Journal of
Fisheries and Aquatic Science

ISSN 1816-4927

Academic
Journals Inc.

www.academicjournals.com

Journal of Fisheries and Aquatic Science 3 (1): 72-76, 2008
ISSN 1816-4927

Change of Fish Fauna and Long-term Dynamics of the Harvest of Aquatic Product in a Large Shallow Lake (Lake Taihu, China)

Yafen Chen and Songquan Zhu
Nanjing Institute of Geography and Limnology, The Chinese Academy of Sciences,
73 East Beijing Road, Nanjing 210008, People's Republic of China

Abstract: A survey on fish fauna in Lake Taihu carried out from March 2002 to December 2003 revealed that an obviously succession of fish fauna has occurred over the past 50 years. There was only 48 fish species belonging to 15 families found in the survey. Most of large and medium-sized fish species and the carnivorous fish species were either extinct or on the verge of extinction, whereas small-sized fish species, such as lake anchovy *Coilia ectenes*, became dominant in the lake. The harvest of aquatic product in the lake increased from 4060.7 tons in 1952 to 30516.5 tons in 2002, which was highest annual yield up to now. The small-sized fish accounted for most of the yield.

Key words: Fish fauna, harvest of aquatic product, Lake Taihu

INTRODUCTION

Lake Taihu (119°53'45"-120°36'15"'E, 30°55'42"'-31°33'50"'N), the third largest freshwater lake in China, is located in the lower reaches of Yangtze River. It is a large shallow lake with a surface area of 2338 km^2, a mean depth of 1.9 m and a maximum depth of 2.6 m (Qin *et al*., 2004). The capacity of Lake Taihu is 4.4 billion m^3, 70% of which is supplied by two headwaters in the west: the Taoxi River and the Nanxi River. About 69-70% of its outflow goes into the Taipu River through the eastern Lake Taihu, which connects the East China Sea via the Huangpu River (Sun and Huang, 1993). Linking with the Grand Canal, Lake Taihu is a downstream lake of the Yangtze River. There are more than 10 waterways from the lake to the Yangtze River.

Lake Taihu is one of the most important sources of aquatic product in Eastern China from of old and there are many species of fish in the lake in the past (Sun and Huang, 1993). On the basis of historical records of fish fauna surveys, it has been established that Lake Taihu previously contained 108 fish species belonging to 24 families. Most of fish species belong to the family Cyprinidae (Sun and Huang, 1993). The 108 fish species can be classified into four main categories according to different life history: lake dwellers, semi-migratory fish, anadromous fish and catadromous fish (Li, 1999). Lake dwellers mainly include Salangidae (such as ice fish*Neosalanx tangkahkeii taihuensis*), Engraulidae (such as lake anchovy *Coilia ectenes*), Cyprinidae (such as topmouth culter *Erythroculter ilishaeformis*). Semi-migratory fish between the great rivers and the lakes which feed in lake Taihu mainly include black carp *Mylopharyngodon piceus*, grass carp *Ctenopharyngodon idella*, silver carp *Hypophthalmichthys molitrix* and bighead *Aristichthys nobilis*. The anadromous fish in Lake Taihu mainly include obscure puffer *Takifugu obscurus*, ocellated puffer *Takifugu ocellatus* and Japanese eel *Anguilla japonicus*, which enter the lake for feeding. The catadromous fish in Lake Taihu mainly include common mullet *Mugil cephalus* and rough skin sculpin *Trachidermus fasciatus* (Li, 1999). To get insight into the present status of lake fisheries in Lake Taihu, a survey on fish fauna in Lake Taihu

Corresponding Author: Yafen Chen, Nanjing Institute of Geography and Limnology,
The Chinese Academy of Sciences, 73 East Beijing Road, Nanjing 210008,
People's Republic of China

was conducted from March 2002 to December 2003 and the information about the annual harvest of aquatic product in Lake Taihu in the past 50 years was also analyzed combining succession of fish fauna.

MATERIALS AND METHODS

A monthly sampling program was carried out from March 2002 to December 2003. Fish were captured monthly by trap net and filter net except during closed season. The specimens were fixed in 8% formalin and then identified in laboratory. The harvest of different aquatic products in Lake Taihu, including lake anchovy, ice fish, culters, omnivorous species, planktivory species, black carp and grass carp and the other, were recorded every year by the Lake Taihu Fisheries Administrative Committee of Jiangsu (Ni and Zhu, 2005). The total yield of aquatic products was thus the sum of above different parts. The proportions of different aquatic products were computed from above data.

RESULTS AND DISCUSSION

Results showed that an obviously succession of fish fauna has occurred over the past 50 years. There was only 48 fish species belonging to 15 families in 8 orders found in this survey (Table 1). Most of fish species still belong to the family Cyprinidae as before. In the 1950s, the dominant species were large and medium size fish species, including both lake dwellers, migratory and semi-migratory species (Li, 1999). However, according to the survey from March 2002 to December 2003, 60 fish species are now extinct in the lake. Most of the migratory and semi-migratory species in the lake were either extinct or on the verge of extinction. Species diversity decreased sharply. In addition, small-sized fish species, such as ice fish and lake anchovy, became dominant at this time. The change trend in fish fauna in Lake Taihu was similar to some other lakes, which also showed a decline in species diversity and a shift in species composition under human impact (Kapasa and Cowx, 1991; Degerman *et al*., 2001; Pombo *et al*., 2002). Fish species diversity can provide managers with a good indication of the health of a particular system (Whitfield, 1996). In the present study, a long-time variation of species diversity is therefore valuable in providing information on the state of ecosystem health in Lake Taihu.

The harvest of aquatic product in the lake was 4060.7 tons in 1952 and then increased gradually. The harvest reached 8552.3 tons in 1963 and increased 110.6% compared with 1952. The average harvest in 1970s, 1980s and 1990s was 11304.5, 14193.0 and 17869.7 t, respectively. In 2002, the harvest increased to 30516.5 tons, which is highest production up to now (Fig. 1). The high enhancement of the harvest of aquatic product in Lake Taihu in the past 50 years indicated that nutrient level and production of food organism increased significantly. Between 1952 and 2003, the aquatic product harvested in the lake was dominated by fish which together accounted for more than 90% of the annual total yield. The other 10% was the crustacean, including crab and shrimp. The lake anchovy, whose yield was the highest in all aquatic products, accounted for 15.8-67.0% of the annual total yield (Fig. 2). The ice fish accounted for 2.5-25.0% of the total yield, but below 10% in most the years. The large and medium-sized fish species, such as silver carp, bighead carp, grass carp and black carp, accounted for small proportion and decreased gradually. The carnivorous fish also accounted for less and less proportion. In a word, the small-sized fish accounted for most of the yield.

The long-term dynamics of the harvest of aquatic product in Lake Taihu was the response to the change of fish fauna in the past several decades' years, whereas the change of fish fauna was completely the result of change in the environment in the lake. Firstly, the yields of most of the migratory and semi-migratory species in the lake decreased gradually because they were either extinct or on the verge of extinction, which may be due to the migratory pathways of fish was obstructed by

Table 1: Fish fauna in Lake Taihu surveyed from March 2002 to December 2003. In the table, the capital Roman numerals represent the number of orders; the minuscule Roman numerals represent the number of families; the Arabic numerals represent the number of species

Species	Species
I Anguilliformes	27 *Hypophthalmichthys molitrix* (Cuvier et Valeneiennes)
i Anguillidae	28 *Aristichthys mobilis* (Richardson)
1 *Anguilla japonica* (Temmiack et Schlegel)	iv Cobitidae
II Clupeiformes	29 *Misgurnus anguillicaudatus* (Contor)
ii Engraulidae	30 *Paramisgurnus dabryanus* (Sauvage)
2 *Coilia ectenes taihuensis* (Yuan)	IV Siluriomles
III Cypriniformes	v Bagridae
iii Cyprinidae	31 *Peheobagrus fulvidraco* (Richardson)
Leuciscinae	32 *Peheobagrus nitidus* (Sauvage et Dabry)
3 *Mylopharyngodon piceus* (Richardson)	33 *Peheobagrus vachelli* (Richardson)
4 *Ctenopharyngodon idellus* (Cuvier et Valenciennes)	vi Siluridae
5 *Squaliobarbus curriculus* (Richardson)	34 *Silurus asotus* (Linnaeus)
Culterinae	V Osmeriformes
6 *Hemiculter leucisculus* (Basilewsky)	vii Salangidae
7 *Toxabramis swinhonis* (Günther)	35 *Protosalanx hyalocranius* (Abbott)
8 *Megalobrama amblycephalus* (Yih)	36 *Hemisalanx branchrostralis* (Fang)
9 *Cultrichthys erythropterus* (Basilewsky)	37 *Neosalanx oligodentis* (Chen)
10 *Culter alburnus* (Basilewasky)	38 *Neosalanx taihuensis* (Chen)
l1 *Culter mongolicus* (Basilewsky)	VI Beloniformes
Xenocyprinae	viii Hemirhamphidae
12 *Pseudobrama simony* (Bleeker)	39 *Hemirhamphus intermedius* (Cantor)
Acheilognathinae	VII Symbranehiformes
13 *Rhode light* (Wu)	ix Symbranchidae
14 *Acheilognathus macropterus* (Bleeker)	40 *Monopterus albus* (Zuiew)
15 *Acheilognathus tonkinessis* (Vaillant)	VIII Percifoformes
16 *Acheilognathus barbatula* (Günther)	x Serranidae
Gobioninae	41 *Siniperca chuatsi* (Basilewsky)
17 *Hemibarbus maculatus* (Bleeker)	42 *Siniperca kneri* (Basilewsky)
18 *Paracanthobrama guichonoti* (Bleeker)	xi Eleotiidae
19 *Pseudorasbora parva* (Temmind et Sehlege1)	43 *Odontobutis potamophila* (Günther)
20 *Sarcocheilichthys sinensis sinensis* (Bleeker)	44 *Micropercops swinhonis* (Günther)
21 *Sarcocheilichthys nigripinnis nigripinnis* (Günther)	xii Gobiidae
22 *Squalidus nitens* (Günther)	45 *Rhinogobius giurinus* (Rutter)
23 *Abbottina rivularis* (Basilewsky)	xiii Channidae
Cyprininae	46 *Channa argus* (Cantor)
24 *Cyprinus carpio* (Linnaeus)	xiv Belontiidae
25 *Carassius auratus auratus* (Linnaeus)	47 *Macropodus chinensis* (Bloch)
26 *Cyprinus auratus gibelio* (Bloch)	xv Mastacembelidae
Hypophthalmichthyinae	48 *Mastacembelus sculeatus* (Basilewsky)

many dams constructed between the Yangtze River and the lake in the past (Li, 1999). Secondly, local fish farmers endlessly collected aquatic plants from the lake to feed herbivorous fish in their own ponds, which resulted in that aquatic vegetation in the lake was gradually destroyed. Some species of fish lost their spawning substrate and spawning ground and thus were extinct in the lake (Cao and Xu, 1981). Thirdly, increasing pollution resulted in the lake eutrophication (Bai *et al*., 2006), which also had a major impact on the fish fauna. Finally, land reclamation destroyed the natural habitats of Cyprinidae and caused the extinction of many species (Zhou *et al*., 1995). All these factors made the large and medium-sized fish species and carnivorous fish became less and less proportion. On the contrary, population of small-sized fish, such as lake anchovy, increased quickly due to their high reproductive ability, short life cycle and without predators (Liu *et al*., 2005).

Therefore, to keep reasonable and sustainable fisheries in the lake, some traditional ideas on the development of lake fisheries in China must be changed and greater attention must be put on protecting the environment and species diversity in the lake.

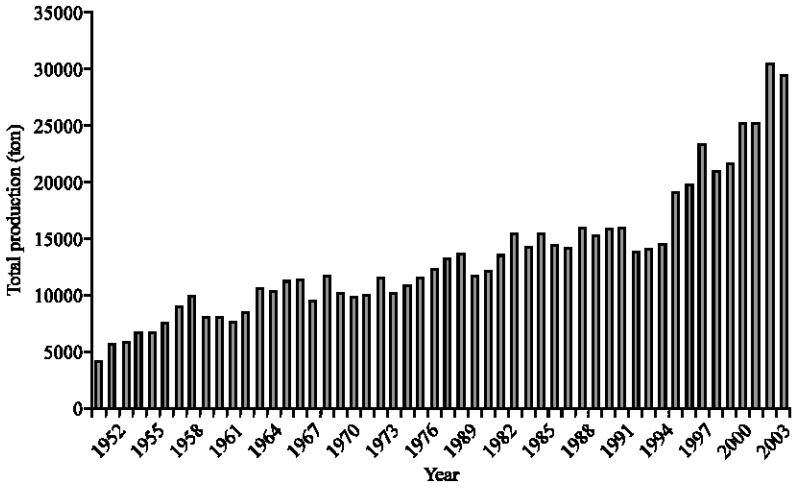

Fig. 1: Long-term (from 1952 to 2003) dynamics of the harvest of aquatic product in Lake Taihu

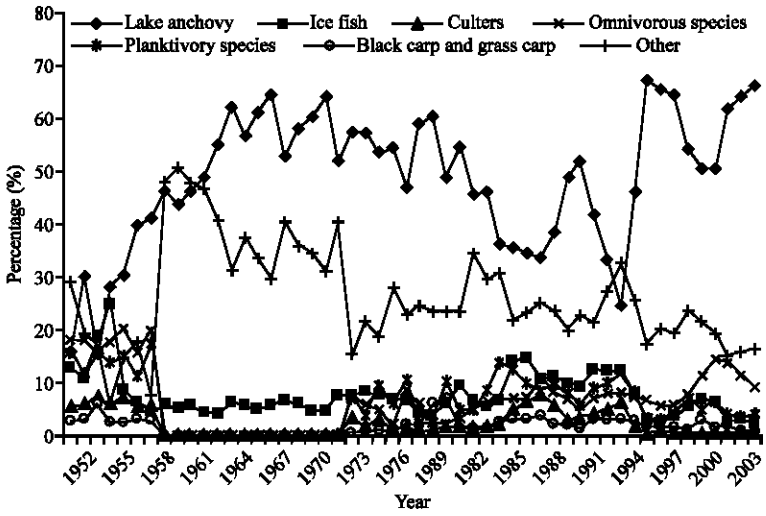

Fig. 2: The proportion of different aquatic product in the total yield in Lake Taihu from 1952 to 2003. Between 1959 and 1972, the other also included culters, omnivorous species, planktivory species, black carp and grass carp

ACKNOWLEDGMENTS

We thank the Lake Taihu Fisheries Administrative Committee of Jiangsu in Suzhou for providing some unpublished historical records in the study. This study was partially supported by the National Natural Science Foundation of China (40601108).

REFERENCES

Bai, X.L., X.H. Gu and L.Y. Yang, 2006. Analyses on water quality and its protection in Lake Taihu. J. Lake Sci. (In Chinese), 18: 91-96.

Cao, C. and Z. Xu, 1981. Surveys on Vascular Plants Resources in East Lake Taihu and Lake Taihu. Wuxi: Lake Taihu Fish Enhancement Station (In Chinese), pp: 215.

Degerman, E., J. Hammar, P. Nyberg and G. Svärdson, 2001. Human impact on the fish diversity in the four largest lakes of Sweden. Ambio, 30: 522-528.

Kapasa, C.K. and I.G. Cowx, 1991. Post-impoundment changes in the fish fauna of Lake Itezhi-tezhi, Zambia. J. Fish Biol., 39: 783-793.

Li, K.M., 1999. Management and restoration of fish communities in Lake Taihu, China. Fish. Manage. Ecol., 6: 71-81.

Liu, E.S., Z.W. Liu, W.M. Chen, C.H. Bao and K.N. Chen, 2005. A study on the change of lake anchovy (*Coilia ectenes*) catches and its mutual relationship to the biological environment in Lake Taihu. J. Lake Sci. (In Chinese), 17: 340-345.

Ni, Y. and C.D. Zhu, 2005. Fishes of the Lake Taihu. Shanghai: Shanghai Scientific and Technical Publishers (In Chinese).

Pombo, L., M. Elliott and J.E. Rebelo, 2002. Changes in the fish fauna of the Ria de Aveiro estuarine lagoon (Portugal) during the twentieth century. J. Fish Biol., 61: 167-181.

Qin, B.Q., W.P. Hu and W.M. Chen, 2004. Process and Mechanism of Environment Changes of the Lake Taihu. Science Press, Beijing (In Chinese), pp: 1-2.

Sun, S.C. and Y.P. Huang, 1993. Lake Taihu. Ocean Press, Beijing (In Chinese), pp: 4-195.

Whitfield, A.K., 1996. Fishes and the environmental status of South African estuaries. Fish. Manage. Ecol., 3: 45-57.

Zhou, M., Q. Shen and J. Li, 1995. Study on population, resources and environment in relation with the development and management of Lake Taihu. Wuxi City Res. (In Chinese), pp: 57-63.