

Determination of minimum ecological water level in Erhai Lake based on lake morphology and hydrological characteristics

He SHihua

(Dali Branch of Yunnan hydrology and water resources Bureau, Dali Yunnan 671000)

Objectives

Erhai Lake belongs to the tectonic lakes formed by the Himalayan crustal movement, and it is also lakes get in-get out water. This time, we mainly considered the lake morphology method to represent the influence of the topographic change characteristics of the lake on the ecological water level, the monthly minimum water level method to represent the influence of the actual water level change characteristics on the ecological water level, and the ecological water consumption method to represent the influence of the watershed water production conditions on the ecological water level. The water level changes of the Erhai Lake from 1952 to 2020 were analyzed by the three methods, and the lowest ecological water level of the lake and the lowest ecological water level of each month during period of ecological water consumption were proposed, which provide certain references for the Erhai Lake water resources management and scheduling, the rational use of water resources and the ecological environmental protection.

Methods

Method 1: Lake morphology is the most basic guarantee for the integrity of lake ecosystems, and the ecosystem will be seriously affected if the lake morphology undergoes large changes. When the decrease in unit water level causes a large change in the surface area of the lake, there is a significant change in the topography of the lake basin, and the function of the lake will change significantly.

Method 2: The management of lakes is close to that of reservoirs, and various types of characteristic water levels are generally formulated, with the minimum operating level determined as the minimum ecological water level.

Method 3: The minimum ecological water level is the lowest level at which a lake can maintain its basic ecological function. The water level of the Erhai Lake is subject to artificial regulation, and it is difficult to restore, so the average value is chosen to calculate the minimum ecological water level.

Table 1 the results of the ecological water level analysis during the water depletion period are shown

period of water consumption	Total multi-year average lake ecological water demand (10^8m^3)	Multi-year average lake ecological minimum water level (m)	Total ecological water demand of 90% of lakes (10^8m^3)	90% lake the lowest ecological water level (m)	Lowest monthly average water level in the last 14 years (m)
Nov	—	1964.41	—	1964.66	1965.06
Dec	-0.1301	1964.46	-0.0367	1964.67	1964.94
Jan	-0.0463	1964.48	0.2108	1964.59	1964.85
Feb	0.0457	1964.46	-0.1607	1964.65	1964.83
Mar	0.1489	1964.4	0.2376	1964.56	1964.73
Apr	0.2043	1964.32	0.1464	1964.5	1964.6
May	-0.0598	1964.35	0.1081	1964.46	1964.44
Jun	-0.5733	1964.35	0.274	1964.35	1964.35

Results

Establish the correlation between lake water level and the difference of lake surface area per unit water level, see Figure 1. The minimum ecological water level determined by the morphology method is the inflection point with a large change in lake morphology, that is, there is a significant change in the topography of the lake basin. so that it can be judged that the Erhai lake morphology in the 1965.00-1965.10m to occur in a large change in the lake morphology method to take the average value was used to The lowest ecological water level determined was 1965.05m.

According to the protection regulations of the Erhai Lake in different periods, the minimum operating water level of the Erhai Lake used to be 1962.69m and 1964.30m, and the changes of the legal minimum operating water level of the Erhai Lake in different periods are shown in Fig. 3. The minimum operating water level of the Erhai Lake in the past 14 years was 1964.30m.

The water level of the Erhai Lake is divided into six stages, the average monthly minimum water level of the Erhai Lake at the present stage is at the median of the whole series, with the annual minimum ecological level of 1,964.30 m. The minimum water level of the lakes at each stage is shown in Figure 2. Combining the above, it was determined that the ecological water depletion period of the Erhai Lake was from November to June of the following year, The annual minimum ecological water level was used as the threshold value to determine the minimum operating water level in each month of the water depletion period, and the results of the ecological water level analysis during the water depletion period are shown in Table 1. Ecological water consumption period of the lowest ecological water level in the introduction of the frequency of 90%, the ecological water consumption method of calculation results below or close to the minimum ecological water level method, 1964.67-1964.30 m. This value can guide the future water scheduling of the minimum water level control in each month. For lake dispatching, it is more reasonable to use the ecological water consumption calculation method at 90% frequency to determine the ecological water level during the water depletion period.

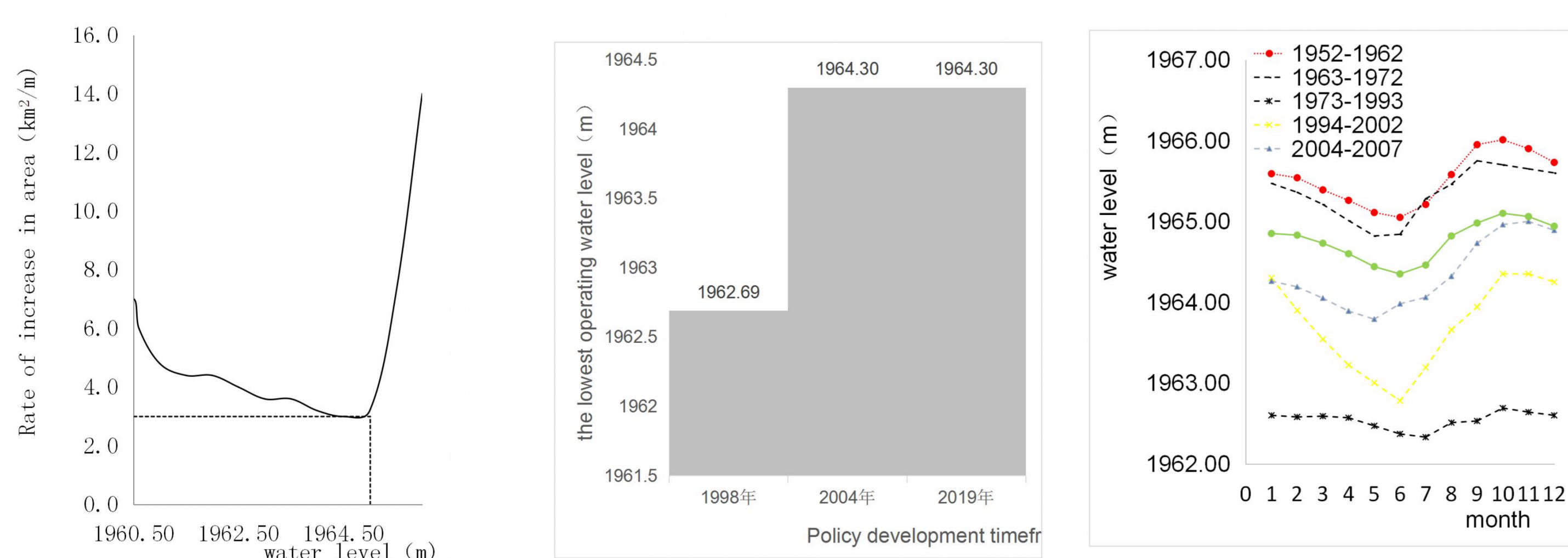


Figure1 Plot of lake level versus rate of increase in area Figure2 Chart of policy changes over time Figure3 The lowest ecological water level by stage