Bulletin on the Ecological and Environmental Monitoring Results of the Three Gorges Project

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Content

Summary

2005 is the second year when the Three Gorges Project entered Phase III Construction period in an all round way. The progress of the project meets overall requirements with steady improvement of project quality. The key structures operate safely with power generation exceeding the production target. The ship lock has smooth operation with orderly shipment.

The river basin of the Three Gorges enjoyed rapid social and economic development in 2005. The total production output of the project area increased by 11.8% in comparable price compared with that of 2004 and the industrial structure being under further improvement. Each economic sector of the project area enjoyed steady fast growth with continuous rising of living standard. In addition, the basic situation of public health was normal.

In 2005, the overall situation of natural ecological environment was basically the same as that of 2004. The climate was a little bit warmer with average precipitation. During the wet season, there was not any large scale and severe flood disasters. The amount of the fish fry of the "four local fishes" in the river flow continuously decline. However, the resource of parent crabs and *colia mystus* went up by different degree but eel fries. The overall water quality of major fishery waters was good, basically meeting the growth and reproduction requirements of fishes. Due to the increasing pressure on ecological environment of farmland, the arable land area and the total sown area were on continuous reduction with some increase of crop proportion. The earthquake intensity kept at relatively low level, same as normal year.

In 2005, a total of 574 million tons of industrial effluent was discharged into the Three Gorges area with major pollutants of COD being 77,100 tons and NH_3-N being 5800 tons. The total urban sewage was 409 million tons, the release of COD was 92,600 tons and NH_3-N 9400 tons. A total amount of 496,900 tons of oil containing wastewater from ships and boats were discharged into the waters, down by 6.2% compared with that of last year, 94.9 percent of such oil-containing water had been treated. The amount of domestic sewage from ships and boats reached 2.068 million tons, up by 9.0% compared with that of 2004.

In 2005, water quality of the Three Gorges project areas was dominated by Grade III standard with relatively poor quality in tributary rivers. There were quite a number of water bloom phenomena in return water areas mainly concentrated on March ~ July. As a whole, the environmental quality of the construction area and resettlement area was quite good.

Chapter 1 Development of the Three Gorges Project

2005 is the second year when the Three Gorges Project entered Phase III Construction period in an all round way and also the critical year for Phase III Construction period of the Three Gorges Project. The progress of the project meets overall requirements with steady improvement of project quality. The key structures operate safely with power generation exceeding the production target. The ship lock has smooth operation with orderly shipment. The capacity of the key water conservancy structure has enjoyed further improvement in terms of flood control, water resource management, power generation and navigation. The comprehensive benefits of the project came up.

In 2005, a total of 1.6944 million m^3 of concrete were poured; and over 21,000 tons of machinery and electric components were buried and installed on site. The dam of the right bank reached the height of 160 m, exceeding the 158 m target of that year. All the power generation sets of the left-bank power plant of the Three Gorges were put into operation. In addition, the quality of the Three Gorges Reservoir Project enjoyed a steady increase. A total of 4,711 subprojects had passed review and examination, 100% qualified with 91.91% being good project. A total of 11.819 billion yuan RMB was invested in the huge project, among them, 6.13 billion yuan for the construction of key structures and 5.689 billion yuan for inundation compensation.

On September 16, 2005, with the on-grid power generation of No.9 generation sets of the left-bank power plant, the 14 power generation sets with the capacity of 700,000 kW were put into operation one year ahead of schedule with the output of 49.1 billion kWh. The accumulated power generation from the terraced power plants from the Three Gorges to Gezhouba Dam reached 65.34 billion kWh, exceeding the power generation target of that year.

In 2005, the ship lock of the Three Gorges Dams had realized safe navigation for 364 days, with annual accumulated operation of 8,373 lock times, 63,800 pass of ships, 32.69 million tons of goods and 1.875 million passengers.

Chapter 2 Economic and Social Development

2.1 Population, Society and Economy

By the end of 2005, the population of the Three Gorges Project area totaled 20.1615 million, up by 0.9% compared with that of 2004. Among them, 13.9327 million were farmers, down by 0.5% compared with that of 2004. And 6.2288 million were urban and township residents, accounting for 30.9% of the total population, with an increase of 1 percentage point.

The total production output of the project area in 2005 was 230.808 billion yuan RMB, an increase of 11.8% in comparable price against that of 2004. Among them, the total output of Chongqing region was 214.165 billion yuan and 16.643 billion yuan for the project area in Hubei Province, up by 11.7% and 12.5% respectively against that of 2004. The primary industry of the project area realized added value of 25.454 billion yuan, up by 5.2%; the secondary industry realized added value of 102.377 billion yuan, rise by 12.9% and the tertiary industry with added value of 102.977 billion yuan, up by 12.2% compared with that of 2004. Industrial restructuring was on continuous pace. As a result, the proportion of the added value of the primary, secondary and tertiary industries against the total production output was adjusted from 12.1:43.4:44.5 to 11.0:44.4:44.6 in 2005.

Table 2-1 Major statistics of economic and social development indexes of the Three Gorges Project area in 2005

Indexes	Amount	Increase (%)
Total grain output (10,000 t)	665.65	1.4
Oil crop yield (10,000 t)	23.98	4.5
Tobacco yield (10,000 t)	4.68	19.4
Meat output (10,000 t)	121.57	4.8
Aquatic products (10,000 t)	14.19	4.7
Financial revenue in local budget (100 million yuan)	108.22	29.5
Financial expenditure in local budget (100 million yuan)	249.97	21.1
Fixed assets investment (100 million yuan)	1533.39	24.0
Total sales volume of consumer goods (100 million yuan)	929.82	15.4
Average urban disposable income (yuan)	9523	10.2
Average net income of rural residents (yuan)	2760	11.6
Balance held on savings deposit (100 million yuan)	1945.51	17.4

In 2005, the production of each industry of the project area was on steady fast growth. The added value of the industries realized 78.785 billion yuan, up by 13.9% compared with that of 2004 in comparable price. The construction industry realized the added value of 23.592 billion yuan, rose by 9.9% against that of 2004. The total amount of cargo shipment reached 282.95 million tons with an increase of 7.6%. A total of 610.58 million passengers were completed in 2005 with an increase of 7.3%. In addition, postal and telecommunication services obtained 9.604 billion yuan revenue with an increase of 17.0%.

In 2005, the budgeted educational expenditure of the project area reached 3.304 billion yuan, up by 25.3% against the year of 2004. Public health expenditure was 789 million yuan with an increase of 19.2%. There were 470,200 professionals across the region, down by 0.8% against that of the end of 2004. Public libraries of the region boasted a collection of 6.9375 million books, up by 4.8% than that of 2004. There were 494 full-time teachers per 10,000 middle and primary school students, 9 more than that of 2004. TV broadcasting coverage was 96.94%, rise by 0.12 percentage point.

2.2 Resettlement

Up to the end of 2005, the accumulated investment of 44.517 billion yuan was put in place for resettlement projects with accumulated resettlement population of 1.1132 million. Among them, 881,700 people used to live under the 156 m water table of the reservoir. Accumulated 41.9691 million m^2 of various buildings had been constructed, among them, 30.8564 million m^2 were residential buildings. The accumulated areas of constructed buildings compensating that demolished by the huge project was 33.8925 million m^2, among which 24.3662 m^2 were residential areas. The accumulated amount of factories, mining companies and enterprises that had been removed, gone bankruptcy or closed down were 1,528.

● Rural Areas

In 2005, a total of 851.7969 million yuan capital was put in place for rural resettlement, taking up 92% of the total scheduled input. 3800 mu land had developed, 7 new canals were built, 385.86 km of rural roads were built. Moreover, 1.2337 million m^2 buildings had been constructed, among them, 1.2308 million m^2 were resettlement residential houses.

● Cities and Towns

In 2005, a total of 1246.2164 million yuan investment for the resettlement of cities and towns was put in place, accounting for 80% of the scheduled amount. 136,000 m^2 of land were requisitioned. A total of 89,500 m^2 of land had been leveled. 6.9 km of new road was built. 1.0069 million m^2 urban buildings were constructed. Among them, 931,900 m^2 were residential buildings. A total of 616,900 m^2 buildings were built in towns, 581,200 m^2 of which were for residential purpose.

● Plants, Mines and Other Enterprises

In 2005, a total of 327.6534 million yuan resettlement investment for the removal of factories, mining companied and enterprises was put in place, accounting for 57% of the planed total of the year. 53.102 million of resettlement input was completed for military industrial enterprises, taking up 71% of the planed amount. 109 factories, mining companies and other enterprises had finished their resettlement work.

● Special Facilities

A total of 367.9718 million yuan resettlement investment for the re-construction of special facilities was completed in 2005, accounting for 120% of the planned total. A total 54.13 km of road, 17 wharfs, 14 hydro power plants and 11 pumping stations were rebuilt. And 167,400 m of power transmission lines, 150,000 m of communication lines and 200,000 m of broadcasting and TV cables had been laid. A total of 1.2363 million m^2 of bed area had been cleared out.

● Environmental Protection

A total of 3.3631 million yuan had been invested in environmental protection projects in the resettlement areas in 2005.

Chapter 3 Natural Ecological Environment

3.1 Climate

The air temperature of the reservoir areas of the Three Gorges in 2005 was continuously higher than the average. The annual average temperature (AT) of the central and western part was higher than that of usual level. While the annual air temperature of the eastern part was similar to the normal level. In winter and summer, the air temperature of the region was same as the normal level. But spring and autumn had relatively higher temperature. The average annual precipitation was close to the historical average with a little bit less in eastern part but same in other parts. The precipitation was less than the normal in winter and autumn but close to the normal level in spring and summer. During the wet season, there were not any large-scale and serious flood disasters. The average wind speed was slightly lower than the normal level. The annual average number of foggy days had an evident decrease. The average evaporation and relative humidity of the Three Gorges area were close to the normal level. The degree of acid rain was slightly heavier than in 2004. Major climate disasters include storms, floods and its secondary geological disasters such as landslides and mud-rock flow, droughts, strong winds, hails, strong convective currents and freezing weather.

Table 3-1 Monitoring results of meteorological items of each weather station of the Three Gorges Project area in 2005

Station name	AT (℃)	P (mm)	E (mm)	RH (%)	AWS (m/s)	NHS (h)	NFD (d)	NT (d)
Chongqing	18.6	1020.3	1156.6	78	1.3	903.9	21	28
Changshou	17.6	1133.3	1092.0	82	1.2	1068.5	47	29
Fuling	18.4	1086.3	1162.8	74	0.7	1192.1	54	31
Fengdu	18.6	934.7	1253.4	72	1.1	1158.2	48	31
Zhongxian	17.8	1191.8	1124.2	79	1.2	1026.6	52	34
Wanzhou	18.4	1144.6	1219.4	76	0.7	1000.1	18	42
Yunyang	17.9	1086.1	1139.8	74	1.1	1381.1	38	35
Fengjie	18.3	893.2	1241.9	70	1.5	1158.8	4	22
Wushan	18.6	913.2	1379.9	66	0.6	1180.3	7	23
Badong	17.4	1032.8	1537.6	70	2.0	1431.0	38	34
Zigui	16.5	976.5	1161.8	75	1.0	1470.4	0	36
Bahekou	17.1	975.9	1189.3	75	1.4	1259.3	4	34
Yichang	17.5	1030.7	1400.3	76	1.1	1304.8	11	35

Note: AT stands for average temperature, RH stands for relative humidity; P stands for precipitation; E for evaporation; AWS for average wind speed; NHS for number of hours with sunshine; NFD for number of foggy days; NT for number of thunder storms.

The annual average precipitation of the Three Gorges Project area was 1037.1 mm in 2005, 85.0 mm less than the average, falling into the normal range. For spatial distribution, the precipitation of each weather monitoring station ranged from 893.2～1191.8 mm with the maximum precipitation occurred in Zhongxian County and the minimum in Fengjie. Compared with normal years, the precipitation amount of each monitoring station was normal except 10%～20% less recorded in Fengdu, Fengjie and Wushan. For time distribution of the precipitation, it had less rainfall in 2004/2005 winter and the autumn of 2005 with same amount of precipitation in spring and summer compared with that of normal years. The precipitation of the project area had its peak in autumn with 252.2 mm, 90% more than the normal level of the same period. But the precipitation of January and September went down by 50%～60% compared with the historical average. The precipitation of other months remained the same level as the historical average.

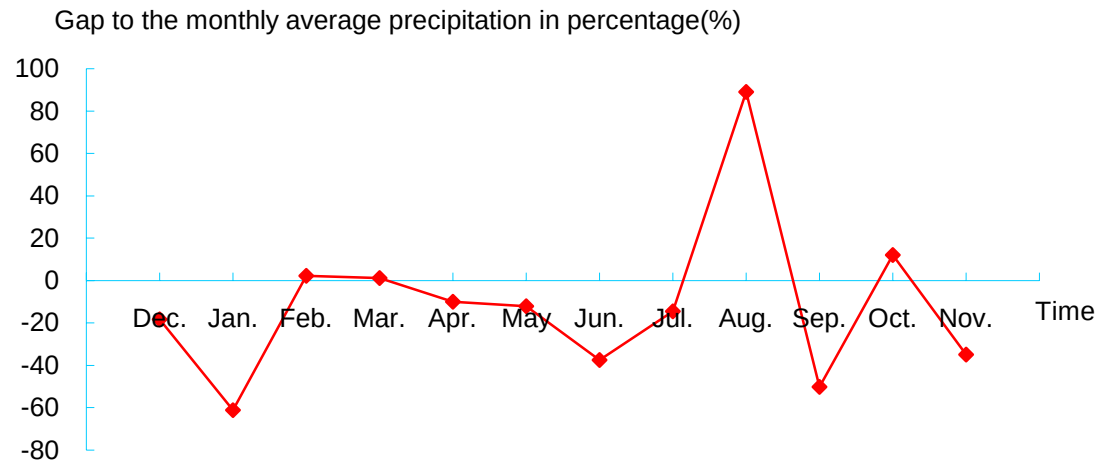


Figure 3-1 Percentage gap to monthly average precipitation of the Three Gorges Project area in 2005

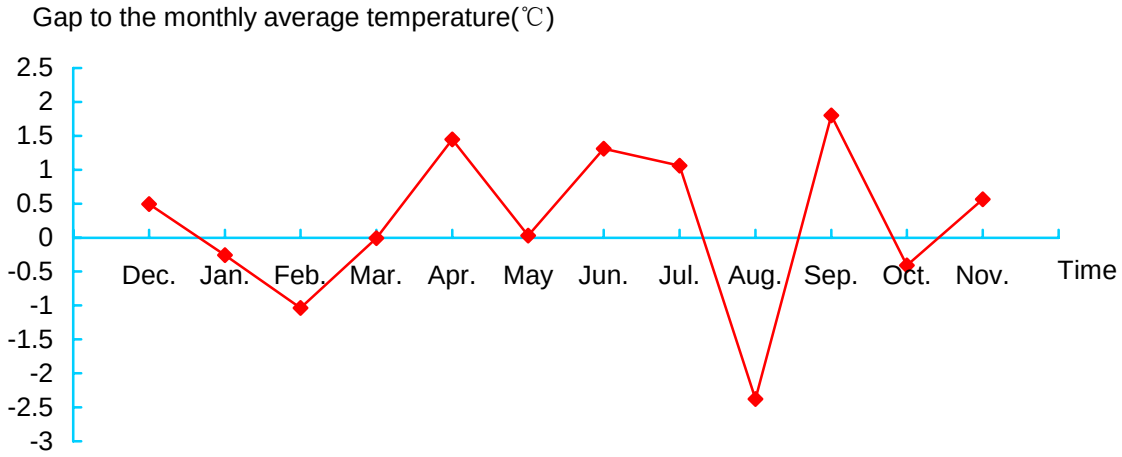


Figure 3-2 Gap to monthly average temperature of the Three Gorges Project area in 2005

The annual average temperature of the Three Gorges Project area in 2005 was 18.1℃, 0.3℃ higher than the historical average level. In spatial distribution, the annual average temperature of each representative station was a little higher than or close to the historical average. Among them, it was 0.5～0.6℃ higher than the historical average in Chongqing, Fengdu, Wanzhou, Fengjie, Wushan and Yichang. In the time distribution, the average air temperature of winter and summer was close to the historical average but a little bit higher in spring and autumn. The average air temperature in February and August in 2005 was lower than the historical average of the same month, especially in August, 2.4℃ lower than the normal. However, the average air temperature of April, June and September was higher than the historical average, especially in September, 1.8℃ higher than the normal. The average air temperature of other months of 2005 was close to the historical average.

The wind of the project area in 2005 was not strong with the average wind speed being 1.1m/s, down by 0.2m/s compared with the normal level. The average wind speed of each representative weather station ranged from 1.0 to 2.0 m/s except Fuling, Wanzhou, Wushan and Zigui stations with around 0.7 m/s.

The annual average foggy days of the project area in 2005 was 28.3 days, 4.5 days less than in 2004 and 9.9 days less than the historical average. 2005 is the year with the least foggy days since 1979. In time distribution, winter had most foggy days, followed by spring, autumn and summer. The foggy days in the winter, summer and autumn of 2005 were less than the historical average but was same in the spring. In spatial distribution, there were more foggy days in the western part than in the eastern part. And 31.3 more foggy days occurred in Yunyang and 0.9 days more in Badong. The former had nearly 5 times more than the normal years. In other stations, there were 0.3 ~ 34.6 less foggy days compared with the normal level. Among them, there was the biggest reduction of goggy days in Wanzhou. The number of heavy foggy days of Chongqing, Wanzhou and Yichang was less than 50% of the normal. And the total number of foggy days of Fengjie was less than 1/6 of the normal level.

In 2005, the annual average relative humidity of the Three Gorges area was 74%, down by 2 percentage points than the historical average. It increased from the east to the west. Compared with normal years, Zigui had 4% increase in relative humidity, while other regions basically kept the same or being less. Among them, Fengdu had 9% decline, Fuling went down by 7% and Wanzhou by 6%. The annual average evaporation of the project area in 2005 was 1239.1 mm, close to the historical average. The regional distribution of the evaporation was big in the east and small in the west. From Wushan to Yichang, The annual average evaporation ranged from 1379.9 to 1537.6 mm with other regions between 1092.0 to 1253.4 mm. Chongqing, Fengdu, Zhongxian and Wanzhou had 10% ~ 20% more annual evaporation compared with the historical average. But Yunyang and Zigui had 10% less. Other weather stations basically had normal evaporation level.

In 2005, the average pH value of the precipitation of 6 monitoring stations was 4.54, 0.13 down compared with that of 2004. This falls into the normal acid rain value and being the lowest value since 1999. The pH value of Wanzhou, Dengjie and Badong was the lowest in the past 7 years, indicating relatively severe acid rain phenomenon.

Major climate disasters of the project area in 2005 were storms and floods as well as secondary geological disasters resulting from floods such as landslide and mud-rock flow, drought of the eastern region in late spring and early summer, drought of western region in summer, gale, hail, strong convective current like gale and hail as well as the freezing weather of eastern region in late winter and early spring.

Storms and floods: Local storms and floods mainly occurring during June ~ September imposed some life and property losses in 2005 but less than that of 2004. The worst storm occurred during July 8-10 in northeast of Chongqing, Yichang and Enshizhou of Hubei Province, which lead to landslides in many places and the highest peak of Jianglingjiang River since the wet season with 380 million RMB direct economic losses.

Drought: The precipitation of most areas of Yichang went down by 20% ~ 50% from January to June of 2005, causing relatively severe spring-summer draught. In particular, each area of the city experienced the abnormal “Kongmei” phenomenon from mid June to early Junly dominating by fine weather with high temperature, leading to rapid spread and worsening of the draught. Among them, Yichang city, Yiling District, Dangyang, YuanAn and Changyang had serious draught. According to primary estimate, this draught caused 280 million yuan direct economic losses of Yichang City, 250 million of which was direct economic losses in agriculture. In addition, Youyang, Xiushan, Pengshui, Jijiang and Fuling of Chongqing Municipality suffered evident reduction of rainfall from early June to Early July with obviously higher temperature, leading to summer draught at different degree. According to statistics, summer drought of Chongqing caused direct economic loss of 190 million yuan RMB.

Gales and hails: The frequency of gales and hails increased compared with that of 2004, causing heavier economic losses. According to primary estimate, more than 90 county-times of the Three Gorges Reservoir areas were hit by local strong convection current weather such as gales and hails, leading to direct economic losses of 1.15 billion yuan.

Low temperature and freezing weather: Part of the Three Gorges areas experienced low temperature and freezing weather in late winter and early spring. The east part of the Three Gorges areas was experiencing continuous weather of low temperature with rains or snows during Feb. 1~19,

this has been the longest such weather in February since 1964. The temperature of some counties and cities of Yichang hit the lowest record of the same month over the past 40 years.

3.2 Terrestrial Plants in the Reservoir Area

The plant species of the Three Gorges Reservoir areas in 2005 remained the same level as that of 2004. There were 6,088 vascular plants in the project area, which belong to 208 families and 1,428 genuses. The forests of the Three Gorges Reservoir areas fall into 76 formations belonging to 15 formation groups. There were 26 formations of shrub vegetation, which were classified into 5 formation groups. There were 17 formations of grass vegetation, which were classified into 2 formation groups.

There were 56 precious, rare and endangered plant species in the Three Gorges Reservoir areas under national conservation program. Among them, 4 were listed as Class I, 23 as Class II and 29 Class III, accounting for 7.1%, 41.1% and 51.8% respectively. There was no obvious vertical distribution pattern for the precious, rare and endangered plant species in the Three Gorges Reservoir areas, which scattered in many habitats at 200~2700 m elevation. Most of them were distributed in forests or lived under trees. Human activities are one of major threats to those precious, rare and endangered plant species.

3.3 Terrestrial Wildlife in the Project Area

The findings of 1999~2005 investigation show that 194 species of terrestrial vertebrates live in the downstream valley of the Longhe River, first tributary of the Yangtze River. Among them, 3 species are the first-class national protected animals and 16 are second-class national protected animals. The breeding nests of 5 species of first and second class national protected animals such as *Aquila chrysaetos, Hieraaetus fasciatus, Ketupa flavipes, Falco peredrinus* and *Falco tinnunculus* are found in this region.

The investigation carried out in 2005 indicates that there are about 80 *Presbytis francoisi* that are first-class national protected animal under Special National Protection Program. They mainly distribute in the Furongjiang Valley bordering Wulong County and Pengshui County. There are 5 baby monkeys in the two *Presbytis francoisi* families under the track investigation of the current year. Among the two families, the members of the one living from Xuanba to Longdong waterfall increase from 6 to 8. And the members of the other family living from Tiaotang to Baichahe have increased from 10 to 13.

The investigation of water birds along the main stream of the Yangtze River and its main tributaries carried out in January of 2006 discovered large amount of nests of *Riparia riparia* at the alluvial bank of the Daning River in Wushan County. *Riparia riparia* is a kind of water-front habitat bird. Most *Riparia riparia* live at the bank of 139 m water table of the tail water of Dachang Town. However, after the impoundment of the Three Gorges Reservoir, 80% of the breeding places of *Riparia riparia* were inundated. There were only two breeding places left at the 145~160 m places, about 1,100~1,300 nests. With the completion of the Three Gorges Project and the impoundment, the habitat of *Riparia riparia* remain a focus of concern.

3.4 Fishery Resources and Environment

3.4.1 Fishery resources

The total fishing amount of the Three Gorges Reservoir, waters downstream the huge Dam, Dongting Lake, Boyang Lake and river mouth area in 2005 was 64,000 tons, similar to that of 2004. The fish fry flow of the "Four native fish species" at Jianli Cross-section and Wuxue Cross-section downstream the Dam continuously declined. The resources of parent crab and *coilia mystus* went up by different degree. But the resource of the output of eel fry in estuary area had some decline.

- **Reservoir areas**

The total fishery catch of the Three Gorges Reservoir in 2005 was 1,820 tons, 23% down compared with that of 2004. If we calculated the catch of individual species in the light of species composition in the reservoir, 340 tons were silver carp, 280 tons were bronze gudgeon, 219 tons

were large mouth bronze gudgeon, 190 tons were catfish, 164 were *pelteobagrus fulvidraco*，151 tons were carp and 69 tons grass carp.

The monitoring results of fishing catch showed that seven species including large mouth bronze gudgeon, bronze gudgeon, silver carp, *pelteobagrus fulvidraco*, carp, catfish and grass carp accounted for 78% of the total fishery catch and were major commercial species of the Three Gorges Reservoir waters. However the size of large mouth bronze gudgeon and catfish was still relatively small and their age was rather young. Among the catch, 85% of large mouth bronze gudgeon and 79% of catfish were only one-year old.

● Waters downstream the Dam

The total fishery catch of the waters downstream the Three Gorges Dam in 2005 was 1,970 tons, a reduction of 6% compared with that of 2004. Among them, the catch of catfish was 542 tons, bronze gudgeon 406 tons, carp 301 tons, *pelteobagrus fulvidraco* 177 tons and the "four major local species" 168 tons.

The catch monitoring results showed that bronze gudgeon, catfish, carp and *pelteobagrus fulvidraco* accounted for 72% of the total catch, which were still the major commercial fish species in the waters downstream the huge Dam.

● Spawning sites of the "Four Major Local Fishes"

The fish fry runoff of the "Four major local fishes" at both the Jianli Cross-section and Wuxue Cross-section was very low during May ~ June of 2005. It went down to 105 million, only 4.2% of the baseline figure before the impoundment, hitting the record low. The fish fry runoff of the "Four major local fishes" of Wuxue Cross-section was 716 million.

● Dongting Lake

The total catch of Dongting Lake was 23,600 tons in 2005, a reduction of 9% compared with that of 2004. Among them, 11,800 tons came from the east Dongting Lake, 6,900 tons from the south Dongting Lake, 4,900 tons from the west Dongting Lake, accounting for 50.0%, 29.2% and 20.8% of the total respectively.

There were 45 spawning grounds for carp and crucian with total area of 263 km^2, similar to that of last year. 13 of them were in the east Dongting Lake with an area of 132 km^2; 26 in south Dongting Lake with an area of 59 km^2, 6 of them in the west Dongting Lake with an area of 72 km^2. The population of carp spawning communities were 15,900 weighing 267 tons, down by 9.1% and 9.8% respectively compared with that of last year. A total of 4.618 billion eggs were produced, down by 8.3% compared with that of 2004. The population of egg-laying crucian carps was 405,000 weighing 108 tons, producing 4.063 billion eggs, all similar to that of 2004.

There were 34 feeding sites in the Dongting Lake with a total area of 686 km^2. 13 of which were in eastern part of the Dongting Lake with an area of 415 km^2, 16 in southern part of the Dongting Lake with an area of 98 km^2, and 5 in eastern part of the Dongting Lake with an area of 173 km^2. The species of fish in those feeding sites were mainly carp, crucian, catfish, *pelteobagrus fulvidraco*, the "four major local fishes", bighead and bream. The fish population in the Lake is 5.532 billion, 4% down compared with that of the last year.

● Boyang Lake

The total fish catch was 36,000 tons in Boyang Lake in 2005, 12% up than that of 2004. There were 33 spawning grounds for carps and crucians in the lake with an area of 321 km^2, up by 39.6% compared with that of the last year. A total of 4.25 billion eggs were produced, rise by 18.7% compared with that of the last year.

The area where fish could seek feed was 520 km^2 in the Lake, up by 20.9% compared with that of the last year. It was mainly distributed in the central and southern part of the Lake. The type of fish in the Lake were mainly carp, crucian, black carp, grass carp, silver carp, bighead, mandarin fish and catfish.

● Estuary Area

In 2005, the catch period of parent Chinese turtle crabs and eel was longer than that of 2004. The total catch days was less than in 2004. The catch period of *coilia mystus* was shorter than in 2004 but with same operation days.

The average catch of *coilia mystus* and parent Chinese turtle crabs per ship during the catch season was 4789.5 kg and 262.2 kg respectively, increase by 44.64% and 284.46 respectively. The total catch of the season was 814.2 tons for parent Chinese turtle crabs and 10,646.3 kg for *coilia mystus*, up by 8.8% and 482.82% respectively. Per ship catch of ell fry during the catch season was 15,615, down by 8.60% and the total catch of eel fry of the entire season reached 27.716 million, down by 22.31% compared with that of the last year.

3.4.2 Fishery Environment

In 2005, the authority established a total of 7 monitoring stations (Yibin, Banan, Wanzhou, Jingzhou, Yueyang, Hukou and Hekou) at the mainstream of the Yangtze River, Dongting Lake, Boyang Lake and Estuary Area and carried out environmental monitoring on major fishery waters of the Yangtze River basin and conducted water quality assessment in line with *Standards for Fishery Water Quality* (GB11607－89) . For the items not covered by the Standard, assessment was carried out according to the function class assessment of relevant water functions stipulated in Environmental Quality Standard for Surface Water. The findings indicated that the overall water quality of major fishery waters of the Yangtze River Basin was good in 2005 and could basically meet the requirements for the growth and reproduction of fishes. However, some waters were subject to pollution at some degree and major pollutants were petroleum, copper, total nitrogen and total phosphorus.

The water quality of the fishery waters of the upstream of the Yangtze River became better than in 2004 with evident reduction of the monitored concentration of petroleum and zinc. Major pollutant was copper, and permanganate index and zinc level exceeded the standard, too. Standard exceeding rate of copper concentration of the waters of Yibin during winter, fish breeding and growth (fattening) periods was 100%, and the standard exceeding rate of permanganate index during fish growth period was 50%. Standard-exceeding rate of copper concentration of the waters of Banan was 100%, so was zinc level during fish growth period. In Wanzhou waters, the standard-exceeding rate of copper concentration was 100%, too.

The water quality of the fishery waters of the mid-stream of the Yangtze River became better than in the last year with major pollutants being petroleum, total nitrogen and total phosphorus, etc. In Guanyinsi water area of Jingzhou, all monitored pollutants did not exceed the standard during winter, but the concentration of petroleum in 66.7% samples went beyond relevant standard in breeding period. During the fattening period, 16.7% of the non-ionic ammonia sample, 83.3% of copper samples and 33.3% of petroleum samples exceeded relevant standard. In Zhicheng water area of Jingzhou, all monitored pollutants did not exceed relevant standard, and petroleum pollution went down as compared with last year. In Yueyang water area, total nitrogen level of 100% samples exceeded relevant standard during winter, fish breeding and growth periods, and total phosphorus level and petroleum level of 100% samples taken during fish fattening period went beyond relevant standards. In Hukou water area, copper-concentration exceeding environmental standard rate was 100% during egg-laying period and 66.7% during winter and fattening period. Compared with last year, petroleum and non-ionic ammonia pollution enjoyed a remarkable reduction.

In May and June, the concentration of petroleum of 8.3% water samples and cooper level of 4.2% samples taken from the egg-laying places of the “four major local fishes” exceeded relevant standard. The monitored value of copper and petroleum levels of individual monitoring stations had some rise compared with that of the last year. In November, all the monitored pollutants of the egg-laying grounds of Chinese sturgeon in water area of Yichang met environmental standard. The monitored level of petroleum had an evident reduction compared with that of the last year.

Major pollutants in fishery waters of Dongting Lake were total nitrogen (TN) and total phosphorus (TP). Copper pollution was lessened compared with in 2004. TN level of 75.0% water samples and TP level of 91.7% of water samples taken in winter exceeded environmental standard. During egg-laying period, TN and TP of 100% water samples went beyond the standard, and the concentration of 10% water samples exceeded relevant standard. During fish fattening period, the

concentrations of non-ionic ammonia and petroleum of 20% samples went beyond relevant standard, and the TN level of 90% samples and TP level of 100% samples exceeded relevant standards.

Major pollutants in fishery waters of Boyang Lake was total phosphorus (TP), its pollution worsened compared with that in 2004. While the pollution caused by non-ionic ammonia had some reduction. In 100.0% of the water samples taken during fish egg-laying, fattening and winter periods, TP concentration went beyond relevant standard. The concentration of copper of 66.7% samples taken during winter and 33.3% samples taken during fattening period went beyond the standard.

For the fishery waters of Hekou Area (estuary) of the Yangtze River, standard exceeding rate of petroleum, TN and non-ionic ammonia was 33.3%, 100.0% and 16.7% respectively during the catch season of ell fry. During the catch season of *coilia mystus*, volatile phenol and copper concentration of 16.7% water samples exceeded relevant standard, and TN concentration of 100.0% of samples went beyond relevant standard. During the catch season of parent Chinese turtle crabs, zinc and TN concentrations of 100.0% of the water samples went beyond the standard.

3.5 Unique Fishes and Rare Aquatic Animals

3.5.1 Unique fishes in the upper reaches of the Yangtze River

In 2005, monitoring work was carried out at such places as the mid reaches of Jinshajiang River, Lijiang River section, Yongsheng section, Panzhihua section, Yibin section, Hejiang section, lower reaches of Wujiang River, Wanzhou section and Yichang section, a total of 117 species (sub-species) of fishes were collected, including 26 unique fishes in the upper reaches of Yangtze River.

Judging from the species composition of the catch, unique fishes took a big proportion in each section of the mid reaches of the Yangtze River. In Yongsheng section, Lijiang section and Panzhihua section of the mid reaches of Jinshajiang River, though fish species were not many, unique species took up relatively big proportion. Among 13 fish species caught at Yongsheng section, 6 were unique species, taking up 46.2%. All 6 species of fish caught at Lijiang section were unique species. Among 25 fish species caught at Panzhihua section, 8 were unique species, accounting for 32%. In Yibin section of the lower reaches of the Jinshajiang River, 9 of 44 fish species caught were unique species, accounting for 20.5%. 51 species of fish were caught in Hejiang section of the upper reaches of the Yangtze River, 14 of which were unique species, taking up 27.5%. Among 48 species of fish caught in the lower reaches of Wujiang River, the biggest tributary at the right of the Yangtze River, 10 were unique species, taking up 20.8%. In Wanzhou section of the Three Gorges Reservoir area, 44 species were caught, 8 of which were unique species, accounting for 18.2%. In Yichang section downstream the Three Gorges Dam, 65 species of fish were caught, 6 of which were unique species, taking up 9.2 of the total.

Judging from the size, weight, gender ratio and age structure, unique fish resources, which were the main fishery target, showed some trend of younger age and smaller size. For example, the fish population of large mouth bronze gudgeon of Yichang section downstream the Dam was dominated by the 3~6 year's old with insufficient amount of 1~2 year's old fish reserve. The weight and amount of fish catch showed that the proportion of unique species of Wanzhou section and Yichang section had some decrease compared with that of past years.

Six new species of fish including minnow, *Ictalurus punctatus,* black bullhead, *Micropterus salmoides, Protosalanx hyalocranius* and bluntnose black bream were discovered in the Three Gorges Reservoir areas, which have not been caught before. They probably were individual fish escaping from fish farm. Among them, the former four were introduced from foreign countries. The last two species do not have their natural habitat in the Three Gorges Reservoir areas. Therefore, whether these exotic fish can have natural reproduction and impose any negative impacts on native fish population requires further study.

3.5.2 Rare and precious fish species

In 2005, the spawning sites of Chinese sturgeon (*Acipenser sinensis*) remained in the river section between Miaozui and Gezhou Dam about 5.5 km, most eggs were laid between the phosphorus fertilizer plant and Miaozui, mainly distributed the right side of the mainstream of the Yangtze River. Downstream Miaozui, the section between Mojishan to Wulongjiang and Huyatan

were not found egg-laying by Chinese sturgeon. There was only once egg-laying occurred on November 9 with the amount about 6,064,000. It is estimated that 10 female Chinese sturgeons had produced eggs.

Sonar detection indicated that Chinese sturgeons distribute between Gezhou Dam to Gulaobei section, concentrating between the Dam and Miaozui with 12 fish detected. It is estimated that the breeding population of Chinese sturgeon in 2005 was about 235 before egg-laying and 157 after egg laying activities. This amount had some increase compared with that of the last year.

The appearance and staying period of young Chinese sturgeons at the river month of the Yangtze River ranged from May to August, mainly occurring in the waters between Tuanjiesha of the east beach of Chongming and Dongwangsha. During June ~ August, Young Chinese Sturgeons Protected Area at Chongming Island of Shanghai received 298 young Chinese sturgeons accidentally caught by fishermen, it is estimated that 2 of which were not from natural reproduction.

In 2005, there was no accidental catch of Chinese sturgeons in the waters from the mid and lower reaches of the Jinshajiang River to the river mouth of the Yangtze River. On June 30, one young Chinese sturgeon was accidentally caught at Yichang section. In autumn, one adult Chinese sturgeon was caught at Yichang downstream of the Gezhou Dam; 12 *Myxocyprinus asiaticus* were caught by accident between Wanzhou and Yichang section, one caught in Wanzhou was returned to the Yangtze River, another 11 caught between Zigui section and Zhijiang section were artificially bred in Yichang for artificial reproduction. There was record of accidental catch of rare and precious fish species in other sections of the Yangtze River.

3.6 Agricultural Ecology

Surveys were conducted in 181 towns and villages of 19 counties (cities) in the Three Gorges Reservoir areas in 2005, the same as that of the previous year.

3.6.1 Ecological environment of the farmland

The survey results showed that environmental pressure on the ecology of farmlands in the reservoir area in 2005 was increasing with slowdown in such activities as upgrading slope land into terrace farmland and “grain for green”. With continuous reduction of arable land area and the total sowing area of cops, the contradiction between many farmers and less land resources became more striking. Agricultural production kept its priority on grain crops and its percentage in total agriculture produce enjoyed some increase.

In 2005, the total area of arable land in the Reservoir area was 192,110 ha, 3.6% less than the previous year. Among them, 16.5% of the land had the slope more than 25^{o}. There were 393,480 ha forest land, down by 1.5% compared with that of 2004. There were 61,760 ha orchard, up by 10.1%. Tea garden area was 8850 ha with a reduction of 3.3%. A total of 25,320 ha farmland with the slope more than 25^{o} had been restored to its original forest or grassland.

The multiple crop index was 253.0. The total agricultural sowing area was 502,350 ha, down by 0.1% compared with that of the last year. Among the total sowing area, 371,090 ha were for grain crops and 131,260 ha for economic crops, taking up 73.9% and 26.1% of the total respectively. Compared with the last year, the percentage of grain crops went up by 2.5 percentage points.

There were 81,330 ha paddy fields and 110, 780 ha dry land, accounting for 42.3% and 57.7% of total arable land. The percentage of paddy fields went up by 0.4 percentage points compared with that of 2004. As to the farming system, paddy fields were dominated by two-crop system, accounting for 59.1% of the total, down by 0.9 percentage points than that of the previous year. Dry land mainly practiced the three-crop system, accounting for 62.2.0% of the total, up by 6.2 percentage points compared with that of 2004.

3.6.2 Rural energy

In 2005, the energy structure in rural areas of the Three Gorges Reservoir area continued its improvement. Energies for rural households were still mainly derived from direct burning of firewood and stalks while the energy percentage from small hydro-power stations and mash gas generation kept on rising. Among all kinds of rural energy, direct burning of firewood and stalk

constituted the largest proportion at around 71.8%, followed by small coal pits being 20.4%, marsh gas 5.6%, and small hydro-power stations 2.2%. Compared with the previous year, direct burning of firewood and stalks went down by 4.6 percentage points, while the percentage of small coal pits, small hydropower stations and marsh gas increased by 4.0, 0.5 and 0.1 percentage points respectively.

With more input of the State in the development of ecological environment of the Three Gorges Reservoir, especially the development of eco-village based on marsh gas utilization and widespread application and extension of highly efficient ecological agriculture technique, the application of march gas enjoyed rapid development. In 2005, 1.367 million rural households of the Three Gorges Reservoir areas utilized marsh gas with the development of 81,804 marsh gas generating pits and annual output of 32.492 million m^3 of such gas, up by 0.7%, 1.6% and 8.4% respectively as compared with that of 2004.

3.6.3 Crop plant diseases and insect pests

The total area affected by plant diseases and insect pests in 2005 had certain drop compared with that of 2004. Plant diseases and insect pests prevention and control rate enjoyed a dramatic rise. But the actual losses were alleviated, and the area involved in prevention and control of plant diseases and insect pests increased with some more damages and actual losses. There was no outbreak or great imperil of certain plant disease or insect pests, and no new plant disease or insect pest was observed.

The total cropland area suffering from plant diseases and insect pests was 479,880 ha·times, 308,770 ha·times of which were affected by insect pests, and 171,110 ha·times by plant diseases, down by 31.4%, 27.6% and 37.2% respectively compared with that of 2004.

The area involved in the prevention and control of plant diseases and insect pests reached 452,150 ha·times, among which 291,390 ha·times were for the prevention and control of insect pests and 160,760 ha·times for the prevention and control of plant diseases, down by 24.5%, 20.2% and 31.1% respectively in comparison with the previous year. The prevention and control rate for plant diseases and insect pests was 94.2%, up by 8.6 percentage points. The actual loss of grain production amounted to 44,823.4 tons, 142,385.6 tons of potential grain losses were averted, up by 11.9% and 3.3% respectively compared with that of the previous year.

Table 3-2 Statistics on the occurrences of major plant diseases and insect pests in the Three Gorges Reservoir area in 2005

Types of plant diseases and insect pests	Area affected (100 ha·times)	Area for prevention and control (100 ha·times)	Losses recovered (t)	Actual losses (t)	Degree
Paddy stem borer	835.89	862.25	18686.05	6576.42	Heavier than medium
Piricularia oryzae	236.94	300.24	28830.08	9119.52	Heavier than medium
Corn northern leaf blight and corn southern leaf blight	169.0	118.3	1300.03	808.97	Medium
Osmotin HarpinEa	155.9	106.9	6383.54	3144.97	Heavier than medium
Corn sheath blight	345.2	299.1	7206.96	2034.15	Heavier than medium
Rat	1290.91	750.98	19273.01	17072.11	Medium

3.7 Geological Disasters in the Reservoir Area

3.7.1 Earthquakes

In 2005, a total of 905 earthquakes measuring at $M_L \geqslant 0.0$ occurred from the head to the middle areas of the Three Gorges Reservoir (from 108°20′ to 112°00′ east longitude and 29°55′ to 31°45′ north latitude). Among these earthquakes, 431 quakes measuring at $0.0 \leqslant M_L < 0.9$, 405 at $1.0 \leqslant M_L < 1.9$,

67 at 2.0≤M_L<2.9 and two at 3.0≤M_L<3.9. The largest earthquake, which measured at M_L=3.5, occurred in Dongxiangkou, Badong County at 15:30, September 22, 2005.

After the second-stage impoundment, slight earthquakes in the Three Gorges Reservoir areas basically concentrated on Wushan-Badong-Zigui-Changyang region. The quake intensity remained at the normal low level except evident increase of the frequency.

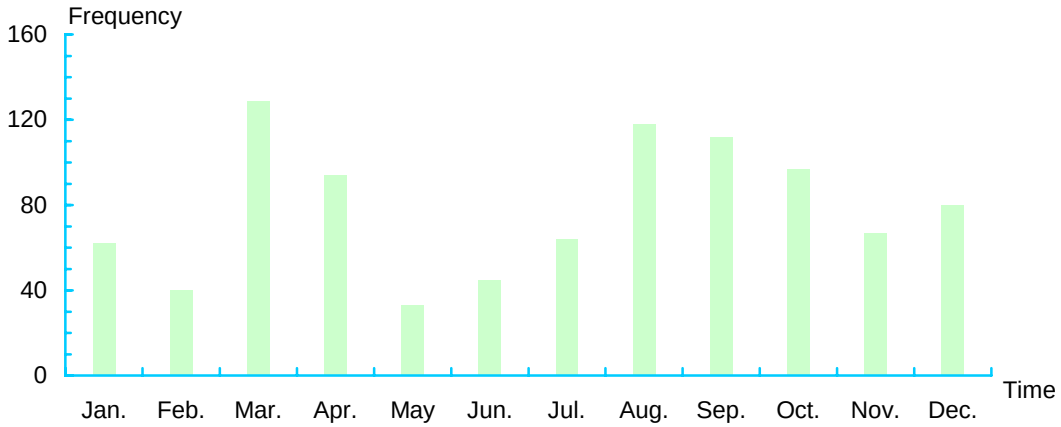


Figure 3-3 Earthquake occurrences from the head to central parts of the Reservoir area

3.7.2 Collapses, landslide and mud-rock flow

● Monitoring and early warning

During 2005, most places subject to collapses and landslide enjoyed relative good stability. Professional monitoring found that there were 22 collapses and landslide with evident distortion at site, accounting for 17% of the total professional monitored results. Among them, 6 occurred at the Three Gorges Reservoir areas in Hubei Province and 16 in Chongqing Municipality. The authority issued early warning to 5 of the above collapses and landslides, facilitating the timely evacuation of the local communities under threat. 18 collapses and landslides were found by local non-professional monitoring, prevention and early warning system, this has ensured the safety of more than 1000 local residents and their properties. Among them, the landslide at Bazimen at the right bank of the river mouth of the Xiangxihe River, Zigui County of Hubei Province was quite typical with a volume of 5.1 million m^3. The sliding materials were Quaternary loose rock and earth with the bed being Jurassic sandstone and mudstone. After the establishment of the Gezhouba Water Control Project, the impoundment has submerged the front with obvious deformation of the landslip. When the impoundment of the Three Gorges Reservoir reached 139m, the lower part of the landslip was inundated with further reduction of stability. In order to ensure the safety of local communities and road in vicinity of the landslide area, a comprehensive professional monitoring network including GPS absolute displacement, deep displacement of drill tiltmeter, Slope thrust and the dynamics of groundwater has been set up and a mass monitoring and preventing system put in place with remarkable achievements. After 10 households were removed in 1998 to avoid the potential disaster, local government arranged emergency removal of 170 people of another 49 households in response to early warning, this has ensured the safety of the lives and properties of local communities.

● Prevention and control projects

In 2005, the Geological Collapse and Landslide Disaster Prevention and Control Project (phase III) of the Three Gorges Reservoir area entered the stages of overall survey, design, and the review, assessment and approval of project outcomes. These projects included emergency treatment of 195 collapse and landslide sites (65 in Hubei, 130 in Chongqing), emergency repair of the collapses of 227 sections of bank (bank rebuilt) with a total length of 92.8 km (67 sections in Hubei with a length

of 26.5 km, 160 sections in Chongqing with a length of 66.3 km) and removal and protection project for steep bank slope, which have laid a good foundation for the implementation of the project. Meanwhile, Hubei Province, Chongqing Municipality and each district and county of the reservoir area began the repair, maintenance and outcome supervision on the finished second-stage prevention and control project and carried out the final check and approval of such projects at district (county), province (big city) and State level. The check and approval authority considered that all the geological disaster prevention and control projects are playing an important role in environmental protection and ecological conservation with good effects.

Chapter 4 State of Pollution Sources Discharge

4.1 Investigation and Monitoring on Key Industrial Wastewater Pollution Sources

According to the environmental statistics of 2005, the total amount of industrial wastewater of the Three Gorges Reservoir areas amounted to 574 million tons. Among them, the industrial wastewater from major downtown areas in Chongqing Municipality constituted the largest proportion of 549 million tons, taking up 95.6% of the total, and the amount from the Reservoir area of Hubei Province reached 25 million tons, taking up 4.4%. In the industrial wastewater, there were 77,100 tons of COD (chemical oxygen demand) and 5800 tons of ammonia nitrogen.

Table 4-1 The amount of industrial wastewater from the Three Gorges Reservoir areas

Area	Wastewater (100 million t)	COD (10,000 t)	Ammonia nitrogen (10,000 t)
Hubei area	0.25	0.06	----
Chongqing area	5.49	7.65	0.58
Total	5.74	7.71	0.58

4.2 Investigation and Monitoring on Urban Sewage

Environmental data of 2005 showed that a total of 409 million tons of sewage were discharged in the Reservoir area. Among them, the discharge volume of the areas of Chongqing Municipality topped the list at 395 million tons, taking up 96.6% of the total, and the amount from Hubei area reached 14 million tons, accounting for 3.4%. In all the urban sewage, there were 92,600 tons of COD and 9400 tons of ammonia nitrogen.

Table 4-2 The Amount of urban sewage from the Three Gorges Reservoir areas

Area	Wastewater (100 million t)	COD (10,000 t)	Ammonia nitrogen (10,000 t)
Hubei area	0.14	0.24	0.02
Chongqing area	3.95	9.02	0.92
Total	4.09	9.26	0.94

4.3 Monitoring of Pesticides and Chemical Fertilizers

In 2005, investigation results on the utilization of pesticides and chemical fertilizers in 156 towns and villages of 19 counties in the Reservoir area showed that the application of chemical fertilizers per unit area remained at high level and was still on the rise. Per unit application amount of pesticides increased at relatively large margin.

4.3.1 Chemical fertilizers

In 2005, calculated by the percentages of pure nitrogen, P_2O_5, and K_2O contained respectively in the three kinds of fertilizers, up to 88,400 tons chemical fertilizers were applied in 156 towns and villages of the Reservoir area, 58,500 tons of which were nitrogen fertilizer, 19,600 tons were phosphorus fertilizer and 10,300 tons of potash fertilizer. The total application of chemical fertilizers went down by 2.4% compared with that of the previous year. Among them, the application of nitrogen fertilizer cut by 3.6%, phosphorus fertilizer down by 3.2% and potash fertilizers up by 8.3%.

The fertilizers applied in the Reservoir area were still dominated by nitrogen ones. The ratio among consumed nitrogen fertilizer, phosphate fertilizer and potash fertilizer was 1:0.33:0.18, witnessing certain degree of improvement than in 2004. This indicated that fertilizer application ratio was developing in an appropriate way.

4.3.2 Pesticides

In 2005, a total of 541.05 tons pesticide equivalents were applied in 156 towns and villages of the Reservoir area including 257.64 tons of organic phosphorus pesticides, 136.45 tons of organic nitrogen, 48.55 tons of trifluorocypermethrin pesticides, 38.24 tons of herbicides and 60.17 tons of other pesticides. Compared with that of the previous year, the application of pesticide equivalents was 3.11 kg/ha, down by 4.6%.

The application percentage of organo-phosphorus pesticides dropped in the Reservoir area at 47.6% of the total, indicating further improvement of the pesticides application structure in the Reservoir Area.

4.4 Monitoring of Mobile Pollution Sources

There were nearly 130 shipping companies in the Reservoir area in 2005, no obvious change compared with that of 2004. There were more than 9,000 registered shipping vessels, less than that of 2004. The major underlying reason for the drop was the reduction of the amount of small ships and non-mechanically propelled boats while the number of big cargo ships increased.

4.4.1 Ship transportation

In 2005, the Three Gorges Dam permanent ship lock operated for accumulated 8,336 times passing through a total of 63,949 ship-times, which transported 1.88 million person-times and 32.91 million tons of cargo, which was 95.6%, 85.2%, 108.7% and 95.9% of the same period of 2004. The lock of Gezhouba Dam had an operation of 16,966 times with 68,473 ships passing through bearing the passenger load of 1.69 million person-times and cargo load of 35.415 million tons, which was 110.7%, 90.9%, 110.5% and 116.4% of the same period of 2004 respectively.

In Chongqing Municipality, Fuling District and Wanzhou District of the Three Gorges Reservoir Area, large and medium-sized ports saw a passenger flow of 9.89 million person-times, 13.6% less than that of the same period of 2004 and a cargo flow of 36.51 million tons, up by 16.3% compared with that of the previous year. The main reason for the reduction of ship passengers was the diversion of passengers due to the rapid increase of the capacity of air, railway and road that are must faster means of transportation.

4.4.2 Oil-containing wastewater from shipping vessels

Investigations on oil-polluted water from ships of the Reservoir areas in 2005 showed that, among the 483 ships, 96.9% had installed oil-water separator with the utilization rate of 86.3% and up-to-the-standard rate of 80.9%. The overall situation was similar to that of 2004.

In 2005, a total of 496,900 tons of oil-containing wastewater were discharged by ships in the Reservoir area, down by 6.2% than that of the previous year. Among them, 454,100 tons were treated with the treatment rate at 91.4%. A total of 400,100 tons discharged wastewater met the standard with the up-to-the-standard rate of 88.1%. In all the oil-containing wastewater, the discharge of petroleum reached 40.46 tons, cut by 8.0% compared with that of 2004. Of all kinds of shipping vessels, the oil pollutant discharged by cargo ships, passenger ships, tugboats, other ships and cruise ships were 33.06 tons, 5.78 tons, 0.87 ton, 0.66 ton and 0.09 ton respectively, accounting for 81.7%, 14.3%, 2.2%, 1.6% and 0.2% of the total respectively. Cargo ships remained as the dominant type of ship causing water pollution in the Reservoir waters.

4.4.3 Domestic wastewater from ships

In 2005, the findings of investigation on the discharge of domestic wastewater from the ships of the Reservoir area showed that the domestic sewage of the 6 of 30 ships under monitoring was treated and met discharging standard. While the sewage from the remaining 24 ships discharged into the waters without any treatment, the concentration of each pollutant obviously exceeded the standard with E.coli the worst.

According to estimate, the total amount of ship domestic wastewater of the Reservoir area was about 2.068 million tons in 2005, up by 9.0% compared with that of the previous year. However, only 36,000 tons of such wastewater went through treatment with the treatment rate of 1.7%. Most

such wastewater directly discharged into the Reservoir. A total of 1,198.5 tons of domestic sewage pollutants had been discharged into the Reservoir area. Among them, 366.0 tons were SS, 287.5 tons were BOD_5, 483.9 tons were COD, 6.08 tons were total phosphorus and 55.0 tons of total nitrogen, taking up 30.5%, 24.0%, 40.4%, 0.5% and 4.6% of the total respectively. Among these pollutants, the top two were BOD_5 and COD.

Table 4-3 Discharge of oil-containing wastewater from shipping vessels in the Three Gorges Reservoir area

Ships		Oil-containing wastewater						Petroleum	
Type	Amount	Discharge amount (10,000 t)	Percent (%)	Disposed amount (10,000 t)	Treatment rate (%)	Up-to-standard discharge amount (10,000 t)	Up-to-standard rate (%)	Discharge amount (t)	Percent (%)
Cruise ship	52	1.33	2.7	1.33	100.0	1.29	97.0	0.09	0.2
Passenger ship	1872	15.31	30.8	13.94	91.0	11.84	85.0	5.78	14.3
Cargo ship	2830	23.35	46.9	20.79	89.0	17.71	85.0	33.06	81.7
Tugboat	381	7.14	14.4	6.96	97.0	6.92	99.0	0.87	2.2
Other ships	946	2.56	5.2	2.39	93.0	2.25	94.0	0.66	1.6
Total	6081	49.69	100.0	45.41	91.0	40.01	88.0	40.46	100.0

4.4.4 Garbage on ships

In 2005, seven garbage collection sites were set up in some ports of the Three Gorges Reservoir areas, equipped with six garbage collection ships. A total of 6,321 tons of garbage was collected throughout the year, up by 28.0% compared with that of 2004.

4.4.5 Ship pollution accidents

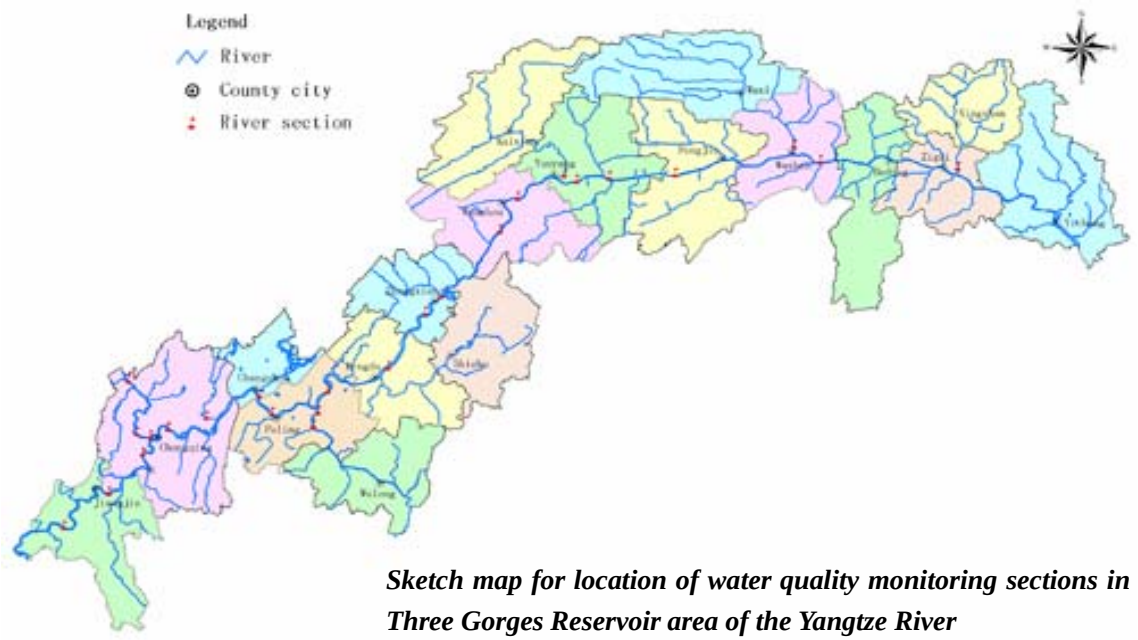
In 2005, the Three Gorges Reservoir area saw 15 pollution accidents. Among them, 4 were very severe accidents, 5 were severe, 2 general and 4 light ones. They accounted for 26.7%, 33.3%, 13.3% and 26.7% of the total respectively. These pollution accidents had caused 11 ship sunk, 15 death with economic loss of 3.98 million yuan, similar to that of the previous year.

Chapter 5 Status of Water Environmental Quality

In 2005, the monitoring of water quality of the mainstream and tributaries of the Yangtze River, early-warning monitoring for water blooms during sensitive period as well as monitoring of pollution belts in riverbanks constituted all components of water environmental quality monitoring work in the Three Gorges Reservoir area. The assessment and testing method of water quality were conducted in accordance with the *Standards for the Quality of Surface Water Environment* (GB3838 －2002), whereas the assessment of nutrition status of water body was carried out according to *Technical Regulations on the Assessment Method and Classification for Eutrophication of Lakes (Reservoirs)*, which is formulated by China National Environmental Monitoring Center.

5.1 Monitoring of Water Quality of the Reservoir

In 2005, a total of 13 monitoring sections were set up in the Reservor areas, 6 were along the mainstream of the Yangtze River, and 7 were established along the primary tributaries of the Yangtze River. The location of the mainstream sections were at Zhutuo, Tongguanyi and Cuntan of Chongqing, Qingxichang in Fuling, Tuokou in Wanzhou and Guandukou in Badong. The locations of the tributary monitoring sections included Beibei at the Jiangling River, Linjiangmen, Wujiangwulong, Yulinhekou, Pengxihekou, Daninghekou and Xiangxihekou. Water quality assessment included 13 items such as pH value, disolved oxygen, permanganate index, BOD_5, ammonia nitrogen, petroleum, total phosphorus, mercury, cadmium, arsenic, copper, lead and hexavalent chromium.



Sketch map for location of water quality monitoring sections in Three Gorges Reservoir area of the Yangtze River

5.1.1 Monitoring of the water quality of the mainstreams of the Yangtze River in the Reservoir Area

In 2005, water of river sections in the mainstream of the Yangtze River of the Reservoir area enjoyed relatively good quality with all 6 sections meeting Grade III national surface water quality standard. No case of inferior to Grade V standard were observed during each month.

From May to September, some pollutants of 5 monitoring sections went beyond water quality standard but Guandukou Section, which still met Grade III standard. The pollution was striking during July and September. Total phosphorus, lead and permanganate index were the major pollutants failing to meet the standards. The water quality of these sections could meet or superior to Grade III quality standards in other months.

Table 5-1 Water quality of the mainstreams of the Yangtze River in Three Gorges Reservoir Area in 2005`

Section	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Whole year
Zhutuo	III	III	III	III	III	III	V	IV	IV	III	III	III	III
Tongguanyi	III	III	III	III	III	III	V	IV	IV	III	III	III	III
Cuntan	III	III	III	III	IV	IV	V	V	IV	III	III	III	III
Qingxichang	III	III	III	III	IV	IV	V	V	IV	III	III	III	III
Tuokou	III	III	III	III	III	III	V	IV	IV	III	III	III	III
Guandukou	III	II	III	III	III	III	III	III	III	III	III	III	III

5.1.2 Monitoring of Water Quality of Tributaries of the Yangtze River in the Reservoir Area

In 2005, tributaries of the Yangtze River in the Reservoir area had relatively poor water quality, no monitoring sections met Grade I and II standard, 3 sections meeting Grade III water quality standard and 4 meeting Grade IV standard, accounting for 42.9% and 57.1% respectively. Among them, the water of Beibei, Wulong and Linjiangmen sections met Grade III standard. While the sections of Yulin River Mouth (RM), Pengxi River Mouth, Daning River Mouth and Xiangxi River Mouth, only met Grade IV water quality standard due to the concentration of total phosphorus.

Table 5-2 Water quality of the primary tributaries of the Yangtze River in Three Gorges Reservoir Area in 2005

Section	River name	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Whole year
Beibei	Jialing	III	III	III	III	III	III	V	III	III	IV	III	III	III
Linjiangmen	Jialing	III	III	IV	III	III	III	V	III	III	III	III	III	III
Wulong	Wujiang	II	III	III	III	III	III	III	III	III	III	III	III	III
Yulin RM	Yulin	III	III	III	III	IV	V	IV	V	IV	IV	IV	III	IV
Pengxi RM	Pengxi	IV	IV	IV	III	IV	IV	IV	III	III	IV	III	IV	IV
Daning RM	Daning	IV	IV	IV	IV	IV	III	III	IV	IV	IV	IV	IV	IV
Xiangxi RM	Xiangxi	IV	IV	IV	IV	IV	IV	IV	IV	V	IV	IV	IV	IV

5.2 Early Warning Monitoring of Water Blooms in the Reservoir Area and Emergency Monitoring

5.2.1 Early warning monitoring of water blooms

In 2005, early warning monitoring on water blooms at the back water areas of 13 primary (or Class I) tributaries of the Yangtze River in the Chongqing area of the Three Gorges Reservoir was carried out. 26 monitoring sections were established in the 13 Class I tributaries with one section in the middle and one section at the end of each tributary. The assessment of comprehensive nutrition status of the water body included 5 items such as chlorophyll a, total phosphorus (TP), total nitrogen, transparency and permanganate index.

The monitoring results indicated that during March-May and September-October of 2005, 12.5% (March), 23.1% (April), 19.2% (May), 19.2% (Sept.) and 7.7% (Oct.) of the sections of the

back water areas of the Class I tributaries of Chongqing Reservoir area was under eutrophication. Among the eutrophicated sections, the water of Nanmenkou Section at the Zhuxi River of Wanzhou District and Daocheba Section of Shennuxi Brook of Wushan County were under very serious eutrophication.

Table 5-3 Synthetical nutrition status of the water bodies of the backwater area in the Yanze River

Nutrition staus	Mar.		Apr.		May		Sept.		Oct.	
	Section amount	Proportion (%)	Section amount	Proportion (%)	Section amount	Proportion (%)	Section amount	Proportion (%)	Section amount	Proportion (%)
Oligotrophic	6	25.00	6	23.08	4	15.38	5	19.23	5	19.23
Mesotropher	15	62.50	14	53.85	17	65.38	16	61.54	19	73.08
Light eutropher	1	4.17	3	11.54	3	11.54	4	15.38	2	7.69
Middle eutropher	1	4.17	1	3.85	1	3.85	1	3.85		
Hyper eutropher	1	4.17	2	7.69	1	3.85				
Total	24	100.0	26	100.0	26	100.0	26	100.0	26	100.0

5.2.2 Emergency monitoring of water bloom

In 2005, many water blooms at different degree occurred in the backwater areas of some Class I tributaries of the Yangtze River of the Reservoir areas. The environmental monitoring stations of the Reservoir areas at different levels carried out emergency site monitoring activities in time. The monitoring outcomes of Chongqing Environment Monitoring Center and the Water Environmental Monitoring Center of the Yangtze River Basin showed that the occurrences of water blooms were relatively concentrated during March and July.

In early March of 2005, water blooms happened in the Baolong River and Daxi River in Wushan County with about 3 km section of the former and 5 km of the latter under moderate eutrophication. During the mid 10-day of March, water blooms occurred at the Baolong River, Daxi River and Daning River of Wushan County and the Tongzhuang River, Chixi River of Zigui County and waters near Muyu Island near the Dam. Among them, the infected length was about 5 km for the Baolong River under moderate eutrophication, 7 km for the Daning River under light eutrophication and 5 km for the Daxi River under moderate-to-severe eutrophication. The water of the Tongzhuang River, Chixi River and waters near Muyu Island of Zigui County became brown. During the late 10 days of March, water blooms occurred in the Baolong River and Shennu Brook of Wushan County, Modao Brook, Tangxi River, Pengxi River, Changtan River and the Bajiao of the Yangtze River in Yunyang County with the infected length of about 4.0 km, 2.5 km, 3.0 km, 2.5 km, 3.0 km, 1.5 km and 1.0 km respectively, the water of such sections was under moderate to severe eutrophication.

In April, *dinophyceae* water bloom occurred at the Meixi River, its water showing the color of soy sauce with *Peridiniopsis sp*. in dominance 3.0×10^7 /L. During late April and the first 10 days of May, the Rangdu River in Wanzhou District experienced a water bloom with moderate eutrophication. In the first 10 days of May, water blooms also occurred in the Meixi River, Zhuyi River and Caotang River of Fengjie County with the water under light to moderate eutrophication. In the last 10 days of May, the water of the Meixi River was under moderate eutrophication again.

In July, blue algae water blooms occurred at Xiangxi River. The water of the river showed blue-green color with strong stinky smell. The dominant algae species was *Oscillatoria sp.* with the density of 1.1×10^8 /L of such algae cells.

Chapter 6 Environmental Quality in Construction Areas

6.1 Hydrological and Meteorological Conditions

6.1.1 Hydrological characteristics

In 2005, actual statistics from Huanglingmiao Hydrological Station downstream the Three Gorges Pivotal Project indicated that the annual average flow was 14,600 m^3/s with the maximum of 47,900 m^3/s on July 10 and the minimum of 3,680 m^3/s on February 18. The annual average sediment discharge rate was 3.27 t/s, and the average sand concentration was 0.224 kg/m^3. The maximum average sand concentration in the monitored section was 1.43 kg/m^3 occurring on August 21, and the minimum was 0.001 kg/m^3 on Feb.9 and December 25. Compared with the previous year, the annual average flow, annual average sediment discharge rate and average sand concentration increased to some extents.

Table 6-1 Monthly statistics of water flow of Huanglingmiao Hydrological Station in 2005

Unit: m^3/s

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Average	4990	4390	5460	7120	13100	17600	28800	36500	22800	17800	9400	5650
Maximum	6230	7790	8130	10000	20000	24900	47900	47500	47200	33100	14600	7480
Minimum	4140	3680	4120	4940	7140	12800	16400	24600	14000	13200	6170	4070

Table 6-2 Monthly statistics of sand concentration of Huanglingmiao Hydrological Station in 2005

Unit: kg/m^3

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Average	0.002	0.002	0.003	0.004	0.011	0.034	0.392	0.540	0.237	0.075	0.015	0.003
Maximum	0.003	0.004	0.003	0.005	0.023	0.060	0.965	1.430	0.487	0.243	0.024	0.007
Minimum	0.002	0.001	0.002	0.003	0.003	0.014	0.035	0.178	0.049	0.013	0.006	0.001

6.1.2 Meteorological characteristics

In 2005, the climate in the Three Gorges Reservoir Area was characterized by mild weather with less rainfall and higher-than-normal temperature. The temperature of most months of the year turned out to be normal. The precipitation was less than historical average.

● Precipitation

The annual precipitation in the construction area totaled 984.6mm, 14.7% less than the historical average. The annual precipitation was quite uneven in the twelve months mainly dominating from May to September. The maximum daily rainfall reached 137.0 mm on July 10. The longest consecutive rainy days across the year reached 11 days occurring in August and the longest non-precipitation consecutive period lasted for 28 days occurring in December. A total of 34 days experienced thunderstorms in the whole year.

● Temperature

The annual average temperature in the construction area was 17.0℃, 0.2℃ lower than the historical average. The highest temperature reached 40.8℃ on July 4, and the lowest temperature was -2.4℃ on January 1.

● **Wind speed**

The annual average wind speed was 1.4 m/s with the extreme speed hitting 16.8 m/s on August 13. The wind direction changed frequently over the year with the dominant wind direction of NNW, accounting for 20% of the total.

Table 6-3 Statistics of important meteorological elements in the Three Gorges Dam Area in 2005

Month		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Whole year
Temperature	Temperature (℃)	4.8	4.4	11.2	19.8	21.6	26.8	28.5	25.2	23.6	17.5	14.0	7.0	17.0
	Difference to the historical average (℃)	-1.0	-3.6	-0.5	2.0	-0.2	1.6	1.0	-1.5	0.3	-0.2	1.3	-0.8	-0.2
Precipitation	Precipitation (mm)	12.1	36.1	31.4	45.6	124.5	63.3	229.8	266.2	94.2	63.7	12.3	5.4	984.6
	Difference to the historical average (%)	-10.6	1.1	-20.6	-39.3	-23.2	-86.6	25.0	64.8	-4.6	-28.2	-33.1	-14.5	-169.8
Wind speed	Average (m/s)	1.7	1.6	1.6	1.5	1.1	1.3	1.3	1.1	1.1	1.3	1.4	1.5	1.4
	Maximum (m/s)	7.7	6.6	9.3	8.7	6.1	10.3	7.9	10.5	9.4	5.1	6.1	6.7	10.5
	Extreme (m/s)	11.1	10.3	14.3	15.3	9.7	16.2	14.3	16.8	15.4	9.9	9.7	11.6	16.8

6.2 Air Quality

The assessment of the ambient air quality of the construction area (including office buildings, residential areas and construction sites) was conducted in accordance with *Ambient Air Quality Standard* (GB3095-1996).

In 2005, the annual average concentration of SO_2 in the construction area was 0.043 mg/m^3, meeting Grade II national air quality standard. The annual average level of NO_2 was 0.029 mg/m^3, meeting Grade I national air quality standard. The daily average concentration of SO_2 of each day of 2005 met or was better than Grade II national air quality standard with only one exception. In addition, all the daily average concentrations of NO_2 met Grade I air quality standard in the year.

The annual average concentration of total suspended particles (TSP) in the construction area was 0.195 mg/m^3, meeting Grade II national air quality standard. Among them, all the daily average concentrations of TSP in office and residential areas met or were better than Grade III air quality standard. In the construction area, the percentage of days whose daily average of TSP meeting Grade I air quality standard was 18.2%, that meeting Grade II air quality standard was 54.7%, that meeting Grade III air quality standards was 20.4% and that failing to meet Grade III standard was 6.6% of the total respectively.

The overall ambient air quality in the construction area during 2005 had some improvement compared with that of the previous year. The annual average concentration of NO_2 remained unchanged; the annual average of SO_2 increased a bit, and the annual average level of TSP went down by 39.6%. TSP remained to be the dominant pollutant in ambient air of the construction area.

6.3 Water Quality

According to the *Environmental Quality Standard for Surface Water* (GB3838－2002), 13 items such as pH value, dissolved oxygen, ammonia nitrogen, COD, permanganate index, BOD_5, volatile phenol, cyanide, arsenic, hexavalent chromium, copper, lead and cadmium were included to assess the water quality in the construction area. Anionic surfactants were added to the list for the assessment of the water quality of waters near or along the bank.

The water quality of all sections in mainstream of the Yangtze River and waters near the bank was good in 2005, all meeting or being superior to Grade II national surface water quality standard. Compared with in 2004, the concentration of suspended particles of the water of the sections of the

mainstream of the Yangtze River under construction project had a further drop while other monitoring indicators were relatively stable. The water quality of Letianxi Section shifted to Grade II from Grade I in the second quarter, but remained the same in other seasons.

Table 6-4 Water quality of the mainstream sections of the Yangtze River in the construction area in 2005

Section name	The 1st quarter	The 2nd quarter	The 3rd quarter	The 4th quarter	Whole year
Taipingxi	I	II	II	I	II
Letianxi	I	II	II	I	II

Table 6-5 Water quality of alongshore water areas of the Yangtze River in the construction area in 2005

Sampling point		The 1st quarter	The 2nd quarter	The 3rd quarter	The 4th quarter	The whole year
Left bank (30m away from the bank)	Upstream navigation channel	I	II	II	I	I
	Downstream navigation channel	I	II	II	I	II
Right bank (30m away from the bank)	Auxiliary dam	I	II	II	II	II

6.4 Noise

The average daytime and night noise of the office and residential areas of the construction area in 2005 was 57.8 dB and 51.3 dB respectively. The average daytime noise met Grade II standard of the *Standard for Urban Regional Environmental Noise* (GB3096－93), while the night noise met Grade III national noise standard. The daytime and night sound equivalent levels of the construction area were in conformity with the requirements for the noise limits of production workshop and operational sites stipulated by the *Design Standards for the Control of Noise of Industrial Enterprises* (GBJ87－85). The noise level at sensitive points outside the boundary was in conformity with the requirements of *Noise Limit for the Boundary of Construction Sites* (GB 12523－90).

Environmental noise of each area of the construction sites enjoyed some improvement compared with that of the previous year. The average daytime and night noise levels of the office and residential areas dropped by 1.0 dB and 0.9 dB respectively. The average daytime and night noise levels of the construction sites decreased by 3.0 dB and 3.3 dB respectively. The average traffic noise of all the construction sites reduced by 2.2 dB compared with that of the previous year.

Chapter 7 Status of Public Health in the Reservoir Area

7.1 Basic Situation

The monitoring scope and the layout of monitoring stations of 2005 was the same as that of the previous year, including the urban area of Chongqing, Wanzhou District and Fengdu County of Chongqing Municipality and Yichang City of Hubei Province. The total population under the monitoring program this year was 508,896, an increase of 22,002 people compared with that of the previous year with the gender ratio of 1.03:1 between male and female.

In 2005, the total number of health institutions at all levels within the monitoring areas was 303, down by 7 compared with that of the previous year. The total number of hospital beds in these institutions was 4,071, up by 446 beds compared with that of the previous year. The total number of public health workers in these institutions was 3,703, down by 344 people against that of 2004, this was mainly due to the population migration of the Three Gorges Reservoir area.

7.2 Life Statistics

7.2.1 Birth and death

There were altogether 3,907 babies born within the monitoring areas in 2005 with the birth rate of 7.68‰, down by 6.68% compared with that of the previous year. Among all the new babies 2,064 were male and 1,843 female. The total number of death was 3,016, among them, 1,741 were male and 1,275 female. The mortality rate was 5.93‰, up by 4.40% compared with that of the previous year. The death rate was 6.74‰ for male and 5.09‰ for female. The death rate of Chongqing Municipality, Fengdu, Wanzhou and Yichang monitoring stations was 4.23‰, 7.25‰, 5.85‰ and 7.11‰ respectively. Compared with that of the previous year, the death rate had a slight reduction in Chongqing but some rise in Yichang, Wanzhou and Fengdu. There were 50 cases of baby death, 28 male and 22 female. The infant mortality was 12.80‰, slightly higher than the level of the previous year but significantly lower than the national average (21.50‰ in 2004).

7.2.2 Analysis of death cause

In 2005, the comparison among cause of death, gender and mortality of the top 5 causes of death for different gender indicated that circulatory diseases was the No. 1 killer for both men and women. The order of the top 5 causes of death were: circulatory diseases, malignant tumor, respiratory diseases, injury and poisoning and acatalepsia diseases. The death toll resulting from these 5 diseases accounted for 88.00% of the total, indicating that they were major killers for dwellers in the Three Gorges Reservoir areas. Compared with 2004, the No.5 killer was acatalepsia diseases replacing digestive diseases. The death percentages of circulatory diseases and malignant tumor had some rise, while that of respiratory diseases and injury and poisoning dropped to some extents.

7.3 Disease Monitoring

7.3.1 Infectious Diseases Monitoring

In 2005, a total number of 3,811 cases of infectious diseases were reported from all the monitoring sites with the total morbidity of 748.88 per 100,000 people. Two death cases were reported with total death rate of 0.39 per 100,000 people. There was no report on the case of Class A infectious diseases. However, 3,037 cases of 12 types of Class B infectious diseases were reported with morbidity of 596.78 in every 100,000 people. A total of 774 cases of 5 types of Class C infectious disease were reported with the morbidity of 152.09 per 100,000 people. Compared with that of the previous year, the incidence of Class B infectious diseases went up by 17.12% and the incidence of Class C infectious diseases went down by 23.97%. For Class B infectious diseases Fengdu had the highest incidence (1036.16/100,000 people) but Yichang had the lowest incidence (238.81/100,000 people). The incidence of Class C infectious diseases was the highest in Wanzhou (263.81/100,000 people) and lowest in Yichang (67.23/100,000 people). The top 5 types of Class B infectious diseases were viral hepatitis (301.83 in every 100,000), TB (197.09 in every 100,000),

dysentery (47.75 in every 100,000), gonorrhea (33.60 in every 100,000) and syphilis (10.61 in every 100,000). Dysentery took the place of gonorrhea compared with that of last year.

For the structure of the infectious diseases under national monitoring program, blood and sexually transmitted diseases, respiratory diseases, digestive diseases and natural epidemic focus-based diseases took up 43.27%, 32.01%, 24.30% and 0.13% of the total respectively. Compared with that of the previous year, blood and sexually transmitted diseases rose to the top position while respiratory diseases went down to the second place. Whooping cough moved out of the list but haemorrhagic fever was added into the type list of infectious diseases. The incidences of hepatitis A and typhoid fever relevant to the impoundment due to water as their transmission medium and that of natural epidemic focus-based diseases haemorrhagic fever and encephalitis B relevant to biological media were at relatively low level.

7.3.2 Endemic Diseases Monitoring

In 2005, the monitoring stations at Chongqing, Wanzhou and Fengdu took random investigations on iodine deficiency of 773 children aged 8-12. Among them, 94 had I^o thyroid enlargement with the enlargement rate of 12.16%, up by 3.45 percentage points compared with that of the previous year but falling into the slight prevalence. Thyroid enlargement rate was 14.05% in Wanzhou, 12.50% in Fengdu and 7.77% in Chongqing, up by 7.17 percentage points in Wanzhou and 0.62 percentage points in Fengdu and down by 2.12 percentage points in Chongqing compared with that of 2004. The findings of salt consumption of 1,417 households showed that 1,351 households consumed iodized salt with the coverage of 95.34%, down by 2.08 percentage points compared with that of 2004. Among the 1,351 household, 1,290 consumed the iodine-added salt that was qualified with the salt qualification rate of 95.48% and the consumption rate of such salt being 91.04%, up by 2.81 and 1.05 percentage points compared with that of the previous year.

The investigation on endemic fluorine diseases in Fengjie County of Chongqing and Zigui County of Yichang showed that 36 of the 195 people under the investigation suffered from endemic fluorine disease, accounting for 18.46%.

The IHA testing result on serum antibody for schistosomiasis at Wanzhou monitoring site showed 3 positive cases among the 503 tested people, accounting for 0.60%. Among the 89 local ship workers and other workers having frequent visit to the schistosomiasis prevalent region, 3 cases showed positive, taking up 3.37%. There were also 3 positive cases among the 105 people from the prevalent region who did business in Wanzhou, accounting for 2.86%. In addition, no egg of schistosome was detected from the stool samples of 450 local residents.

The test results on serum antibody of leptospirosis of healthy population of each monitoring site showed 55 positive cases among 1,324 samples with positive case rate of 4.15%. The monitoring site of Chongqing had the highest rate of 8.80%, while no positive case occurred at the monitoring site of Yichang.

7.4 Biological Media Monitoring

7.4.1 Mouse Monitoring

The indoor mouse density was 4.08% in 2005, up by 2.41 percentage points compared with that of 2004 but similar to the average level of the 5 years before second-stage impoundment (3.94%). The mouse density in spring was lower than that in autumn. The outdoor mouse density was 3.90%, lower than the average level of the 5 years before second-stage impoundment (4.22%) but 1.21 percentage points higher than that of the previous year. The outdoor mouse density was higher in spring than in autumn. In spring, outdoor mouse density (4.50%) was higher than the indoor density （2.58%）and vice versa in autumn. This is mainly because that there are no small insect eating animals (e.g. muskrat and small mouse) in houses in spring but many in outdoor environment.

Sewer rat dominated the indoor mouse species, accounting for 82.35% of the total. Buff-breasted mouse ranked the second and took up 11.76%. In outdoor environment, small beast of insectivore (mainly short-tailed shrew) still dominated all other species and accounted for 85.71% of the total. Sewer rat (9.52%) was the second and the amount of both black strip rat and buff-breasted mouse was relatively small, less than 3%. Black strip rat (*Apodemus agrarius*) was the host animal

for epidemic haemorrhagic fever virus and leptospirosis, its percentage dropped from 7.96% of 2004 to 2.38% in 2005, continuously maintaining a low level. Among all monitoring sites, Fengdu had the highest indoor mouse density at 4.08% while Yichang had the lowest of 1.20%. As for outdoor mouse density, Fengdu was the highest at 3.90% while Wanzhou was the lowest at 0.33%.

In 2005, all monitoring sites carried out relevant tests on the lung (286) and kidney (325) samples of mice or rats to identify the infection causes of epidemic haemorrhagic fever virus and leptospirosis. The findings showed 2 positive cases on leptospirosis. The positive rate of epidemic haemorrhagic fever virus was 0.68% in Chongqing, 4.00% in Fengdu and 8.89% in Wanzhou. However, there were few such patients. And no positive case occurred in Yichang.

7.4.2 Mosquitoes Monitoring

In the year 2005, the overall adult mosquito density in livestock pen of all monitoring sites was 113.74/(pen · artificial hour), lower than 132.76/(pen · artificial hour) of 2004 or the average level of the 5 years before second-stage impoundment [198.57/(pen · artificial hour)]. The overall indoor adult mosquito density was 32.76/(pen · artificial hour), lower than the level of 36.82/(pen · artificial hour) of the previous year or the average level of the 5 years before second-stage impoundment [63.97/(pen•artificial hour)]. Compared with that of the previous year, the adult mosquito density of livestock pen of all monitoring sites enjoyed some reduction with most significant decrease in Fengdu monitoring site. Except in Wanzhou, the indoor adult mosquito density of the other monitoring sites also enjoyed reduction at different degree.

The change of both indoor adult mosquito density and livestock-pen adult mosquito density showed the same 10-day trend between May and September. The adult mosquito density peak was generally in the trend of moving from the head to the tail of the Reservoir. The mosquito density in residential buildings was the highest in Chongqing Municipality [46.15/(pen · artificial hour)] and lowest in Yichang [10.04/(pen · artificial hour)]. At the same time, the mosquito density in livestock pens was the highest in Wanzhou [163.56/(pen · artificial hour)] and the lowest in Fengdu [78.84/(pen · artificial hour)].

Regarding the composition of mosquito species, *Desvoidea obturbans* dominated both residential buildings and livestock pens, accounting for 59.71% and 59.29% of the total number respectively. Similar to the previous year, the No. 2 species of mosquito was *culex pipiens fatigans*, it accounted for 20.41% in residential buildings. No.3 was *Anopheles sinensis*，taking up 14.06%.

Chapter 8 Environmental Quality of the Migration Resettlement Areas

Comprehensive environmental quality monitoring was conducted in 15 districts (counties) of the migration resettlement area in Chongqing Municipality of the Three Gorges Reservoir area. The major components of the monitoring work were water quality, environmental air quality and acoustic environment quality.

8.1 Water Quality Monitoring

Water quality monitoring work includes the monitoring of surface water quality, water quality of both backwater in sensitive areas and drinking water sources. Water quality evaluation standard and testing methods employed were in accordance with the *Standard for the Quality of Surface Water Environment* (GB3838-2002). The nutrition evaluation of water bodies would comply with the *Technical Regulations on Eutrophication Evaluation Method and Grading for Lakes (Reservoirs)* issued by the China National Environmental Monitoring Center.

8.1.1 Surface water quality

A total of 140 river sections were set up in 48 rivers of 15 districts (counties) of the Three Gorges Reservoir area to carry out the monitoring activities, one river and 10 sections more than in the previous year. The water quality evaluation covered 20 items such as pH value, dissolved oxygen, permanganate index, COD, BOD_5, ammonia nitrogen, copper, zinc, fluoride, selenium, arsenic, cadmium, mercury, hexavalent chromium, lead, cyanide, volatile phenol, petroleum, anion surfactant and sulfide.

The monitoring results showed that the overall surface water quality in the migration resettlement areas was fairly good in 2005. 118 sections met or were superior to Grade III national water quality standard, taking up 84.3% of the total, up by 2.0 percentage points than in 2004.Six sections met Grade IV standard, 5 met Grade V standard and 11 failed to meet Grade V water quality standard, accounting for 4.3%, 3.6% and 7.9% of the total respectively. Major pollutants were ammonia nitrogen, petroleum and COD.

The water quality in low, level and high water seasons was all good, with 83.7%, 80.1% and 82.6% of all the sections monitored meeting or superior to Grade III standard, up by 0.8, 2.1 and 0.6 percentage points compared with that of the previous year. The river sections failed to meet Grade III national water quality standard mainly occurred in the districts of Banan, Changshou, Yubei and Wanzhou with 87.5%, 57.1%, 40.0 and 38.5% of the total sections exceeding national water quality standard.

8.1.2 Water quality of the backwater in sensitive areas

A total of 60 river sections were established in 31 rivers of 9 districts (counties), one district (county), 5 rivers and 11 sections more than in 2004. The monitoring covered 11 items such as water transparency, water temperature, pH value, dissolved oxygen, permanganate index, BOD_5, total nitrogen, ammonia nitrogen, nitrate, chlorophyll *a* and total phosphorus.

● Water quality

Six items including pH value, dissolved oxygen, permanganate index, BOD_5, ammonia nitrogen, and total phosphorus were employed to evaluate water quality.

The evaluation findings showed that the overall surface water quality of the backwater in sensitive areas of the migration resettlement areas was quite good in 2005. A total of 52 river sections met or were superior to Grade III national water quality standard, taking up 86.7% of the total, down by 1.1 percentage points compared with that of 2004. The amount of sections meeting Grade IV, V or inferior to Grade V standard was 3, 2 and 3 respectively, accounting for 5.0%, 3.3% and 5.0% of the total respectively. Major pollutants in the water were BOD_5, total phosphorus and ammonia nitrogen.

The percentage of river sections with water quality meeting or being superior to Grade III water

quality standard was 87.2%, 81.1% and 93.0% in March, April and May, up by 4.4, 5.5 and 3.4 percentage points compared with the same period of the previous year. The sections with relatively poor water quality were mainly in Wanzhou District, Fuling District and Wushan County.

● **Nutrition status of the water bodies**

Five items including chlorophyll *a*, total phosphorus, total nitrogen, water transparency and permanganate index were employed to evaluate the nutrition status of the water body.

The monitoring results showed that the water body of 16 river sections was under eutrophication, accounting for 26.7% of the total. Among them, 11 were under slight eutrophication, 4 under intermediate eutrophication and 1 under severe eutrophication, accounting for 18.3%, 6.7% and 1.7% of the total respectively. Six sections were under poor nutrition and 38 sections were under medium nutrition, taking up 10.0% and 63.3% respectively. The comprehensive nutrition status index of the water bodies ranged from 20.96 to 72.53.

8.1.3 Water quality of drinking water sources

A total of 98 monitoring sites were set up in all major centralized drinking water sources of Class I towns in 15 districts (counties), 14 sites more than in 2004. The evaluation contents covered the basic water environmental items including pH value, dissolved oxygen, permanganate index, BOD_5, ammonia nitrogen, total phosphorus, copper, zinc, fluoride, arsenic, cadmium, mercury, hexavalent chromium, lead, iron, manganese, cyanide, volatile phenol, petroleum, anion surfactant and sulfide, sulfate, chloride and nitrate totaling 24 items.

The monitoring results indicated that in 2005, the water quality of the concentrated drinking water sources in the migration resettlement areas was quite satisfactory with the quality of 95.9% drinking water sources meeting or superior to Grade III water quality standard. Compared with the previous year, the proportion of sections meeting the functional requirements for drinking water source reduced by 4.1 percentage points. To be specific, the proportion of sections meeting Grade I and III water quality standard decreased by 4.0 percentage points and 0.1 percentage points respectively while the proportion of sections meeting Grade II quality standard remained the same as in 2004.

8.2 Environmental Air Quality Monitoring

The monitoring of environmental air quality of the migration resettlement areas was mainly composed of the monitoring of urban air quality and precipitation quality.

8.2.1 Air quality

A total of 31 air quality monitoring sites were established in 15 districts (counties) and 32 dust monitoring sites were established in 14 districts (counties). The key monitoring items included sulfur dioxide (SO_2), nitrogen dioxide (NO_2), total suspended particles (TSP) and dust. The *Ambient Air Quality Standard* (GB3095－1996) was applied in the evaluation of the environmental air quality.

Monitoring results showed some improvement of urban air quality in the migration resettlement areas in 2005. The comprehensive air pollution index went down by 5.0%.

The annual average concentration of sulfur dioxide in 2005 was 0.048 mg/m^3, meeting Grade II national air quality standard. The daily average concentration of SO_2 was 0.003~ 0.276 mg/m^3 with 1.4% of the total failing to meet national air quality standard. The highest daily average level of SO_2 was 1.84 times of the standard value. Among the 15 districts (counties) monitored, the annual average level of sulfur dioxide of 10 districts (counties) met Grade II air quality standard, accounting for 66.7% of the total.

The annual average concentration of nitrogen dioxide in 2005 was 0.027 mg/m^3, meeting Grade II national air quality standard. Its daily average level ranged from 0.001 to 0.170 mg/m^3, and 0.1% of the total failed to meet the national daily average standard. The highest daily average concentration was 0.42 times higher than the standard value. The annual average concentration of nitrogen dioxide in the air of all the 15 districts (counties) met Grade II national air quality standard.

The annual average concentration of total suspended particles (TSP) in 2005 was 0.148 mg/m^3, meeting Grade II national air quality standard. Its daily average level ranged from 0.003 to 0.583 mg/m^3, 2.2% of the total failed to meet the national daily average standard. The highest daily average level was 0.94 times higher than the standard. Among the 15 districts (counties) monitored, the annual average level of TSP of 14 districts (counties) met Grade II air quality standard, accounting for 93.3% of the total.

The annual average level of dust was 6.42 ton/km^2 · month, 0.52 times higher than the reference standard. The peak amount was 1.26 times higher than the standard value. Among all the 14 districts (counties) monitored, only Shizhu, Wulong County and Fengdu County failed to meet relevant national standard, taking up 21.4% of the total.

8.2.2 Precipitation quality

In 2005, 18 precipitation quality monitoring sites were set up in 15 districts (counties). A total of 846 precipitation samples were collected. Among them, 472 were acid rain samples with the frequency of 55.8%. The amount of acid rain accounted for 59.5% of the total precipitation, up by 1.6 and 12.4 percentage points compared with that of the previous year. The pH value of the precipitation tested ranged from 3.40 to 8.60, with an averaging of 4.58. Among all the 15 districts (counties) monitored, the annual average pH value of 9 districts (counties) was under 5.60, accounting for 60.0%.

8.3 Monitoring of Acoustic Environmental Quality

The monitoring of acoustic environmental quality in the migration resettlement areas included the monitoring of regional environmental noise, traffic noise and functional area noise. The evaluation work complies with the *Standard for Urban Regional Environmental Noise* (GB3096－93).

8.3.1 Regional environmental noise

A total of 1,643 monitoring grids were established in the towns of 15 districts (counties), covering 106.69 km^2 of established urban area.

Monitoring results showed that the overall regional environmental acoustic quality was under slight pollution in 2005 with the equivalent sound level of 56.2 dB. Among all the districts (counties) monitored, the equivalent sound level of Kaixian County was the highest at 63.1 dB followed by Fengjie County at 62.4 dB. Banan District was the lowest at 53.3 dB. The source of noises was mainly from social life and domestic noises, accounting for 60.3% of the total. Traffic noise took the second, taking up 26.7%. Among the 1,643 monitoring grids, 1,197 grids met relevant national noise standard, accounting for 72.9%. The grid noise up-to-standard rate of Class I, II, III and IV region was 29.3%, 74.2%, 93.8% and 88.4% respectively. Banan District enjoyed the highest grid noise up-to-standard rate at 97.9% while Fengjie the lowest at 27.0%. Among the 15 districts (counties), only 2 enjoyed relatively good regional acoustic environment, accounting for 13.3% of the total.

8.3.2 Traffic Noise

In 2005, a total of 135 road sections were set up in 15 districts (counties) for the monitoring of traffic noise, covering a total length of 180.56 km.

Monitoring findings indicated that the overall road traffic acoustic quality was relatively good with average equivalent sound level being 69.0 dB. The average traffic flow was 1,169 vehicles/hour; and the total length of trunk road with equivalent sound level over 70 dB was 54.38 km, accounting for 30.1% of the total monitored length. 10 districts (counties) out of the 15 had rather good traffic acoustic environment, taking up 66.7% of the total.

8.3.3 Noise of functional areas

In 2005, 35 monitoring sites were set up in the towns of 15 districts (counties) to monitor the environmental noise functional areas, covering an area of 79.43 km^2.

The findings showed that daytime and nighttime equivalent sound levels of the functional areas

was 57.4 dB and 48.3 dB respectively, and the equivalent sound level in both the daytime and nighttime was 57.7 dB. 21.1% of the daytime hours and 36.8% of nighttime hours could not meet the national hourly noise standard. The equivalent sound level of all regions met relevant national noise standard for both daytime and nighttime with the exception of that (59.1 dB) of Class IV region during nighttime, which was 4.1 dB higher than the standard.

Chapter 9 Monitoring and Studies on Ecological Environment

9.1 Monitoring on Ecological Environment of Wanzhou Model Zone

Runoff plots trial for the study and monitoring of eco-environment of Wanzhou model zone continued in 2005. The trial carried out comparison observation and investigations on soil water content and soil erosion under different modes of land use.

9.1.1 Trial of compound farming of grain crops, cash crops and fruit trees on ridges of slope cropland

The pattern of compound farming of grain crops, cash crops and fruit trees on ridges of slope farmland (Pattern I) has been established and developed for 4 years with evident improvement in soil water retention capacity. The comparison trial among Pattern I, compound farming of grain crops, cash crops and fruit trees on flat farmland (Pattern II) and the planting of pure grain crops on flat farmland (Pattern III as the control pattern) have been operated for four years. The trial findings showed that Pattern I enjoys the best effects in soil water retention with the highest soil water content, followed by Pattern II and Pattern III. Compared with Pattern III, soil water contents of Pattern I and Pattern II enjoyed an increase of 6.83%~22.38%, 14.68%~23.14% and 23.72%~42.96 respectively 2, 4 and 8 days after raining.

The lapse rate of soil water content after rainfall was the highest in Pattern III, followed by Pattern II and Pattern I. But the order of the variations of soil water content at different soil layers was vice versa, i.e. it was the smallest in Pattern I, followed by Pattern II and III. Under the same land-use mode, the changing rate of soil water content is smaller in spring, autumn and winter as compared with that in summer. This has close relations with the crop growth and the precipitation during the growth season.

The soil structure of Pattern I farmland enjoyed evident improvement after 4-year operation with relatively stable water contents. Under the same application of fertilizers, the concentrations of various nutrients of the soil of Pattern I farmland were obviously higher than that of the soil of Pattern II and III. With the passing of time, soil improvement effects of Pattern I became more and more evident with the rise of nutrients in both the ridge and furrow soil, the nutrient level of the latter higher than that of the former. In 2005, the level of each nutrient in furrow soil was higher than that of the ridge soil.

No matter the amount of rainfall that produces runoff, the comparison trial showed that Pattern I achieved the best results in reducing soil erosion and run-off, followed by Pattern II with less good results and Pattern III with the worst effect. Compared with the control pattern, the reduction of soil erosion and surface runoff was 62.94%~82.00% for Pattern I farmland and 39.88%~72.28% for Pattern II farmland. Compared with the previous year, the concentrations of organic matter, total nitrogen, total phosphorus, total potassium, quick-acting nitrogen, quick-acting phosphorus and quick-acting potassium in the eroded soil went down by 9.98%, 21.40%, 35.05%, 23.09%, 1.04%, 16.78% and 11.94% respectively.

9.1.2 Trial of the pattern of steep slope with biological fence (Fence Pattern)

The findings of the comparison trial of steep slope farmland fenced with shaddock-king grass hedgerows (Fence Pattern) and the pattern of flat cultivation of pure grain crops along the slope (Pure Grain Crops Pattern as the control pattern) indicated some good effects as enhanced capacity in soil water content retention, evident increase of soil water content and the reduced lapse rate of soil water content after raining of the 4-year-long Fence Pattern farmland. In addition, the changing rate of the moisture in different soil layers of this farmland was higher that of the Pure Grain Crops Pattern. Soil water contents after rainy days had the maximum variations in the summer but minimum in spring, autumn and winter. Compared with the control pattern, soil water content of Fence Pattern farmland enjoyed 11.31%~29.95%, 18.51%~36.03% and 29.06%~62.00% increase respectively 2, 4 and 8 days after the rainy date. The soil under the hedgerows enjoyed the highest soil water content with relatively small change rate (or variations) during the days after rainfall. The water content of the soil up to the hedgerows and down to the hedgerows was similar and had

relatively big variations during the days after rainfall.

The concentrations of such items as organic matter, total nitrogen, quick-acting nitrogen, total phosphorus, quick-acting phosphorus, total potassium and quick-acting potassium of the soil of the Fence Pattern were all higher than that of the Pure Grain Crops Pattern. Compared with in 2003, the concentrations of organic matter and total nitrogen of the Fence Pattern went up by 7.23% and 4.29%, the concentrations of total phosphorus and quick-acting phosphorus decreased by 4.35% and 1.43% and the concentrations of total potassium and quick-acting potassium kept the same level.

The development of Fence Pattern was more effective in preventing soil erosion of the slope farmland. Compared with the Pure Grain Crops Pattern, the amount of soil erosion and surface runoff reduced by 91.69%~96.53% and 72.28%~87.44% respectively. Compared with that of the previous year, the concentrations of organic matters, total nitrogen, total phosphorus, quick-acting nitrogen and quick-acting potassium of the eroded soil from the Fence Pattern decreased by 12.21%, 13.58%, 22.71%, 7.83% and 21.53% respectively, and the concentrations of total potassium, and quick-acting phosphorus went up by 3.05% and 7.97%.

9.2 Monitoring on Ecological Environment of Zigui Model Zone

Zigui Eco-Environment Experimental Station continued the monitoring and study on soil erosion and soil fertility of arid slope farmland under different farming management conditions in Zigui of the Three Gorges Reservoir areas in 2005.

9.2.1 Monitoring on soil and water erosion

The monitoring results on soil and water erosion of arid-slope orchard plot and forage grass-grain cropland plot under different water conservation measures such as grass vegetation, straw mulching and natural biological fence showed evident reduction of soil erosion. Compared with navel orange-wheat-groundnut growth pattern, navel orange-whiteflower clover pattern, navel orange orchard with straw mulch and navel orange-day lily pattern enjoyed the reduction of runoff by 41.45%, 42.59% and 57.51% and decrease of soil erosion by 89.59%, 41.35% and 52.22% respectively. Compared with the wheat-groundnut pattern on slope farmland, perennial alfalfa pattern, wheat-groundnut-Chinese toon biological fence pattern and wheat-groundnut-alfalfa biological fence pattern had reduced runoff by 66.72%, 41.02% and 21.58% respectively and soil erosion by 94.00%, 90.18% and 86.81% respectively.

In addition, grass vegetation, straw mulch and biological fence measures had significantly reduced the nitrogen nutrient loss of slope orchard and dry land. Compared with navel orange-wheat-groundnut pattern, nitrogen nutrient loss of the navel orange-whiteflower clover pattern, navel orange orchard with straw mulch pattern and navel orange orchard with day lily biological fence pattern was reduced by 78.96%, 63.71% and 75.04% respectively. Compared with wheat-groundnut pattern, perennial alfalfa pattern, wheat-groundnut-Chinese toon biological fence pattern and wheat-groundnut-alfalfa biological fence pattern on dry land had decreased the nitrogen loss in runoff by 68.97%, 53.50% and 24.45% respectively. Interplanting on slope orchard or the planting of perennial grass on dry land was conducive to the control of the loss of phosphorus. For example, phosphorus loss of slope orchard with intercropping cut by 53.80% compared with that of orchard-wheat-groundnut pattern. And phosphorus loss of dry land with perennial grass cover decreased by 84.11% compared with that of wheat-groundnut pattern. In addition, wheat-groundnut-Chinese toon or alfalfa biological fence patterns produced relatively good effects on the control of phosphorus nutrient loss by reducing phosphorus level in the runoff.

9.2.2 Monitoring on soil fertility

The concentrations of organic matters, total nitrogen and total phosphorus were at low level in the soil of orchard. But the concentration of total potassium was relatively high. In topsoil (0~5 cm) and the subsoil (5~20 cm), the concentration of organic matters reached 7.66~11.64 g/kg and 6.81~10.12 g/kg respectively; total nitrogen was 0.51~0.64 g/kg and 0.45~0.63 g/kg respectively; total phosphorus was 0.26~0.33 g/kg and 0.25~0.32 g/kg respectively and total potassium level was 15.40~16.19 g/kg and 16.23~17.02 g/kg respectively. At the orchard farmland with little or no cultivation for 6 consecutive years, there has been some difference of the level of organic matters

between the topsoil and the subsoil with higher concentration in the topsoil. However, there was no consistency in the concentrations of nitrogen, phosphorus and potassium nutrients in the soil. For navel orange-wheat-groundnut pattern, there was no difference in organic matters between the topsoil and subsoil due to frequent cultivation. Navel orange-white flower clover pattern and navel orange orchard with mulch pattern had significantly raised the levels of total nitrogen and potassium in the soil. Moreover, navel orange-day lily biological pattern and navel orange orchard with mulch pattern had raised the level of total phosphorus in soil.

Different cultivation and management approaches imposed different influence on the level of quick-acting concentrations of nitrogen, phosphorus and potassium in soil. Compared with the navel orange orchard without any cover, straw mulch had raised the levels of quick-acting phosphorus and potassium by 60.00% and 175.00% in topsoil and by 42.00% and 104.00% in subsoil. It had also widened the differences of quick-acting phosphorus and potassium concentration between topsoil and subsoil. As a result, the concentration of quick-acting phosphorus and potassium of topsoil was 7.27 mg/kg and 100.40 mg/kg higher than that of the subsoil.

9.3 Monitoring on Groundwater Table and Soil Gleization

The monitoring on groundwater table change and the observation on gleization indicators of soil from Xiaogang to Shimatou of Honghu Lake located at the “Four lakes” at the middle reaches of the Yangtze River continued in 2005.

9.3.1 Monitoring on groundwater table

The groundwater monitoring section consisted of 10 long-term observation boreholes in 5 groups. The distances from the 5 groups of borehole marked with the code of A, B, C, D and E to the Yangtze River bank was 1.5km, 3.0km, 5.0km, 8.5km and 13.0km respectively. The depth of boreholes of confined water was about 35m while that for phreatic water observation was 5m~7m deep with the internal diameter of observation borehole being 1.1 m.

The monitoring results showed that average annual groundwater level of all observation boreholes ranged from 21.47m to 22.47m in 2005 with fluctuations of 0.51m~2.02m within the year, the maximum table range reached 22.08~23.24m and the lowest 20.68~21.69m. The phreatic surface changed from 21.12m to 23.14m with maximum fluctuation margin of 2.02m. And the water table of confined groundwater varied from 20.68m to 23.24m with the maximum change margin of 2.56m. The range of monthly average of the phreatic surface of each observation borehole was 21.53 ~ 22.89m and that of the confined water table was 20.96 ~ 22.92m. Be it confined or phreatic water, the high groundwater table mostly occurred during May-October with highest monthly average in July-September and the lowest in February.

In 2005, the annual average groundwater table of each borehole was slightly lower than the historical average but higher than that of the previous year. This was in consistency with the trend of the water level of the new dam of the Yangtze River.

Table 9-1 Groundwater table of each observation borehole in 2005

Unit: m

Borehole	Confined water table					Phreatic surface				
	A	B	C	D	E	A	B	C	D	E
Annual average	22.47	21.56	21.76	21.47	21.92	22.22	22.42	22.20	21.96	21.92
Maximum	23.24	22.08	22.72	21.98	22.21	23.14	22.99	22.78	22.99	22.20
Minimum	21.41	20.94	20.94	20.68	21.67	21.12	21.65	21.64	21.56	21.69
Change margin	1.83	1.15	1.78	1.30	0.54	2.02	1.34	1.14	1.43	0.51

9.3.2 Monitoring on indicators of soil gleization

Indicators of soil gleization at 16 soil monitoring sections affected by different degrees of gleization (light, intermediate and severe) were monitored continually from Xiaogang Farm to Shimatou in 2005. The monitoring work was carried out once in winter and once in summer with indicator parameters monitored including oxidation reduction potential, total amount of reduction materials, active reduction materials and ferrous iron, etc.

Monitoring results indicated that the range of total reduction materials was 0.67~13.26cm · mol/kg with the average of 4.40cm · mol/kg; the range of active reduction materials was 0.074~10.02cm · mol/kg with the average of 2.732cm · mol/kg; the ferrous level ranged from 0.024~1.243cm · mol/kg with the average of 0.417cm · mol/kg. Compared with that of the previous year, all the three monitored gleization indicators were obviously higher, particularly in winter. This was in consistency with the change trend of groundwater level.

9.4 Special Monitoring on Terrestrial Plant Community

9.4.1 Identifying fixed monitoring sample plots

Based on the work of the previous year, 200 fixed monitoring sample plots were added in 2005 with an area of about 4.20 hectares. Among them, 109 were in forests and 91 in shrubberies with grasses. When classified by the altitude, 125 were at low altitude (< 600m) including 34 in forests, 25 in shrubberies and 66 at grassland; 24 at intermediate altitude (600~1,000m) and 51 at high altitude (≥1,000m) both located in forests. By the end of 2005, there were 393 fixed monitoring sample plots with a total area of 8.38 hectares. Among them, 201 were in forests and the other 192 in shrubberies and grassland.

9.4.2 Investigation on vegetation type

In 2005, a total of 414 quadrats were established on the fixed monitoring sample plots under additional investigations. A total of 200 soil samples and 1,300 plant samples were collected involving 62 vegetation types, 51 of which were forest types, 20 shrub types and 15 herbosa types. By the end of 2005, 92 vegetation types had been investigated, 51 of which were forest, 20 were shrubberies and 21 herbosa. A total of 2,800 plant samples had been collected and identified. And 393 soil samples were collected and analyzed.

● Forest

The investigation conducted in 2005 showed that *Pinus massoniana* and *Cupressus funebris* were still the dominant vegetation type with widest distribution in low and intermediate altitude zones of the Reservoir area. Most forests at low altitude were artificial forests. At intermediate altitude, there was certain amount of natural forests. However, most forests at high altitude were natural forests. *Cupressus funebris* at low and intermediate altitude were dominated by such broad-leaved forests as *Quercus variabilis*, *Quercus serrata var. brevipetiolata*, *Liquidambar formosana*, *Quercus aliena*, *Platycarya strobilacea* and *Betula luminifera.* Most of them were natural forests. The natural forests at high altitude were dominated by such forests as *Cyclobalanopsis glauca, Fagus sp., Quercus variabilis-Quercuc aliena, Pterostyrax plumosa-Davidia involucrata, Betula luminifera, Pinus massoniana-Liquidambar formosana, Pinus armandi, Thuja sutchuensis* and *Abies fargesii, etc.*

In Chongqing, Jinyun Mountain in Beibei District, Shengdeng Mountain of Nan'an District, Tieshanping of Jiangbei District, Jinfo Mountain of Nanchuan, Damuxiang of Fuling District and Xuebao Mountain of Kaixian County maintain the natural evergreen broad-leaved forests and evergreen broad-leaved mixed with evergreen broad-leaved deciduous forests. At the same time, they also conserve many precious and endangered species such as Thuja sutchuensis, Pterostyrax plumosa, Davidia involucrata,Taxus wallichiana var. chinensis, Alsophila spinulosa, Phobe zhennan, Cinnamomum camphora etc.

● Shrubs and grasses

During the vegetation investigation in 2005, 5 new shrub types and 8 new herbosa types were discovered. The new shrub types include the *Salix variegata, Rhus chinensis, Rosa laevigata, Salix*

wilsonii and *Pterocarya stenoptera.* The new herbosa types include *Neyraudia reynaudiana, Cynodon dactylon, Saccharum arundinaceum, Arundlinella fluviatilis, Pseudoraphis spinescens var. depauperata, Hemarthria altissima, Paspalum paspaloides and Phragmites australis*.

9.5 Monitoring of Water and Salt Concentration Trend at Estuary (Hekou)

In 2005, monitoring work at estuary (land-sea interface) continued to focus on the monitoring on dynamic change trend of salt concentration of the water at land-sea interface. Three monitoring sections were established at the north tributary estuary of the Yangtze River, 4 km, 22 km and 35 km from the land-sea interface respectively. At each section, 3 south-north monitoring points were identified. Major monitoring items included water conductivity, soil conductivity, soil negative pressure, groundwater table and groundwater conductivity of the tributary river.

Monitoring results showed that the dynamic change pattern of the conductivities of river water, groundwater and soil of each monitoring section along the river was basically the same. That is, with the increase of the distance from the section to the land-sea interface, the monitored conductivity would gradually decrease with the highest at Yinyang section, followed by Daxing and then Xinglongsha. The water level of the Yangtze River has a close relationship with the conductivities of the water of the Yangtze River, water of inland rivers, groundwater and soil. The reduction of water level of the Yangtze River would cause the rise of monitored conductivity values.

● Conductivity of the water of the Yangtze River

In 2005, the dynamic change of water conductivity of the Yangtze River did not have any significant difference compared with that of the previous years. The dynamic change pattern of each monitoring section was similar, gradual reduction during January-May, down to lowest during June-September and continuous rise after September. With the decrease of the distance between monitoring section and land-sea interface, the conductivity would gradually rise with the highest at Yinyang Section, which is the closest to land-sea interface.

At Yinyang Section, the conductivity of water of the Yangtze River from January to September was higher than the same period of the previous years but lower during October-December. At Daxing Section, the conductivity of the water of the Yangtze River each month was lower than that of the same period of previous years with significant difference in autumn and winter. The conductivity of the water of the Yangtze River at Daxing and Xinglongsha each month was lower than the historic average of the same period before 2003 but with small variations.

● Groundwater table

In 2005, there was relatively big variations of the groundwater table with the maximum of 100 cm. The groundwater table was the shallowest at Yinyang Section and deepest at Xinglongsha Section. The change pattern of the groundwater table of each section in the year was basically the same: gradually deep during January-June with the maximum in May and June, dramatic rise during July and August and decline beginning from September. After that, the variation was not big. In general, the groundwater table during January-June was deeper than that of the same period of 2004 but shallower during July-December.

The groundwater table of each section had something to do with the water level of the Yangtze River with similar change pattern. However, the change of groundwater table lagged behind the change of water level of the Yangtze River and with smaller variations.

● Conductivity of groundwater

The change pattern of groundwater conductivity of Yinyang Section was the same as that of Daxing Section. That is, groundwater conductivity gradually rose from February and reached the peak in June. It had some decrease but kept stable during July-September, and gradually went up during October-December. Groundwater conductivities of the Yinyang Section in January-April were lower but in May-July higher than that of the same period last year. At Xinglongsha Section, groundwater conductivity did not have any big change during January-August with some reduction in September. It gradually rose during October-December. The monitored value each month was higher than that of the same period of 2004.

● **Conductivity of soil**

In general, soil conductivity gradually went down in spring and began rise in autumn. Peak soil conductivity of each section basically occurred during May-September. Soil conductivity of Yinyang Section was significantly higher than that of 2004 and higher than the historical average. Soil conductivity of Daxing Section during January-July was higher than that of the same period of the previous year but lower in other months. At Xinglongsha Section, soil conductivity during January-June was similar to that of the same period of last year but higher during July-December.

9.6 Study on Special Fish Species

In 2005, based on the successful propagation of *procypris rabaudi*, study on special fish species was conducted to observe the early stage growth and continue artificial propagation of such fish species so as to improve relevant technical details and accumulate the information about early-state growth of *procypris rabaudi*.

● **Experiment of artificial propagation of *procypris rabaudi***

During April and May of 2005, three artificial propagation experiments were conducted on *procypris rabaudi* with the help of drug fecundation with 56 female parent *procypris rabaudi* involved, the fecundation rate being 43%~53%, effective fecundation period of 16~28 hours, fertilization rate of 70%~80% and hatchability of 80%~88%. As a result, 131,000 fry were produced and 100,000 of them grew into young fish.

● **Study on early stage growth of *procypris rabaudi***

The egg of *procypris rabaudi* was round in light yellow color with the diameter of 1.77 ± 0.03 mm and the egg wall was quite thick. When contacting water, the egg diameter would become 2.38 ± 0.19 mm. Under the water temperature of 25^{o}C, the egg germinal disc swelled 57 minutes after fertilization. It divided into two cells after 1 hour 22 minutes and became multi-cells 4 hours 32 minutes later. At 5 hours and 32 minutes, it entered early blastula stage; at 10 hours and 27 minutes, it entered early gastrula stage; at 16 hours and 37 minutes, the phrenula hole closed. At 22 hours and 57 minutes, myotomma developed. At 35 hours and 37 minutes, it entered the muscle effect period. At 44 hours and 47 minutes, the crystal developed. At 54 hours and 57 minutes, the first fry appeared.

After 93 hours and 47 minutes, 50% fry went out of the egg wall with heartbeat of 176 per minute. After 169 hours and 17 minutes, the swim bladder I appeared. At 181 hours and 27 minutes, the fry began eating and the swim bladder appeared in long oval shape. At 191 hours and 47 minutes, the caudal vertebra began bending upward, the front chamber of swim bladder took its shape and fin with melanin appeared on the bottom of the tail. At 215 hours and 47 minutes, the front part of dorsal fin swelled indicating the beginning of the division of dorsal fin. And a black point appeared at the end of tail backbone. At 276 hours and 47 minutes, the yellow was completely absorbed. At 444 hours and 57 minutes, the front chamber of swim bladder appeared and entered the swim bladder II stage. At 612 hours and 57 minutes, the ventral fin spout appeared. At 660 hours and 37 minutes, the ventral fin developed with the appearance of light reflecting substance at the abdomen. At 731 hours and 17 minutes, the ventral fin was fully developed with more light-reflecting substances on gill cover and the abdomen.

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Water Conservation Committee of the Yangtze River

Office of the Fishery Resources Management Committee of the Yangtze River

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Chinese Center for Disease Control and Prevention

Ecological and Environmental Monitoring Center of the State Forestry Administration

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