

Original Research Article

From SWOT Analysis to Strategic Options: Potential Development of Qaroun Lake in Fayoum Governorate, Egypt

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Abstract: Lake Qaroun is one of the important sources of fish production in Egypt. The lake also considered as important source for minerals. It has a very important economic role. The high levels of pollution in the lake require strategic interventions which might not of significant impact unless deeply investigated. This research aims at determining the most important strategic options for the development of Lake Qaroun using the SWOT Analysis Matrix. Secondary data is used in addition to primary data that obtained through one-on-one interviews using pre-designed structured-questionnaire. Interviews included fishermen, experts and government officials. Results of the SWOT analysis matrix refer to high negative impacts on the development of the lake by both internal and external environment. The implementation of the strategic development of the lake will lead to wasting the resources and capabilities, and reduce the opportunities available at the present time and, thus, the inability of the lake to face the threats it faces at the present time and in the future. It's essential, before starting the development process, to clarify the most important negative results and provide the necessary instructions and directions. It's highly recommended to have a powerful integrated entity to be responsible for the management of fisheries in Fayoum Governorate. The entity should include representatives from the following organizations; Fayoum University and other related research institutes, the General Authority for Fish Resources Development, Egyptian Environment Affairs Agency of the Ministry of Environment, water resources police, the cooperative union for water wealth and fishermen's cooperative societies.

Keywords: Lake Qaroun, Fisheries, Fayoum, Development.

INTRODUCTION

Lake Qaroun is one of the important sources of fish production in Egypt in general and Fayoum Governorate in particular. The lake has faced many problems that have led to a sharp deterioration in its production environment and, accordingly, its fish production capacity (National Institute of Oceanology and Fisheries). These problems also led to the disappearance and extinction of luxurious types of fish due to the lake's pollution with different kinds of pollutants (Barania, 1992). The lake also considered as important source for minerals as it produced about 385K tons of sodium chloride, hydrated magnesium sulfate and anhydrous sodium sulfate in 2020 valued at 497.8 EGP (Egyptian Mineral and Salts Company in Fayoum). In addition; the lake offers big number of job opportunities through the original and complementary activities especially in the tourism sector. This illustrates the economic importance of Lake Qaroun not only as a fish source but also as source of minerals and a tool for industrial and touristic development (Waly, 2002).

The sustainability of inland rivers and lakes around the world as an important source of fish production and mineral wealth in addition to tourist attractions, is increasingly threatened by environmental changes caused by the intensification of land use, increased demand for the limited water resources and climate change. These changes directly affect the availability & quality of water and the environmental systems in many areas. Unlike other lakes, the Egyptian lakes are suffering more due to the continuous drainage of various types of industrial, health and agricultural pollutants. These pollutants negatively affect the quality and specifications of water and the fish production. These factors are clearly reflected in the low production of Lake Qaroun (Egyptian Ministry of Environment). Considering the shortage in

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the monitoring and follow up by the government officials, these lakes are deteriorated over time and negatively affect the health, economic and social status of thousands who are affiliated with these lakes' activities.

Problem Statement

Lake Qaroun is one of the important sources of fish production in Egypt, as well as an important source of mineral wealth and an important tourist destination. However, the fishing wrong practices in Lake Qaroun threaten the sustainability of its fish resources. The threat is caused mainly because of the following reasons; the absence of scientific management, the continuous depletion due to illegal fishing practices and the environmental pollution of agricultural, health and industrial drainage. All the mentioned reasons led to high rates of salinity and pollution with pesticides, chemicals, and organic & inorganic compounds. This, in turn, led to the decrease and deterioration of fish production capacity and the extinction of some economic fish varieties in addition to the decline of tourist attractions in the region as a result of this pollution (Husein, 1993).

Research Objectives

This research aims to identify the potentials of developing Lake Qaroun in Fayoum Governorate through; determining the most important strategic options for the development of Lake Qaroun using the SWOT Analysis Matrix. This will be done through transforming qualitative data into quantitative data that helps decision makers to reach the right and rational decisions.

METHODOLOGY

Data Sources

The data required for this research was collected and compiled from two main sources of data;

1. **Secondary Data:** includes published and non-published data obtained from the Central Agency for Public Mobilization and Statistics, the General Authority for Fish Resources Development and some periodicals in addition to Arab and foreign references related to the subject of the study.
2. **Primary Data:** collected using a personal interview questionnaire for three categories of beneficiaries and stakeholders in Fayoum Governorate. The first category includes 39 experts and academics specialized in fish production and economic development selected from the General Authority for Fish Resources Development and the Qaroun Lake Development Authority. The second category includes 105 fishermen and owners of fisheries' projects established along the lake area representing 15% of the total population of this category. The third category includes 217 beneficiaries and original inhabitants of the region.

Using the Benzaghta *et al.*, (2021) approach, when determining the study indicators, the researchers gave a relative weight for each category in proportion to its experience and relevance to the subject of developing the lake. After consulting with development specialists, the researchers gave a relative weight of 50%, 30% and 20% to the previous three categories, respectively.

SWOT Analysis Matrix

The strategic decision-making tools including the SWOT analysis matrix is becoming of significant importance because of the characteristics of strategic decisions (Papadakis, 2006). The process of conducting SWOT analysis and decision making is usually built upon three phases. In the first phase "Perception", information is gathered as an input for the model. In the second phase "Understanding", the problem is analyzed and the inputs are transformed as preparation for the last phase. In the third phase "Consideration", the outputs are concluded and are ready to be used by decision-makers see figure 1 (Papulovaa and Gazovaa, 2016).

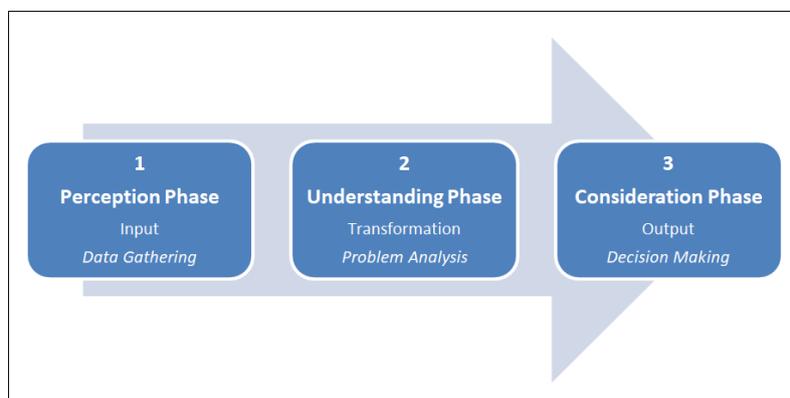


Figure 1: SWOT Analysis Process

According to Helder (2018), the model distinguishes between two dimensions; internal and external where the internal factors (strengths and weaknesses) can be controlled and external factors (opportunities and threats) cannot be controlled. The objective of the SWOT matrix is to present the strategic decision considering four dimensions of strategic directions based on the results of the internal and external environmental analysis (Hunger and Wheelen, 2003). The matrix framework is shown in figure 2 (Skinner *et al*, 2012).

	Strengths Positive characteristics and advantages of the issue, situation, or technique	Weaknesses Negative characteristics and disadvantages of the issues, situation, or technique
Opportunities Factors or situation that can benefit, enhance, or improve the issue, situation, or technique	S-O Strategy Using strengths to take advantage of opportunities	W-O Strategy Overcoming weaknesses by taking advantage of opportunities
Threats Factors or situation that can hinder the issue, situation, or technique	S-T Strategy Using strengths to avoid threats	W-T Strategy Minimize weaknesses and avoid threats

Figure 2: SWOT Analysis Matrix Framework

The SWOT analysis is applied through steps that can be clarified through figure 3 (Idris and Almorsi, 2006).



Figure 3: SWOT Analysis Steps

The strategic decision can be taken based on the interactions between internal and external environment factors. The following matrix illustrates the strategic decision-making process (Emblemsvag and Kjolstad, 2002) and (Jones and George, 2008).

#	Internal Environment	External Environment	Rationale
1.	Positive	Positive	Result: positive. Decision: implement the decision under review. Reason: the organization has good strengths and great opportunities that can be utilized.
2.	Negative	Negative	Result: Negative Decision: don't implement the decision under review. Reason: there are weaknesses and threats that have a high negative impact on the strategic decision under review. Therefore, the implementation of the strategic decision will lead to lose the resources and capabilities of the organization, and reduce the opportunities available to tackle at the present and in the future, and

#	Internal Environment	External Environment	Rationale
			thus the inability of the organization to mitigate the threats that will face in the future. In this case, the most important negative results should be clarified and the necessary instructions & directions should be addressed in order for the organization to be able to take such decisions in the future.
3.	Positive	Negative	<p>Result: positive. Decision: subjective. Reason: if the positive internal factors are greater than the negative external factors, the strategic decision-makers will take the decision considering the following: Highlighting the important strengths of the organization that will help in implementing the strategic decision. Presenting the most important threats will face the organization, which will lead to the ineffectiveness & inefficiency of the decision implementation in addition to its economics.</p>
4.	Positive	Negative	<p>Result: negative. Decision: subjective. Reason: if the positive internal factors are less than the negative external factors, the strategic decision-makers will take the decision considering the following: Clarify the most important threats facing the organization that will be barriers of implementing the strategic decision and that will lead to ineffectiveness & inefficiency of the decision implementation in addition to its economics. Highlighting the most important strengths that the organization has in terms of resources and capabilities that will support the implementation of the strategic decision.</p>
5.	Negative	Positive	<p>Result: positive. Decision: subjective. Reason: if the negative internal environment is less than the positive external environment, the strategic decision-makers will take the decision considering the following: Clarify the weaknesses that have an important impact on the organization's performance and will lead to impeding the implementation of the strategic decision. Presenting the most important opportunities available to the organization that will greatly support implementing the strategic decision.</p>
6.	Negative	Positive	<p>Result: negative. Decision: subjective. Reason: if the negative internal environment is greater than the positive external environment, strategic decision-makers will take the decision considering the following: Clarify the weaknesses that have a significant impact on the organization's performance level and the difficulties that will prevent implementing the strategic decision. Highlighting the most important opportunities available to the organization that will help implement the strategic decision.</p>

According to Khattab (2001), the matrix of internal and external factors evaluation can be used in analyzing the internal and external environment elements for the following reasons:

- Increased severity of external factors surrounding business organizations.
- Determining the internal strategic factors that have the greatest impact for each strategic decision which will enable correcting the situation in a timely manner.
- Determining the organization's position on the external environment and identify the most important opportunities & threats that will affect the strategic decision.
- Determining the organization's position on the internal environment to identify the most important strengths & weaknesses that will affect the strategic decision.
- Comparing the weight of each of the strategic factors from year to year to determine the extent to which its importance and impact on the organization have evolved.
- Support the strengths & opportunities of the organization to reduce weaknesses & threats on the other hand.

- Follow up on weaknesses & threats with higher weights and work on and search for the best means and ways to fix them as soon as possible.

RESULTS

The steps for building the SWOT analysis matrix and identifying strategic options for development is built upon four steps as explained by Hunger and Wheelen (2003).

- Determining the good and bad factors to determine the causes for which they occurred.
- Evaluate the external factors.
- Evaluate the internal factors.
- Interaction between internal & external factors (building the matrix).

First: Determining Good and Bad Factors

These factors will be addressed in preparation for finding out the reasons behind them through:

- 1- Determine the good and bad factors.
- 2- Define the main reasons that led to the good and bad factors and classify them into internal and external environment.
- 3- Reframing opportunities (good external factors) and threats (unfavorable external factors).

1. Good and Bad Factors

Good factors	Bad factors
1. The large water surface and the availability of natural foods needed for fish rising.	1. Quantitatively & qualitatively water pollution and the spread of parasites and predators in the lake.
2. The presence of fish collection centers on the southern shore of the lake.	2. The recent deterioration of fish production from the lake.
3. The presence of a branch of the National Institute of Oceanography and Fisheries and a branch of the General Authority for Fish Resources Development, which includes many scientific and research cadres, in addition to the Fisheries Office to facilitate administrative procedures for fishermen.	3. The operation of the marine hatchery has been disrupted.
4. Lake Qaroun suitability for fish production and tourism activities.	4. Continuous rise of the salts' concentration in the lake.
5. The presence of a marine hatchery on the shore of the lake.	5. Non transporting marine fish fry.
6. The availability of licensed boats and trained labor in the neighboring villages of the lake.	6. The lack of markets equipped for the inputs of fish production and fish products.
7. Existence of a complex of factories to extract salt from the lake and the possibility of accommodating more other factories.	7. Decline in foreign tourism in Lake Qaroun.
8. Lake Qaroun and its environs are considered a promising area for tourism.	8. The use of primitive methods of fishing.
	9. Migration of skilled labor to work in urban areas.

2. The Main Reasons for Good and Bad Factors

During this step, an attempt is made to determine the most important main reasons that led to the emergence of these good and bad factors, as well as to determine which of these factors are within the internal environment that can be controlled and which are within the external environment that cannot be controlled but can be benefited from or try to reduce damage consequent (Idris and Almorsi, 2006) and (Emblemsvag and Kjolstad, 2002).

Reasons for good factors	Internal/External
1. Large quantities of agricultural drainage water that carries organic matter and phosphate residues.	External
2. Long shores of the lake and the abundance of productivity in the past.	Internal
3. The government's interest in developing fish production in the lake.	External
4. Moderate climate in the Qaroun region.	External
5. Producing marine fish fry locally instead of transporting them from outside the governorate.	Internal
6. The high population density in Lake Qaroun area and the increase in fishing returns in the past.	Internal
7. The high concentration of salts in the lake.	Internal
8. Availability of touristic attractions in the Qaroun area.	Internal

Reasons for bad factors	Internal/External
1. Low quantities of agricultural drainage water entering the lake recently.	External
2. The illegal fishing practices and the lack of fry supply.	Internal
3. Absence of skilled personnel on marine fish spawning operations.	Internal
4. Pollution of the lake water with industrial and sanitary drainage.	External
5. Lack of funding for the purchase and transfer of fry.	External
6. The inadequacy of the role of the concerned authorities and the high costs of establishing markets for production inputs and fish products.	External
7. Lack of security and increased levels of pollution in the lake.	External
8. Absence of training and guidance on modern fishing practices.	Internal
9. Declining fish production and declining incomes from fishing revenues.	Internal

3. Reframing Opportunities and Threats

In this step, an attempt is made to reformulate the previous phrases into positive phrases that are an area for improvement or a verifiable goal, and this is done for opportunities and threats (the external environment) only. Thus, these goals are the strategic options that must be chosen from among them later to achieve the desired development of Lake Qaroun (Waly, 2002).

Reasons for opportunities	Verifiable strategic goals
1. Large quantities of agricultural drainage water that carries organic matter and phosphate residues.	1. Benefit from the large quantities of agricultural drainage water that carries organic matter and phosphate residues.
2. The government's interest in developing fish production in the lake.	2. Benefit from the government's interest in developing fish production in the lake.
3. Moderate climate in the Qaroun region.	3. Benefit from the adequate climate in the Qaroun region.
Reasons for threats	Verifiable strategic goals
1. Low quantities of agricultural drainage water entering the lake recently.	1. Reducing the damage resulting from the small quantities of agricultural drainage water added to the lake.
2. Pollution of the lake water with industrial and sanitary drainage.	2. Reducing the damage resulting from the pollution of lake water with industrial and sanitary drainage.
3. Lack of funding for the purchase and transfer of fry.	3. The ability to deal with the lack of funding needed to purchase and transport fry.
4. The inadequacy of the role of the concerned authorities and the high costs of establishing markets for production inputs and fish products.	4. Reducing the damage resulting from the no-interest of the authorities and the high costs of establishing markets for production inputs and fish products.
5. Lack of security and increased levels of pollution in the lake.	5. Reducing the damage resulting from the lack of security and the increase in pollution rates in the lake.

Second: External Factors Analysis Matrix

In this section, the external factors will be analyzed in several steps as follows depending on Riston (2008);

- 1- Determine a list of the most important opportunities as well as threats with the greatest impact on the organization.
- 2- Determine a relative weight for each of the previous factors between one and zero, where one represents the most important factor and zero represents the least important factor.
- 3- Determine the order of each of the previous strategic factors based on the organization's current response to this factor. This arrangement is as follows:
- 4-

1	2	3	4	5	6
Poor	Below average	average	Over average	Important	Very important

- 5- The relative weight of each factor is multiplied in the order of this factor, i.e. (the second column x the third column) in order to obtain the weighting for each factor.
- 6- The weights are summed in the previous step to obtain the total weight of the organization.
- 7- Comparing the total results of the weighted box with the result of the weighted average total score which is estimated to be 3.5.
- 8- If the total weight of the organization exceeds the overall weighted average, the external environment represents opportunities for the organization.

Table 1 represents the external factors analysis for Lake Qaroun. The results show that Lake Qaroun faces external threats as the sum of the total weights is 3.10 which are below 3.5. The sum of the subtraction process is negative, which

will be discussed later in the interaction between internal and external factors (building and calculating the degrees of the analysis matrix).

Table 1: external factors analysis matrix for Lake Qaroun

Opportunities & Threats	Relative weight	Ranking	Total weight
Opportunities			
1. Availability of agricultural drainage water that carries organic matter.	0.1	2	0.2
2. The government's interest in developing fish production in the lake.	0.1	3	0.3
3. Moderate climate in the Qaroun region.	0.1	3	0.3
4. The vast local tourist fame of the lake.	0.1	3	0.3
5. The non-existence of competitive beaches.	0.1	2	0.2
Total Opportunities			1.3
Threats			
1. Less quantities of agricultural drainage water entering the lake.	0.1	4	0.4
2. The small number of tourists visiting the lake.	0.05	1	0.4
3. Lack of funding for the purchase and transfer of fry.	0.05	1	0.05
4. The inadequacy of the role of the concerned authorities.	0.05	4	0.2
5. Low security level to secure investments.	0.05	5	0.25
6. The migration of hundreds of fishermen to work in other lakes in Suez and Damietta,	0.1	2	0.2
7. Pollution of the lake's water with industrial and sanitary drainage and pouring fish farms' waste into it.	0.1	3	0.3
Total Threats			1.8
Opportunities + Threats			3.1
Opportunities - Threats			-0.5

Third: Internal Factors Analysis Matrix

Similar to the process applied in analyzing the external factors, the same process is applied to analyze the internal factors. Table 2 shows that the internal environment factors of Lake Qaroun are considered weaknesses with total weight of 3.20 which is less than 3.5. This refers to the necessity of better management system of the lake to avoid and reduce weaknesses that significantly affect the lake.

Table 2: internal factors analysis matrix for Lake Qaroun

Strengths & Weaknesses	Relative weight	Ranking	Total weight
Strengths			
1. Long shores and the abundance of productivity in the past.	0.1	3	0.3
2. Producing marine fish fry locally.	0.1	3	0.3
3. The high population density in Lake Qaroun area.	0.1	3	0.3
4. High fishing returns in the past.	0.05	2	0.1
5. The high concentration of salts in the lake.	0.1	3	0.3
6. Availability of touristic attractions in the Qaroun area.	0.05	3	0.15
Total Opportunities			1.45
Weaknesses			
1. The illegal fishing practices and the lack of training.	0.1	5	0.5
2. Absence of skilled personnel on marine fish spawning operations.	0.05	2	0.1
3. Lack of fry supply.	0.05	3	0.15
4. Extinction of certain varieties of fish from the lake.	0.1	3	0.3
5. The emission of unpleasant odors from the lake, which leads to dangers to humans and fish.	0.1	4	0.4
6. Declining fish production and incomes from fishing revenues.	0.1	3	0.3
Total Threats			1.75
Opportunities + Threats			3.2
Opportunities - Threats			-0.3

Fourth: Interaction between Internal & External Factors

In the previous sections, the external and internal factors were analyzed separately. In this section the SWOT analysis matrix is built based on the interaction between the two groups of factors. The results are calculated based on the interaction between: strengths and both opportunities and threats, then the interaction between weaknesses and both opportunities and threats as well. Opportunities and threats are considered strategic objectives and the most important of which are chosen according to the highest score within the matrix. Those objectives with the higher scores are the first priority objectives for decision-makers to consider.

To obtain the score for each objective, the sum of the strategic objective's weaknesses is subtracted from the sum of the strategic objective's strengths. Then, the strategic objective of the highest score is chosen as a first priority, followed by those with the following higher scores. These objectives represent strengths and opportunities at the same time SO, followed by the objectives that represent strengths and threats of ST.

Table 3: SWOT analysis matrix and strategic objectives for Lake Qaroun

		External Factors												
		Opportunities						Threats						
		1	2	3	4	5	1	2	3	4	5	6	7	
Internal Factors	Strengths	1	2.5	2	1.9	4	3.1	3	1.3	2.4	3	4	1.5	3.5
		2	2	1.1	2.4	2	2	3	2	3	2.8	3	2	2.2
		3	1.8	2	2	2	1.9	2	1	2	4	3	1	4
		4	2.1	1.9	3	1.8	2	3	1.9	2.5	2.7	2	1.9	2
		5	2.5	2	2	2	2	3	2.5	2.3	2	1	2.5	3
		6	1.4	4	2	4	4.4	2	3	2	4	4	3	2.6
		Total	12.3	13	12.2	15.8	15.4	16	11.8	14.2	17.5	16	11.8	17.2
	Weaknesses	1	2.2	1.1	1.9	1.9	1.4	1.5	1.1	2.9	1.7	1.9	1.1	2
		2	2	2.3	2	1.5	1.3	2	1.3	2	2	2	1.3	2
		3	1.1	2.1	1.9	2	1.5	1.1	2.1	1.9	2.8	1.9	2.1	2.6
		4	1.4	2.2	1	2	1.5	2	2.2	2	2	2	2.2	2
		5	1.6	1.2	1	1.8	1.7	1.5	1.2	1	1.5	1.2	1.2	1
		6	2	1.8	1	1.6	1	1	1.8	1	1.5	1.1	1.4	1
		7	2.9	2.5	1.6	1.1	2	1.6	1.5	1.6	1.5	2	1.9	2.6
Total	11.6	12.2	9.4	11.8	10.4	10.7	10.2	12.4	13	10.9	10.2	13.3		
Scores		0.7	0.8	2.5	4	1.8	5.3	1.6	1.8	4.5	5.1	1.6	3.9	
Rank		12	11	6	4	7	1	9	8	3	2	10	5	

As per the results shown in table 3, the strategic objectives with priority in implementation are determined. The implementation of the objectives will be reducing the negative impact in the case of threats and increasing the positive impact in the case of opportunities.

The priority objectives are, in order:

1. Less quantities of agricultural drainage water entering the lake that led to increasing water salinity (Threat).
2. Low security level which threatens investments (Threat).
3. The inadequacy of the role of the concerned authorities (Threat).
4. Moderate climate in the Qaroun region (Opportunity).
5. The vast local tourist fame of the lake (Opportunity).
6. Pollution of the lake's water with industrial and sanitary drainage and pouring fish farms' waste into it (Threat).

DISCUSSION AND RECOMMENDATIONS

In light of the foregoing, the use of an integrated SWOT analysis with the performance evaluation matrix will help in the strategic decision-making process. Two indicators can be extracted from the calculations of the matrix;

Subtracting weaknesses from strengths: $1.45 - 1.75 = (-0.3)$

Subtracting threats from opportunities: $1.30 - 1.80 = (-0.5)$

As seen from the calculations; both environments (internal and external) have high negative impacts on the development of the lake. Therefore, the implementation of the strategic decision (developing the lake) will lead to wasting the resources and capabilities, and reduce the opportunities available at the present time and, thus, the inability of the lake to face the threats it faces at the present time and in the future. It's very important, before starting the development process, to clarify and tabulate the most important negative results and provide the necessary instructions and directions to address the current situation of the lake so that it will be able to take such decisions in the future.

Based on the results of the SWOT analysis matrix, the decision-making matrix, the suggestions of lake workers, fishermen, researchers, and economic development specialists; it's recommended to consider the following actions:

- Form integrated entity to be responsible for the management of fisheries in Fayoum Governorate. The entity should include representatives from the following organizations; Fayoum University and other related research institutes, the General Authority for Fish Resources Development, Egyptian Environment Affairs Agency of the Ministry of Environment, water resources police, the cooperative union for water wealth and fishermen's cooperative societies. The new entity should set plans for the development of the lake, reduce the negative impacts, and unify the control and supervisory over the lake.
- The authorities should take actions towards the treatment of the drainage water flows to the lake to reduce the effects of agricultural, industrial and health pollution.
- Holding awareness and guidance courses & training for fishermen on complementary industries related to fishing activity during the fishing breaks.
- The necessity of providing adequate security level in the lake to ensure good returns of tourism and tourism activities to the region, as well as combating illegal fishing activities and smuggling of seed.

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