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Fish Migration Based on BP Algorithm

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ABSTRACT.*As the carbon emissions caused by human activities continue to increase, the greenhouse effect continues to increase, leading to global warming, which changes the global ocean temperature, and marine life migrates to future life and habitats that are easy to reproduce successfully. This article focuses on the distribution of two fish populations that have significant economic contributions to the fisheries in Scotland, analyzes the data related to global warming and climate factors, and further proposes a stable plan for the fishery economy in Scotland.*

KEYWORDS: *Global warming; Nonlinear integer programming; Neural network models; Bioeconomic models*

1. Introduction

As people burn fossil fuels, such as petroleum, coalEtc, or deforestation and burning will generate a large amount of carbon dioxide, these greenhouse gases are highly permeable to visible light from solar radiation, andLong wave radiationIt is highly absorptive, and can strongly absorb infrared rays in the ground radiation, which will cause the temperature of the earth to rise. Global warming will redistribute global precipitation, glaciers andfrozen soilAblation,Sea-level rise etc, not only endanger natureecosystem, the balance also threatens human survival.

With the increasing content of carbon dioxide ha, the acidity of seawater increases, affecting the stability of underwater ecology.At the same time, due to the reduction of biodiversity, each species will play a more important role in the ecosystem in different proportions. Therefore, studying the impact of global warming on marine life is of long-term value and significance.

2. Neural network model

The first is to process the global ocean surface temperature data obtained on the network over the years to obtain a gis map, and to predict the change of water temperature through a neural network model.

Data Preprocessing. This article uses NOAA OISST (Optimum Interpolation Sea Surface Temperature) The optimized interpolated monthly average sst dataset is used as a background field to study the correlation between the changes in the Pacific sst and the sea ice in the Bohai Sea. The time range of this data is from December 1981 to the present, and the spatial coverage $89.875^{\circ}S-89.875^{\circ}N$, $0.125^{\circ}E-359.875^{\circ}E$ With a spatial resolution of $1^{\circ}\times1^{\circ}$ The following figure shows the global sst distribution field of this data.

3. Nonlinear integer programming

This section adds more consideration variables, using the collated data set, 80% of the data is used to solve the model to determine the weights and thresholds of the variable indicators, and the remaining 20% of the data Residual calculation is used for model accuracy test. In order to further improve model accuracy and calculation efficiency, this paper proposes to use Levenberg-Marquardt algorithm to solve.

3.1 Spatial Distribution of Ocean Warming Trends

By analyzing the trend graph of Net SLA, you can comprehensively understand the speed of warming or cooling in the waters of Scotland, so as to have a comprehensive understanding of the increase in the heat of the global ocean.

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3.2 Model Improvement Based on Levenberg-Marquardt Algorithm

In order to improve the accuracy of the model prediction and the speed of calculation, this section uses another algorithm for BP neural network model solving, which is committed to reducing residuals and reducing the number of iterations. Therefore, this paper introduces the Levenberg-Marquardt algorithm for model solving.

The lm algorithm based on numerical optimization uses not only the first derivative information of the objective function, but also the second derivative information of the objective function. The iterative formula of the lm algorithm is:

$$X_{k+1} = X_k - (J^T{}_k J_k + \mu I)^{-1} * J_k * F(X_k)$$

In the formula, J_k is a Jacobin matrix containing the first derivative of the network error pair weight and threshold, I is the identity matrix, and μ is the damping factor. The LM algorithm dynamically adjusts the damping factor based on the result of the iteration so that the value of the error function for each iteration There is a decline. It is a combination of gradient descent and Newton's method, and its convergence speed is faster.

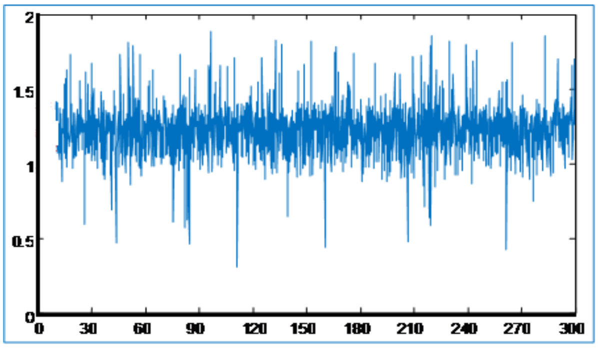

Figure.1 Residual Plot of Actual Value and Expected Output after Precision Improvement

The improved BP neural network model is solved according to the above steps, and the residual map obtained according to the corresponding more accurate weights and thresholds is shown in the figure above.

4. Bioeconomic Model

Static Bioeconomic Model: Gordon-Schaefer Model

Gordon introduced the concept of cost and benefit on the basis of Schaefer's surplus production model.

A simple static bioeconomic model has been established. The model expression is as follows:

$$Y = qfK(1 - \frac{qf}{r})$$
$$\pi = TR - TC = pY - cf$$

From the above static model, the maximum sustainable yield (msy), maximum economic yield (mey), and bioeconomic equilibrium point (be) of the developed fishery resources can be deduced, that is, the ecological benefits, economic benefits, and social benefits of the fishery. Fishing yield corresponding to various benefit targets f_{MSY}、 f_{MEY} *and* f_{BE} .

The comparison of the acquisition of fish resources by using small fishing vessels is as follows:

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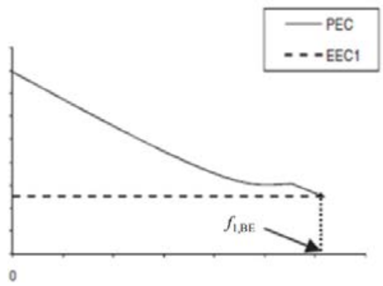

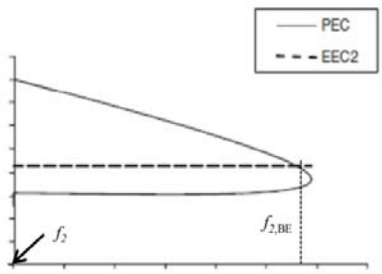

Figure.2 Catch $f_1(t)$ *Figure. 3 Catch* $f_2(t)$

It can be clearly seen that when a certain percentage of small fishing vessels are used without relying on land to support operations, the acquisition of resources will generate more efficient returns than in the past, and at the same time, the economic output will continue to expand. A huge impact.

5. The establishment and solution of the fourth model

5.1 Model Construction

We first represent the number of fisheries ecosystems with the utility function x:

$$U^i = G^i(E^i - T^i(E^j), T_i(E^i))$$
$$U^j = G^j(E^j - T^j(E^i), T_j(E^j))$$

Where, T_i Is the diffusion function for the quantity of catches in the seas of country i. T_j Diffusion function for the quantity of catches in the seas of country j.

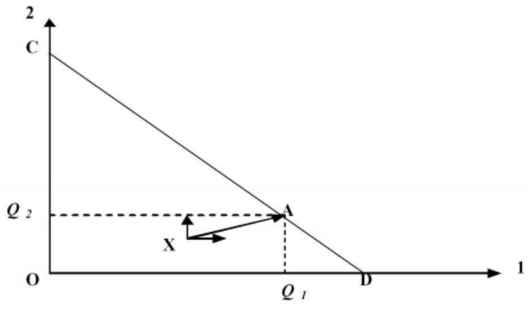

Figure.4 Diffusion function diagram

5.2 Economic Impact Analysis

According to the business strategy of Question three, if entering the territorial sea of another country, the cost will increase due to the policies of different countries. At this time, cooperative games will be required to maximize the benefits. We can use income calculation to estimate the entry into the seas of other countries. Economic impact.

Among transboundary fishery countries, if a dialogue mechanism can be established to reach a transboundary fishery agreement, then the fishery countries that have transboundary fisheries can achieve cooperation, which can ensure the stability of the fishery ecosystem and achieve transboundary fisheries. Harmony in fisheries management. Let us illustrate the model of cooperative game.

In a cooperative game, transboundary fishery countries as a whole take the same action, minimizing their total cost as a whole, and then allocating the added utility.

The objective function of minimizing their total cost as a whole is:

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$$\min[D^1(S_0^1 - T(S_r^1) - S_r^1) + D^2(S_0^2 - T(S_r^2) - S_r^2 + C^1(S_r^1) + C^2(S_r^2)]$$

The optimal conditions are:

$$-\frac{dD^2}{dS_r^2}(S_0^2 - T(S_r^1) - S_r^2) = \frac{dC^2}{dS_r^2}(S_r^2)$$

From the above formula, minimizing the overall total cost requires the country to reduce the marginal cost of catches.

Minimizing the overall cost of transboundary fishery countries is the optimization under transfer payments. It first requires cooperation between transboundary fishery countries to maximize the benefits of fisheries, and then this maximum benefit is distributed among the countries.

It can be seen that when the Scottish fishing boats enter different territorial waters, the value they receive is different, so we need to evaluate from multiple aspects.

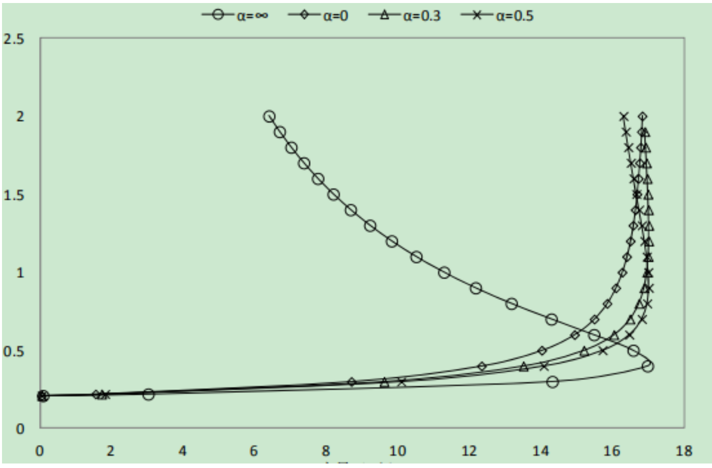

Figure.5 Economic Benefits from Entering Different Territorial Seas

In the end, we use transfer policy under the cross-border fisheries management cooperation game to solve this problem. When small Scottish fishing companies enter the territorial waters of other countries, they can use transfer payments and cooperation strategies as their company's strategic development.

6. Conclusion

This article selects different models for different problems, not only for the purpose of solving the problem, but also for testing the model, ensuring the accuracy of the model, and providing a research path for predicting the impact of global warming on marine fisheries. The model results are not limited to individual countries, and are generally applicable in various countries around the world. It has a high use value and a wide scope of application, and provides a certain reference for future scholars' research on similar evaluation and analysis problems.

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