual maturity

- What conception will we derive from the future fishing?
- What fishing technology will we realize the new conception?

Thank You !