Acoustic investigation of fishery resources in Guanting Reservoir

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Abstract. This project uses acoustic methods to conduct a comprehensive survey of the fishery resources of the Guanting Reservoir. It uses the "Zigzag" survey route based on the actual situation of the reservoir, and uses the scientific fish finder (EK80, Simrad, Norway) as the main survey equipment. Post-processing software (Echoview, Myrix, Australia) analyzes the amount and distribution of biological resources. Statistical analysis of the existing reservoir resources and the spatial distribution of resource density showed that the fishery resources in the central part of the reservoir area are relatively high, the fishery resources in the waters near the dam in the southern reservoir area are second, and the northernmost fishery resources in the northern reservoir area. Resource Fengdu is relatively small. According to the analysis results of acoustic data, combined with the situation of biological sampling, various types of resources are also obtained. This survey provides basic data for the management of reservoir fishery resources and the formulation of enhancement and release plans, and provides a scientific basis for protecting the ecological resources and environment of the Guanting Reservoir.

1. Introduction

Guanting Reservoir is located within the boundary between Huairai County, Zhangjiakou City and Yanqing, Beijing. The construction started in October 1951 with a total design capacity of 4.16 billion m3. It is the first large-scale reservoir built by my country after its establishment, with a perennial area of 8,000 hm2. Since the operation of the Guanting Reservoir, it has played a huge role in flood control, water supply, irrigation, power generation and fishery. This project is to use acoustic methods to conduct a comprehensive survey of the fishery resources of the Guanting Reservoir, and to perform statistical analysis on the existing stock of reservoir resources and the spatial distribution of resource density. It is expected to provide basic data for the management of reservoir fishery resources and the formulation of enhancement and release plans, and provides a scientific basis for the rational protection of the ecological resources and environment of the Guanting Reservoir.

2. Investigation materials and methods

The main work of this field investigation is divided into two parts: acoustic investigation and biological sampling. Biological sampling is carried out using gillnets and cage pots. The fished samples are identified and biologically measured.

The acoustic survey was carried out using the fishery administration vessel of Guanting Reservoir as the survey vessel. The design of the acoustic survey route refers to the "Acoustic Survey and Evaluation of Fishery Resources" in the China Marine Biological Survey Code, and combines the long and narrow geographical features of the reservoir area to design the survey route in a zigzag shape. However, due to actual driving and
sailing conditions, and based on on-site conditions, the actual route taken during the investigation may deviate from the designed route.

In the survey, a scientific fish finder (EK80, Simrad, Norway) was used for acoustic surveys. The scientific fish finder was installed on the ship's side of the survey ship near the bow 1/3, and the water depth was 0.5 m. The special software ER80 was used to collect acoustic data. Acoustic survey data of biological resources can be obtained by collecting and recording; after the on-site survey is completed, the amount and distribution of biological resources can be obtained through analysis of acoustic data post-processing software, Fig 1, Fig 2 (Echoview, Myrix, Australia).

![Fig 1. Image of acoustic survey in the central waters of Guanting Reservoir](image1)

![Fig 2. Image of acoustic survey in the northern waters of Guanting Reservoir](image2)

Acoustic assessment of biological resources is to use scientific fish finder to emit sound waves vertically to the water area, and to understand the distribution of biological resources in the water area and its biomass through the analysis of echo signals. It has the advantages of fast investigation speed, wide range, and no
damage to resources. The acoustic instrument used in this investigation is the scientific fish finder (EK80, SIMRAD, NORWAY). The difference is that the data collection and storage of the new system are all automated. During the investigation, if the operating parameters are not suitable for the current environment, the system will automatically give relevant prompts, combined with prompts that investigators can quickly make adjustments, which effectively guarantees the quality of the survey data.

In terms of the time and scope of the survey, the acoustic survey covered the entire time of the survey. The acoustic data obtained from the survey was processed in the software (ECHOVIEW 9.5, MYRIAX, AUSTRALIA) specially used for the underwater acoustic survey and analysis of biological resources.

In this acoustic investigation, the data quality is good, but individual events are also affected by a little data background noise. The processing process is as follows:

(1) This survey uses the latest version of acoustic data processing software (ECHOVIEW 9.5, MYRIAX, AUSTRALIA), in which a special background noise processing module has been updated, which is based on the research results of De Robertis and Higginbottom, The use of it can remove a considerable part of the noise data, and its effect can be found to be quite obvious in use.

(2) Set up for the interference noise removal module in this processing. This module uses the different characteristics of interference noise and biological resource noise. It uses the matrix analysis function in the software to analyze and automatically identify the noise, but the data needs to be processed in the process. Resampling. However, this brings about a problem. In order to ensure the accuracy of the acoustic data during the investigation, the equipment parameters are often adjusted according to the water temperature and salinity changes. The modification of this parameter will cause the sampling points of a sampling process to be different. Changes will cause the interference noise removal module to fail to work. The countermeasure taken in this case is to turn off the module and only use the background noise removal module for automatic data processing. However, in this case, the manual processing workload in the later period is often increased.

3. Investigation results and discussion

The result of the hydroacoustic survey is mainly the Nautical Area Scattering Coefficient (NASC) of biological resources per unit segment. The larger the NASC value of a unit segment, the higher the abundance of biological resources in that segment. In this survey, combined with the length of the survey route of the reservoir, the unit flight segment is set to 500 m. The following figure shows the distribution of NASC during this survey. You can also see the entire reservoir area. The central fishery resources are relatively high. The fishery resources in the waters near the dam in the southern reservoir area are second, and the northernmost fishery resources in the northern reservoir area are relatively small. This can also be clearly seen from the NASC values of the three waters, the highest in the middle is 793.79 m²/nmi², the lowest in the north, the NASC value is 180.81 m²/nmi², and the south is in the middle, and the NASC value is 473.25 m²/nmi².

In this investigation, the biological sampling was carried out using gill nets and cage pots, and the fished samples were identified and biologically measured. Combining acoustic surveys and biological sampling, it can be found that silver carp, bighead carp and common carp have a relatively high proportion, followed by group head bream, grass carp, crucian carp and other fish resources.

This survey started at 9:00 am and ended at 16:00 pm. It may be affected by the diurnal distribution of fish populations. This can be adjusted in the follow-up survey. In addition, the biological sampling in this investigation mainly uses gillnets and cage pots, which are more selective for fish fishing, and may not be able to scientifically and accurately reflect the overall situation of the fish population in the reservoir, and thus have a certain impact on the results of this investigation.

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