Analysis on Spatial Distribution and Influencing Factors of A-Level Scenic Spots in Shandong Province

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Abstract: In this paper, the spatial distribution situation and influencing factors of 1,227 A-level scenic spots in Shandong Province are analyzed based on the text and mathematical statistics, and the following conclusions are drawn: (1) The spatial distribution of A-level scenic spots in Shandong Province is significantly different among cities. Three major A-level scenic clusters have been formed, namely, southern Shandong (with Linyi and Jining as the core), east Shandong (with Qingdao and Weifang as the core) and central Shandong (with Jinan, Taian and Zibo as the core). (2) The concentration degree and density of the spatial distribution of A-level scenic spots in different cities of Shandong Province are imbalanced. It has formed a higher-density distribution area with the central parts of Dongying and Qingdao cities as the core, a high-density distribution area with the belt-shaped area from Jinan city to Weifang city in the east, the eastern part of Binzhou city, the northern part of Taian city, the central part of Jining city, the northern part of Linyi city and the peripheral block-shaped areas in the central parts of Dongying and Qingdao cities as the core, a medium-density distribution area with Jinan-Zibo-Linyi-Zaozhuang-Jining-Taian and other cities in the central and southern Shandong regions as the core, and a low and lower-density distribution area with the block-shaped areas formed by Dezhou-Liaocheng-Heze belt-shaped area in the western Shandong region and Yantai-Weihai-Rizhao three cities in Jiaodong Peninsula. (3) Social and economic factors, especially the financial revenue of service industries above designated size and the total retail sales of social consumer goods, have the strongest impact on the spatial distribution of A-level scenic spots in Shandong Province.

1. Introduction

Since the spatial distribution of A-level scenic spots, as an important projection of tourism activities in geographical space, implies the spatial attribute and complementary relationship of tourism activities to a great extent [1], the analysis on the spatial distribution and influencing factors of A-level scenic spots is conducive not only to the rational planning and development of regional tourism, but also to the development, utilization and optimization of tourism resources [1]. In recent years, the research on A-level scenic spots by domestic and foreign scholars has been continuously improved, but insufficient in the analysis on Shandong Province, an important province in the lower Yellow River. Therefore, the spatial distribution situation and influencing factors of A-level scenic

spots in Shandong Province were analyzed in this paper so as to provide reference for subsequent research.

It is found after sorting out that the research of foreign scholars on A-level scenic spots mainly focuses on the concept definition [2], types and classification of scenic spots [3], spatial layout and planning of scenic spots [4], influence and driving mechanism of landscape formation [5] and tourists' perception of scenic spots [6]. Domestic scholars analyzed the spatial distribution characteristics and structural combination of large-scale or small-scale regions [7], and analyzed the evolution law and development pattern of spatial structure of regional A-level scenic spots based on the special tourism resources and socio-economic statistical data and introducing quantitative methods such as multivariate function [8], as well as the spillover effects of spatial distribution of A-level scenic spots and its radiation-driven effects on surrounding areas [9,10].

The integration reveals that the current research on A-level scenic spots and related tourism resources by scholars is shifting from traditional classical, field and sociological analysis to quantitative analysis based on the combination of quantitative statistics and geospatial analysis, with the visualization and contrast of analysis and research significantly enhanced [1].

Shandong Province, as a strong economic and tourism province in eastern China, is rich in tourism resources, which are numerous and complete in variety. By 2022, Shandong Province has a total of 1,227 A-level scenic attractions, including 12 5A scenic spots, covering both natural scenery such as the Yellow River Estuary Eco-Tourism Zone, and the humanities and customs areas such as Confucious Family Mansion, Temple and Cemetery Tourism Area in Qufu, forming a relatively complete and systematic tourism system. Therefore, in this paper, according to the list of A-level scenic spots published by the National Tourism Administration, the spatial distribution characteristics and influencing factors of 1,227 scenic spots in Shandong Province were analyzed using the extraction module in GIS spatial analysis, in order to provide reference for the spatial layout and optimization reconstruction of A-level scenic spots in Shandong Province.

2. Methodology and Data Sources

2.1. Methodology

2.1.1. Geographic Concentration Index

Geographical concentration is an effective index to measure the spatial distribution and agglomeration situation of A-level scenic spots in each research unit within the region. The formula is $R = \frac{AL_i \sum AL_i}{ter_i \sum ter_i}$, where AL_i and ter_i are the number of A-level scenic spots and the land area of i city respectively.

2.1.2. Kernel Density Analysis

Kernel density estimation is a spatial analysis method based on the distribution characteristics of research objects. The level of kernel density represents the degree of spatial agglomeration of research objects [11], which can be calculated by

$$F_n(x) = \frac{1}{nh} \sum_{i=1}^{n} k(\frac{x - x_i}{h})$$

(1)

Where,
$F_n(x)$ =the kernel density;
h =the estimated bandwidth of the kernel density;

n =the number of points within the bandwidth;

k =the kernel density function;

and $x - x_i$ =the distance from the estimated point to the sample point [12].

2.2. Data Sources and Preprocessing

Firstly, the data of A-level scenic spots in this paper was taken from the part of Shandong Province in the list of A-level scenic spots in 2020 published by the National Tourism Administration (https://www.mct.gov.cn/). Secondly, the geographical coordinates of 1,227 A-level scenic spots were obtained based on the Locaspace Viewer and summarized based on Excel software [1]. Third, the standard administrative division map of the research area was obtained from the standard map service website of National Bureau of Surveying and Mapping Geographic Information, and the data was re-processed by ArcGIS10.5 software, and finally the required analysis data for this paper was formed.

3. Spatial Distribution Characteristics of A-level Scenic Spots in Shandong Province

3.1. Analysis on the Overall Distribution Structure of A-Level Scenic Spots in Shandong Province

As shown in Figure 1, the spatial distribution of A-level scenic spots in Shandong Province is significantly different. Depending on the unique natural scenery and cultural characteristics, Linyi City has the largest number of A-level scenic spots, and Jining and Qingdao are ranked second and third respectively. The sum of the number of A-level scenic spots in these three places accounts for 33.7% of Shandong Provinc. The number of A-level scenic spots in Heze (29), Weihai (45) and Liaocheng (49) is relatively small due to the development history and other factors.

As a whole, three A-level scenic clusters have been formed in Shandong Province, namely, southern Shandong (Linyi and Jining as the core), eastern Shandong (Qingdao and Weifang as the core) and central Shandong (Jinan, Taian and Zibo as the core).
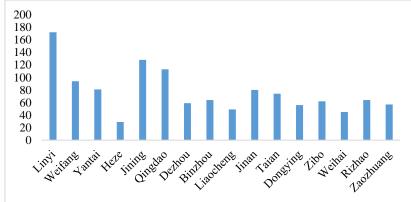

Figure 1: Distribution differences of A-level scenic spots in cities of Shandong Province

3.2. Analysis on Spatial Distribution Concentration of A-Level Scenic Spots in Shandong Province

With reference to the research of relevant scholars, the geographic concentration index was introduced in this paper to analyze the agglomeration situation and differences of the spatial distribution of A-level scenic spots in Shandong Province. Based on Table 1, the degree of city agglomeration of A-level scenic spots in Shandong Province is different, among which Taian City

has the highest geographic concentration index and the strongest spatial concentration degree, followed by Linyi City and Qingdao City, both of which have geographic concentration index higher than 1. In comparison, the geographic concentration index of Zibo, Binzhou, Zaozhuang, Heze, Rizhao, Yantai and Jinan are relatively low. The above shows that the degree of agglomeration in the spatial distribution of A-level scenic spots in various cities of Shandong Province is unbalanced, which is closely related to the number of A-level scenic spots in various cities and the size of administrative areas.

Table 1: Geographic concentration index of cities in Shandong Province

Cities	Geographic concentration index	Cities	Geographic concentration index
Linyi	1.49	Liaocheng	0.645
Weifang	0.969	Jinan	0.476
Yantai	0.468	Taian	2.585
Heze	0.404	Dongying	0.567
Jining	0.972	Zibo	0.283
Qingdao	1.11	Weihai	0.664
Dezhou	0.421	Rizhao	0.448
Binzhou	0.315	Zaozhuang	0.368

3.3. Analysis of Spatial Distribution Density of A-Level Scenic Spots in Shandong Province

In order to reduce the influence of administrative division area on the spatial distribution of A-level scenic spots, the spatial distribution density of 1,227 A-level scenic spots in Shandong Province was analyzed in this paper according to the research of relevant scholars based on the kernel density analysis module in ArcGIS10.3 (Figure 2). It was found that the central areas of Dongying and Qingdao were the areas with higher spatial distribution density of A-level scenic spots in Shandong province, with the core density value ranging from 0.021 / km^2 to 0.032 / km^2, the belt-shaped area from Jinan city to Weifang city in the east, the eastern part of Binzhou city, the northern part of Taian city, the central part of Jining city, the north central part of Linyi city, and the peripheral block-shaped areas in the central parts of Dongying and Qingdao cities were the areas with high spatial distribution density of A-level scenic spots, with the core density value ranging from 0.013/ km^2 to 0.021/ km^2. The comparison showed that Jinan—Zibo—Linyi—Zaozhuang—Jining—Taian and other cities located in the middle and south of Shandong province formed an annular region with a A-level scenic spot with medium spatial distribution density. In contrast, the block-shaped regions formed by Dezhou-Liaocheng-Heze belt in the western Shandong Province and Yantai-Weihai-Rizhao in Jiaodong peninsula constituted the main regions with low and lower spatial distribution density of A-level scenic spots.
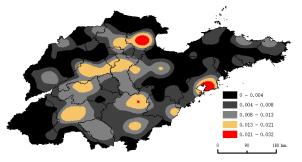

Figure 2: Characteristics of kernel density of spatial distribution of A-level scenic spots in Shandong Province

4. Factors Influencing Spatial Distribution of A-level Scenic Spots in Shandong Province

There are complicated factors affecting the spatial distribution of A-level scenic spots. Shandong province, a province with a relatively developed social economy, is becoming increasingly prominent in the influence and driving role of social and economic factors. Referring to the research of relevant scholars, this paper selected the relevant indicators such as GDP, the total population, domestic and foreign tourism income, urban and rural per capita disposable income, the financial income of the service industry above designated size and the total retail sales of social consumer goods in each city based on the *Statistical Yearbook of Shandong Province* in 2021, and extracted the relevant factors affecting the spatial distribution of A-level scenic spots in Shandong Province based on SPSS19.0. The results showed that the fiscal revenue of service industry and total retail sales of social consumer goods above designated size in all cities of Shandong Province had the strongest correlation with the number of A-level scenic spots, with the correlation coefficients of 0.883 and 0.861, respectively. The correlation between GDP and total population of each city and the number of A-level scenic spots was relatively strong, with the correlation coefficients of 0.835 and 0.817.

Further comparison and analysis revealed that the spatial distribution of high-level scenic spots with 3A level and above in Shandong Province is unique. Therefore, in this paper, the scenic spots with 3A level and above in various cities in Shandong Province were selected and analyzed. The results showed that the fiscal revenue of service industry above designated size, domestic and foreign tourism revenue, total retail sales of social consumer goods and GDP had a strong correlation with the number of 3A level and above scenic spots, with the correlation coefficients of 0.751, 0.763, 0.772 and 0.709, respectively. By contrast, the correlation between the total population and the number of 3A level and above scenic spots was weak, with the correlation coefficient of 0.617.

5. Discussions and Conclusions

The spatial distribution structure, concentration situation and density of A-level scenic spots in Shandong Province were analyzed by the methods of geographic concentration index and kernel density analysis based on the text and mathematical statistics analysis, so as to provide reference for the spatial layout and optimization reconstruction of A-level scenic spots in Shandong Province. The following conclusions were drawn:

(1) The spatial distribution of A-level scenic spots in Shandong Province was significantly different among cities. Three major A-level scenic clusters had been formed, namely, southern Shandong (with Linyi and Jining as the core), east Shandong (with Qingdao and Weifang as the core) and central Shandong (with Jinan, Taian and Zibo as the core).

(2) The concentration degree of spatial distribution of A-level scenic spots in various cities of Shandong Province was unbalanced, which was closely related to the number of A-level scenic spots in various cities and the size of administrative areas.

(3) According to the kernel density analysis, the spatial distribution density of A-level scenic spots in Shandong Province had significant regional differences, that is, the higher-density distribution area with the central parts of Dongying and Qingdao cities as the core, the high-density distribution area with the belt-shaped area from Jinan city to Weifang city in the east, the eastern part of Binzhou city, the northern part of Taian city, the central part of Jining city, the northern part of Linyi city and the peripheral block-shaped areas in the central parts of Dongying and Qingdao cities as the core, the medium-density distribution area with Jinan-Zibo-Linyi-Zaozhuang-Jining-Taian and other cities in the central and southern Shandong regions as the core, and the low and lower-density distribution area with the block-shaped areas formed by Dezhou-Liaocheng-Heze belt-shaped area in the western Shandong region and Yantai-Weihai-Rizhao in Jiaodong Peninsula.

(4) Social and economic factors such as the fiscal revenue of service industry above designated

size and the total retail sales of social consumer goods had the strongest influence on the spatial distribution of A-level scenic spots in Shandong Province.

Acknowledgements

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