

The role of Environmental Management in the economic benefit of Fisheries: an analytical study of the Tigris River in Nineveh Governorate

<https://orcid.org/0000-0001-7545-4144>

Dr. Adel Mohammed Al-Taie

adel_mohamed@uomosul.edu.iq

<http://dx.doi.org/10.29124/kjeas.1654.3>

ABSTRACT

Purpose: The current research aims to measure the cumulative impact of some negative practices on the Tigris River, specifically some of the negative effects that lead to economic losses on workers in the fisheries industry, and to determine how inefficient environmental management leads to many negative environmental impacts on fisheries. The current research helps to achieve a number of benefits, the most important of which are the economic benefits related to those working in the fisheries industry and calculating the effects and indirect costs resulting from the loss of such wealth as a result of factors and difficulties associated with environmental management, such as job loss, scarcity of resources, and lack of returns, which significantly affected the loss of an important resource. One of the resources of Iraq and Nineveh, which is provided by the Tigris River, is the mineral wealth.

Design/methodology/approach: The research used the method of content analysis, specifically the analysis of the records of the Department of Environment, Agriculture and livestock in Nineveh, the records of animal statistics in the Nineveh Statistics Department and the reports of the Ministry of planning, to reach the basic data of the research for analysis. As well as international reports and reports of official authorities in the countries located on the river, as far as they relate to the subject of research.

Findings: The research found that there is a pollution rate in the river that is the highest in Iraq, especially in the last five years, and that the largest percentage of water wastage is in the agricultural field as a result of the use of old irrigation methods, and as a result of inefficient environmental management that led to the loss of a large portion of workers in the fishing field. For their jobs and the shift to fish farming, which has a higher economic return, but at the same time has less benefit to the environment. The research also found the extinction of many fish species, the scarcity of existing ones, and the loss of the natural environment for large numbers of fish species. The subject of the research has also been addressed by a few studies at the level of Mosul, Nineveh, and Iraq.

Originality/value: The importance and value of the current research lies in the impact of the functions of managing the aquatic environment in the Tigris River from theoretical and applied points of view on the size and type of fish wealth in the Tigris River, being one of the important rivers on the banks of which about 70 million people live in three countries (Turkey, Syria and Iraq)(Chabuk et al., 2020), and the possibility of predicting the future trends of the Tigris River, whether it is heading towards the extinction of some fish species, and developing management solutions related to water quality and determining their priorities to rebuild that wealth because of its impact on strengthening the economy and increasing economic benefits in terms of increasing employment opportunities and providing a more qualitative form of fish wealth production in Nineveh Governorate.

Keywords: environmental management, water quality, fisheries, economic benefit of Fisheries.

Introduction

The health of Fisheries Resources is one of the most important indicators of the safety and health of the environment and the quality of its management, as the presence of rates of toxins and pollutants, and the various residues put by organizations and individuals in the river at high rates will not only affect the fish wealth towards its production and decay, but this pollution will lead to many direct economic effects on the livelihoods of people in the area living in that river. The current research is based on the question: "How can the environment be managed to preserve fishery species to increase the economic return resulting from them in the Jalah River in Nineveh Governorate?", Assuming "the absence of quality indicators in the waters of the Tigris River from a statistical point of view in the

qualitative and quantitative balance of fish wealth in the river will lead to lower yields and higher economic costs for fish market workers in Nineveh Governorate". The current research attempts to diagnose the reality and analyze the reasons that benefit decision makers towards the management of Fish and water resources in Nineveh Governorate and to take appropriate measures to prevent the aggravation of the economic crisis in the fish market, as a result of the presence of uncontrollable pollution rates. (Adamo et al., 2020) and it becomes irreparable. The current research was based on the method of content analysis by analyzing statistics published by specialized government organizations and analyzing them using a set of statistical tools in measuring pollution in the Tigris River, and in measuring economic indicators and the economic effects resulting from pollution in the river. among those statistical tools are the 20/80 scheme, quality control schemes, cause and effect scheme, checklists (examination) in addition to Anova variance analysis to calculate the impact of pollutants in the Tigris River on samples of fish in the river.

The current research has found that there is an impact of industrial and medical pollutants, fishing methods with toxins, and an increase in household pollutants in the extinction of fish such as bass, catfish, and the increase of some fish species in certain areas such as running Fish, and carp because the first type lives on organic waste, and the second lives in artificial ponds, so it is fattening and of little use when consumed. The current research includes the following axes: in order to clarify the dimensions of the current research and indicate its variables, we discuss the methodology within the following axes:

1. Methodology.

1.1. The problem of research .

Fish wealth assessment reports in the Tigris River, submitted by the Iraqi Ministry of Agriculture, (Ghawi & Tisti, 2021) indicate that the negative impacts on the river negatively affect the size of the economic benefits that workers in the fisheries industry can achieve in terms of the impact of pollutants, lower river levels, and water flow. These indicators affect the loss of fishermen's jobs, the lack of financial returns for the state and individuals, and the loss of many species of fish that live in the river, and thus the loss of fish wealth and the loss of their economic returns. The research problem can be determined by asking the following questions:

1. What are the causes of pollution in the Tigris River?
2. How can the management of the aquatic environment preserve fish wealth to reduce abandonment of the profession and reduce unemployment among workers in the fishing industry?
3. Who are the groups most affected if the level of the Tigris River drops?
4. How can the negative effects of the decline in the level of the Tigris River be reflected in the economic benefits?

1.2. Approach

The current research used the descriptive analytical method in presenting and analyzing data, specifically the method of content analysis or quantitative analysis based on the facts published in reports in government organizations in Nineveh Governorate, from the Ministry of planning, the Ministry of Health and international organizations to the extent that these data are related to the variables of the current research.

1.3. Objective of research

The current research seeks to shed light on facts related to environmental management and reducing pollutants in the waters of the river, being the main source of fish wealth in Nineveh Governorate, as the Tigris River is the seventh longest river in the world and the second longest river in the Arab world. The current research seeks to measure the dimensions of Environmental Management in the Tigris River and the extent of dependence on it in providing a suitable economic environment for natural resources in the river and determine the appropriate ways to manage the environment in the river waters in a way that achieves a balance in the species of fish living in the river, as there is a direct relationship between the length of the river and the rates of pollution due to the many pollutants and pollution points along the river, and try to highlight the problem of imbalance in fish wealth resulting from that pollution. (Jaber & Rashied, 2022)

1.4. Hypotheses.

The research hypotheses are determined by the following:

H01 " There is no serious pollution rates on the fisheries in the Tigris River in Nineveh Governorate".

H02 " There is no significant waste in the optimal use of Water Resources in the Tigris River in Nineveh Governorate.

H03 " There is no significant effect of overfishing in the diversity and renewal of fish wealth in the Tigris River in Nineveh Governorate."

H04 "There is no significant effect of the lack of water flow of the Tigris River on the volume of fish **production** " in the sense that the less water flow of the Tigris River leads to a lack of fish wealth and as a result, the lack of production and self-sufficiency of fish in Nineveh and Iraq.

H05 "There is no significant effect of the lack of water flows in increasing the **unemployment** of fishermen in the Tigris River " and this hypothesis is considered a fact and logical considering that fishermen directly depend on the high water levels of the river in the practice of fishing.

H06 "There is no a direct correlation between the water **levels** of the Tigris River and the fisheries **industry** in Iraq and in Nineveh Governorate"

H07 " There is no significant effect of the lack of Tigris river water on the loss of **farmers' jobs** and agricultural land in Nineveh Governorate."

The sub-dimensions of the research can be clarified through diagram (1)

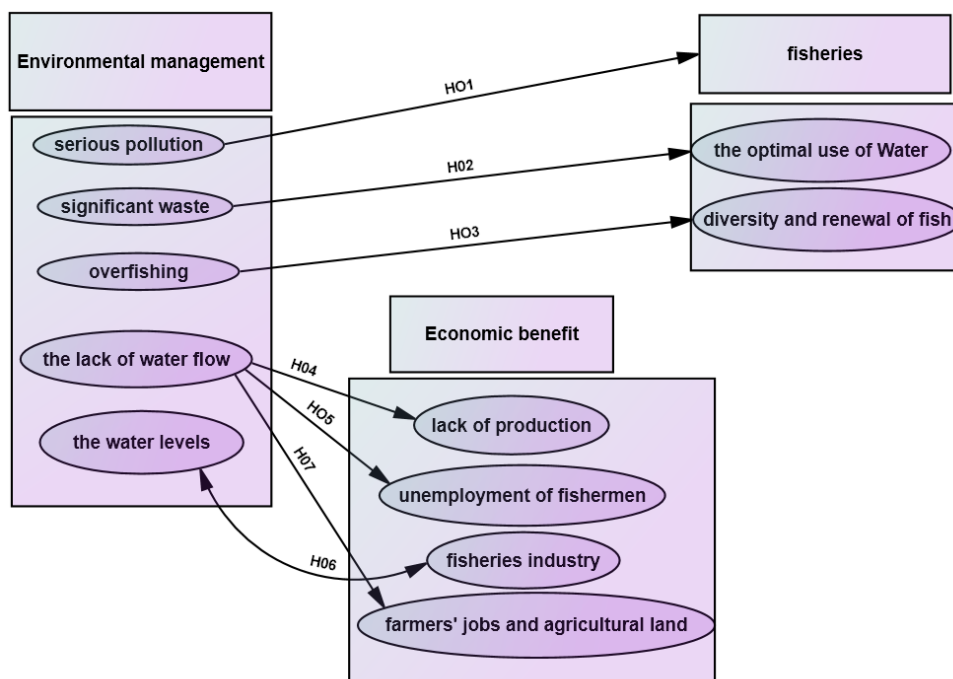


diagram (1) Hypothetical diagram for the research variables and sub-dimensions

1.5. The importance of research

The current research achieves many benefits, including what is reflected on multiple parties, including the local government to make decisions related to monitoring and improving the water management of the Tigris River, raising the water quality of the river and improving the natural environment of the river, as well as providing realistic evidence and indicators of pollution of the Tigris River to determine the suitability of its water for human consumption or agriculture, as the death of fish is an important indicator of water health for various community groups (Whitfield & Elliott, 2002). As well as determining the economic costs of the decay of the river and the extinction of fish on the markets in Nineveh Governorate and on workers in the fisheries trade.

1.6. Methods of statistical analysis and measurement tools.

The current research is based on the facts published by specialized and government agencies as sources of data and analysis of Statistics and facts collected from official organizations, from a statistical and administrative point of view, and not from an organic chemical point of view, which has been adopted by many researches in specialties such as (science, environment, veterinary medicine, etc.) and the methods used by the current research is what he identified (Khalil & Ouarda, 2009) and (Fu & Wang, 2012) are:

A-Pareto chart Pareto Chart scale 80/20: this scale is used after obtaining information from various sources (such as records of organizations, checklist, questionnaire form, random samples, the internet, specialized organizations, specialized magazines and other sources) and the rule 80/20 is based on the fact that 80% of the problems of the total phenomenon (pollution, for example) is caused by 20% of the causes that have accumulated on it for the occurrence of such a high percentage of pollution.

B-histogram, favorable ratios obtained from specialized government organizations in Nineveh Governorate.

2. River water quality and Fisheries

We will address the topic of the relationship between the dimensions of river water quality and the natural balance of fish species according to the opinions and conclusions drawn about them in the light of the following paragraphs:

2.1. The concept of Environmental Management and river pollution.

Water makes up almost 70% of the Earth's surface, of which 97.5% is salt water and 2.5% is fresh water. Only less than 1% of it is accessible and 2.5% of the amount of fresh water is suitable for human consumption without treatment. With the rise of sea water, and the melting of ice in the poles of the globe, the salty ocean water is filtered as fresh coastal water, which leads to heavy rainfall and flooding, but the frequent dumping of waste from fertilizers and sewage mixed with coastal fresh water all this leads to the transformation of these waters into oxygen-free water necessary for the growth of natural biology (Mishra, 2023). He points out.(AL-OBAIDI et al., 2020) The concept of river pollution includes " the set of toxic indicators that transform fresh water in rivers from a normal state to high levels of toxicity in such a way as to affect the ability of those rivers to sustain the life that lives in or around them "and we note that this definition includes not only fish but also the rest of the life in the river (Zelevánková et al., 2020).On the other hand, defines river pollution in some detail as "increasing the depletion of fresh water resources and the continuous consumption of it and the disposal of waste in a way that exceeds the river's capacity to absorb it and leads to the death of food resources in it"(Devesa et al., 2009).

2.2. The impact of the forms of river pollution on the economy of the coastal areas of the Tigris River.

Many studies have been working to identify the direct and indirect causes that lead to river pollution, and the agreement between those studies that pollution in the river will lead to its transformation from the natural to the polluted situation, which is the cumulative effect of a number of influences, but in general, the size and type of impact varies depending on the length of the river, the nature of the culture of society, government treatment processes, the intensity of pollutants and other factors, and the impact of those factors varies according to certain priorities, the studies have agreed that the most important causes of river pollutants in Iraq specifically are: (Al-Battat, 2009)and (Al-Maliki et al., 2021)

2.3. environmental effects of Tigris river pollution

With regard to agricultural pollution, in particular, trolls are the main source of increasing the salinity of the Tigris River in Nineveh Governorate, with a total length of trolls in the governorate amounting to 1326 km/ length, which means that more than 600 million/ cubic

meters are released annually into the Tigris River and Nineveh Governorate(The Ministry of Planning, 2021). More than one billion cubic meters of trocar water are released into the Tigris river annually, in addition to the waste from factories that use toxic chemicals, which threatens aquatic life and fishery resources (Al-sarraj et al., 2012) . Reports of the Ministry of planning and the Ministry of Water Resources also indicate that 42 thousand liters are thrown into the river water every second. While each liter of them pollutes four clean liters. On the other hand, as a result of the water of the massacres, which number up to 90 massacres in Iraq, being discharged into the rivers without treatment, will lead to the lack of provision of water suitable for agriculture. An indication of the presence of highly toxic pollutants in the Tigris River as a result of agricultural and industrial **pollutants that make the river's water unsuitable for human consumption**. The impact of pollution caused by sewage in the Tigris River is shown by an increase in population density, which introduces health pollutants, with high percentages of plastic, phosphates, microbes, and bacteria, as there are (11) main stations in Iraq and(27) represent substations, which serve 25% of the Iraqi population and their efficiency is low because they are old, in addition, there are (74) hospitals throughout Iraq without medical waste treatment systems, specifically water treatment, in addition to (235) others with inefficient treatment systems, which it leads to an increased health risk in the main sources of water in the Tigris and Euphrates rivers (Ghawi & Tisti, 2021). **This enables us to refuse Null hypothesis the first hypothesis and accept alternative " There is no serious pollution rates on the fisheries in the Tigris River in Nineveh Governorate"**.

The consumption of fresh water in Iraq annually amounts to (3% for domestic consumption, 5% and industrial pollution, 92% and agricultural pollution)(Chabuk et al., 2020) it is noted that water consumption in agriculture constitutes the largest percentage and that the citizen's share of usable water amounts to 1,482 cubic meters per year, an indication of the lack of domestic consumption compared to waste in agricultural consumption as irrigation systems in Iraq suffer from age and inefficiency (Ewaid et al., 2020) that the indicators of pollution in the aquatic environment of the Tigris River indicate a weakness in the environmental management practiced by Stakeholders in dealing with and benefiting from the Tigris River, as evidenced by the lack of opportunity for the river to replenish the fresh water provided by this river, which will lead to the inability of the river to replenish its waters, the extinction of aquatic and plant life that depend directly on the river in addition to the indirect social, environmental and economic impact on the population in the river basin in Nineveh

Governorate. Figure (1) shows the priorities of the impact of the Tigris river water consumption ratios on three forms of use, which explains, according to the philosophy of the Pareto scheme, that the first reason for the waste in the river water is due to domestic consumption, which accumulated the rest of the industrial and agricultural consumption to form the highest percentage of consumption and waste in the water wealth of the river, **which This enables us to refuse Null hypothesis the second hypothesis and accept alternative which states: "there is a significant waste in the optimal use of Water Resources in the Tigris River in Nineveh Governorate.**

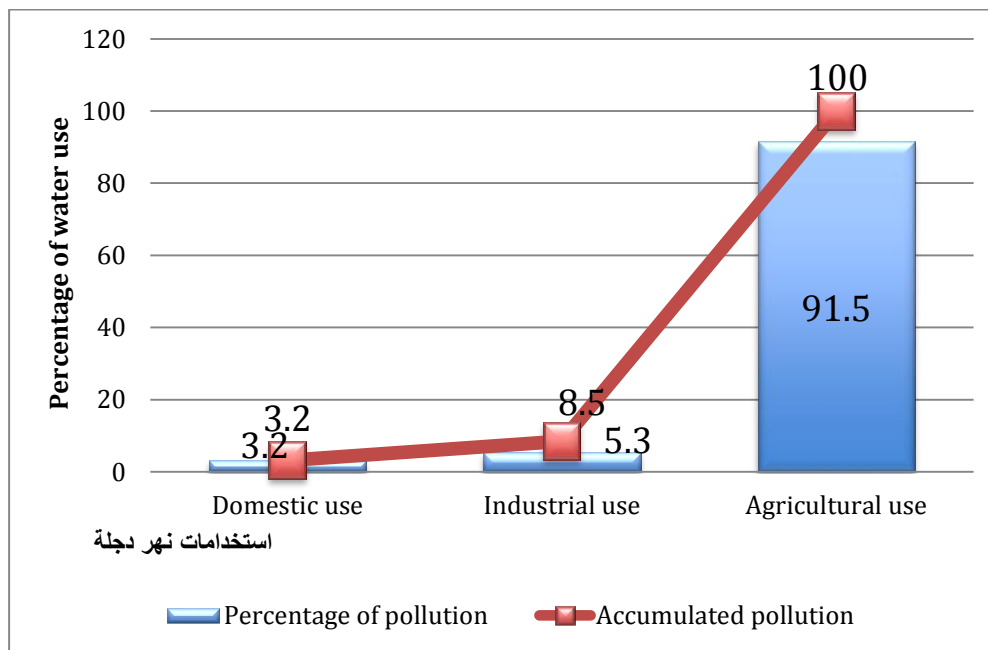


Figure (1) annual utilization rates of the Tigris River.

Source: Chabuk, A., Al-Madhlom, Q., Al-Maliki, A., Al-Ansari, N., Hussain, H. M., & Laue, J. (2020). Water quality assessment along Tigris River (Iraq) using water quality index (WQI) and GIS software. *Arabian Journal of Geosciences*, 13, 1-23.

The impact of overfishing is shown: overfishing in the Tigris River includes both large-scale fishing and illegal fishing: the efforts, legislation and its implementation carried out by both the Ministry of Agriculture and the Ministry of environment of Iraq, especially in Nineveh governorate, are characterized by being very limited and insufficient to protect freshwater fish populations. Also, the process of aquaculture and replenishment of fish wealth in the waters of the Tigris River is not at the required level, as it does not take into account the environmental balance by the fact that aquaculture includes only economically profitable

fish, as there are no pre-prepared plans or a specialized system has not been developed to replant rare fish and increase their reproduction in the breeding season, and fish replenishment operations only include initiatives and volunteer campaigns of research institutions and specialized colleges through rare individual practices are negligible. These indicators indicate the inability of fish to regenerate as a result of fishing campaigns at a young age as a result of illegal fishing methods or during breeding times, and as a result, these practices will lead to the complete extinction of fish in the Tigris River specifically (Ben-Hasan et al., 2017), which requires the provision of infrastructure, laboratories and specialized farms according to a well-thought-out system that works to revive rare species and monitor fishing operations in the breeding season between April and June to prevent the extinction of fish in Iraq in general(Jawad, 2013), **which This enables us to refuse Null hypothesis the third hypothesis and accept alternative which states: " There is significant effect of overfishing in the diversity and renewal of fish wealth in the Tigris River in Nineveh Governorate."**

According to water resources experts in the Eighties of the twentieth century, in the last thirty years, flow discharges decreased by 33% from the monthly average, mainly due to the establishment of the GAP project in Turkey (Hussein et al., 2023), especially the Ilisu dam, as well as the construction of dams and giant reservoirs that Turkey has worked on specifically over the past two decades, reduced the water levels in the Tigris River, which led to the rise of high-salinity tidal waters in the Arabian Gulf to distances close to the confluence of the two rivers in Qurna, and mixed with the waters of the two tributaries, in addition to the high percentage of pollution, which made the water in Basra unfit for drinking. (Al-Obaidy & Al-Khateeb, 2013) . The decrease in the flow of the Tigris River, which is 33%, is subject to continuous increase, indicating the weakness of environmental management of river water, the most important of which is the formation of water management systems, the use of modern technology, reducing irregularities and encroachments on river water, water networks and irrigation, the adoption of drip irrigation and the optimal investment of water in order to preserve the water environment in the Tigris River from decreasing or completion. **Which This enables us to refuse Null hypothesis the first hypothesis and accept alternative which states: "There is significant effect of the lack of water flow of the Tigris River on the volume of fish production " in the sense that the less water flow of the Tigris River leads to a lack of fish wealth and as a result, the lack of production and self-sufficiency of fish in Nineveh and Iraq**

Economic effects of Tigris river pollution

The economic effects of river pollution will be addressed within the following axes:

2.4. Fish production and breeding in Iraq and Nineveh Governorate

Aquaculture production in Iraq is being carried out in various areas along the Tigris River Basin to ensure the flow of fresh water to these ponds, which have an area of more than 7,500 hectares of licensed ponds, and the main fish species are common carp, grass carp and silver carp. Trout species are also raised in concrete ponds in mountainous areas (HARLIOĞLU et al., 2023), and an increase in fish production was observed between 2011 - 2014. Of the total fish production in Iraq amounted to about 80,000 and 85,000 tons in 2012 to 2014, respectively. On the other hand, the infection of fish with the herpes coy virus (Ababneh et al., 2020) and the decrease in the water level of the Tigris and Euphrates rivers (Ababneh, et al: 2020) caused a gradual decrease in fish production in Iraq after 2014. Production decreased to approximately 51,000 tons in 2015 (HARLIOĞLU, et el: 2023). Moreover, as shown in Figure 2, the total fishery production in Iraq amounted to 62,673 tons in 2018(HARLIOĞLU et al., 2023) .While the total fish production in Iraq (in ponds and natural) reaches 241,848 tons (150 thousand tons from aquaculture and 91,848 tons from wild catches) in 2020. An indication of achieving self-sufficiency in the field of production and consumption of fish wealth in Iraq until 2020, but this production is inversely proportional to the amount of water available in the Tigris River, as the less the flow of River Water leads to the closure of many aquaculture ponds, especially unlicensed ones due to the depletion of river water in the summer season, and therefore this leads to a lack of fish production throughout Iraq, especially in the provinces located on the river, the most important of which is Ninawa governorate.

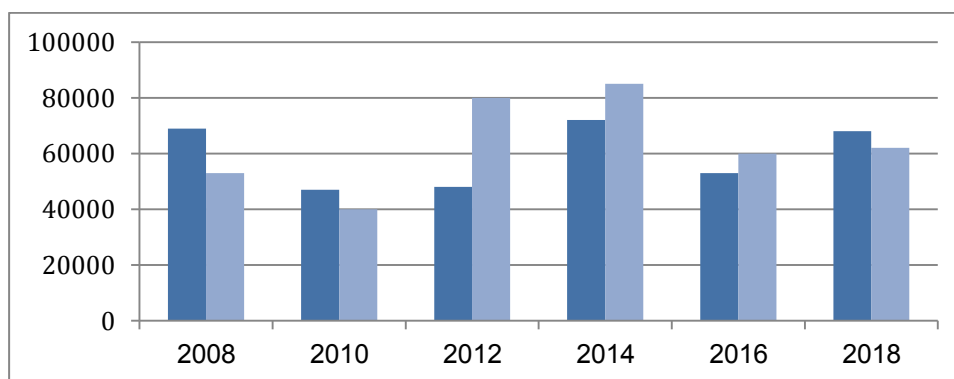


Figure (2) the volume of fish production in Iraq between 2008 – 2018

Source: HARLIOĞLU, M., MUSTAFA, S. O. M., & Batool, Z. (2023). The Present Situation of the Fisheries Sector in Iraq: A Critical Review. *Çanakkale Onsekiz Mart University Journal of Marine Sciences and Fisheries*, 6(1), 70-75.

Figure (2) shows, according to the use of the Parito scheme, which prioritizes economic factors or reasons in the variation in the production of fish wealth in 2021, that the first reason, which constitutes 20% of the total reasons affecting the production of fish wealth in Iraq, including Nineveh Governorate, is that the decline in production is due to fluctuations in fish meat prices by 20%, which accumulated the rest of the other reasons in terms of (water shortage 15%, then the corona pandemic and the complete closure of markets 12%, then security 12%, then the deterioration of genetic factors in Fish and the extinction of many species 10%, then poor feed quality 10%, then the problem of marketing and transportation of fish 8%, then the lack of medicines and Prevention As a result, the current research was able to explain 99% of the reasons for the deterioration of fish wealth in Iraq and Nineveh from an economic point of view, and these reasons represent the main factors in the disparity in the failure to achieve self-sufficiency in the Iraqi market from economic points of view, which led to a negative impact on fish wealth, **Which This enables us to refuse Null hypothesis the fourth hypothesis and accept alternative which states: "There is significant effect of the lack of water flow of the Tigris River on the volume of fish production "** in the sense that the less water flow of the Tigris River leads to a lack of fish wealth and as a result, the lack of production and self-sufficiency of fish in Nineveh and Iraq.

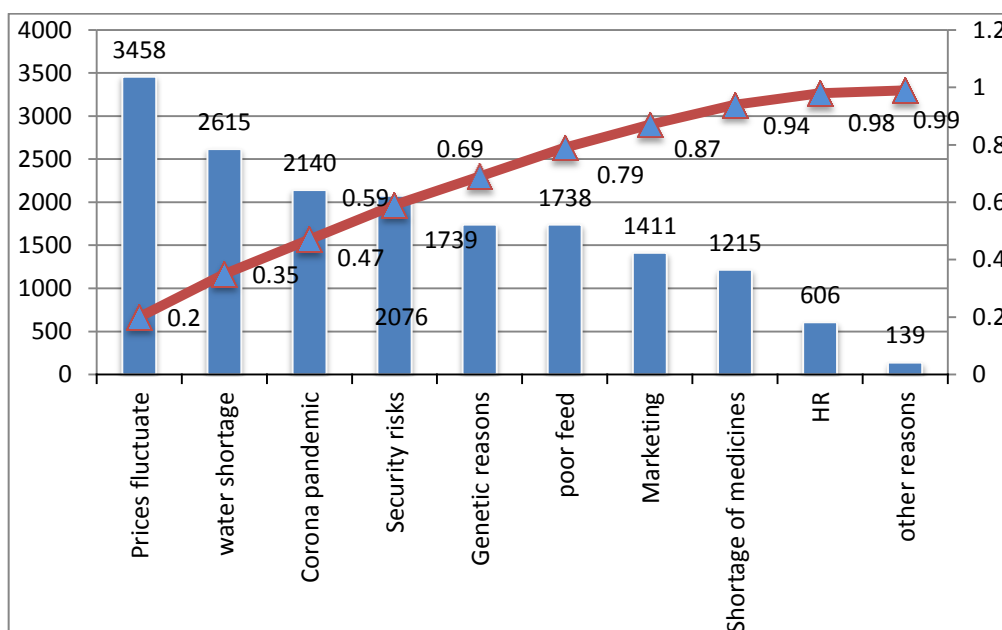


Figure (3) prioritization of the economic effects causing the variation in fish stocks in the Tigris River in 2021.

Source: Ministry of planning, 2021, Directorate of Agricultural Statistics, aquaculture survey (fish farms)2021, P.7.

2.5. The impact of the lack of flow of the Tigris River on unemployment

With regard to the impact of environmental change in the Tigris River and its impact on economic indicators, the unemployment index for workers in the fisheries industry shows that although Nineveh Governorate is not one of the governorates located by the sea, it is located on three forms of water bodies: the Tigris River, the Mosul Dam Lake 54 km from the governorate center, and the fishing sector employs an average of 2% of the workforce in Nineveh governorate, but the pollution of the Tigris River and its low levels will be discussed within the topic of the economic effects of Tigris river pollution on unemployment in two forms:

A. The impact of the lack of river water flow in unemployment is the indirect impact of managing the Tigris water environment in the economic indicators in Nineveh

Governorate, as Iraq's losses from fish wealth amount to about 400 million dollars a year (HARLIOĞLU et al., 2023), as many young people, especially graduates from universities and institutes have established small ponds, because of their appropriate cost that suits those with limited income, and the cost of one basin is 1200 US dollars, and feed prices range from 500 to 700 dollars, and this seems to be a suitable budget for workers in the field of fish ponds, but the low level of the river and the closure of those ponds by the competent authorities will lead to the loss of A lot of young people for low-cost job opportunities, a decent return. **which This enables us to refuse Null hypothesis the fifth hypothesis and accept alternative which states: "There is significant effect of the lack of water flows in increasing the unemployment of fishermen in the Tigris River " and this hypothesis is considered a fact and logical considering that fishermen directly depend on the high water levels of the river in the practice of fishing**

B. The direct impact on the workers in the fishing and industry of fish.

Carp fish is one of the most consumed types of fish in Iraq in general and specifically in Nineveh, as the increase in production volume contributed to the decline in prices to reach between 3,500-7,000 Iraqi dinars (2.5 to 5 dollars) per kilogram after their

prices reached 15,000-20,000 (11 to 15 dollars) between 2003 and 2010. According to a report by the Iraqi Ministry of planning in 2021, the total number of productive fish farms reached 3,794 farms, employing 14,441 workers throughout Iraq, and the sustainable impact resulting from the decline in river levels will lead to the loss of more than 10,000 families working directly as fishermen or indirectly as restaurants, workers, in marshes and in artificial lakes to the loss of their jobs. An indication of the high risks on this type of market, and the low volume of employment in the river fisheries industry. (Ministry of planning, 2021) **which This enables us to refuse Null hypothesis the sixth hypothesis and accept alternative which states:** "There is a direct correlation between the water levels of the Tigris River and the fisheries **industry** in Iraq and in Nineveh Governorate"

On the other hand, according to a statistic of the Iraqi Ministry of Agriculture, 2021, about 60% of farmers in Nineveh alone abandoned their lands and went to the districts and districts due to drought, although in 2020 the province witnessed the cultivation of 6 million dunums, while 2023 is considered a drought year because the cultivated area did not exceed 300 thousand dunums, out of 6 million dependent on rainwater, and these are considered high costs due to the lack of agricultural land and irrigation. **which This enables us to refuse Null hypothesis the seventh hypothesis and accept alternative which states "**There is significant effect of the lack of Tigris river water on the loss **of farmers' jobs** and agricultural land in Nineveh Governorate."

3. Conclusions

- The presence of highly toxic pollutants in the Tigris River as a result of agricultural and industrial pollutants that make the river's water unsuitable for human consumption.
- The lack of household consumption compared to the waste in agricultural consumption, as the irrigation systems in Iraq suffer from age and inefficiency, and this is consistent with a study.(Ewaid, et al, 2020) that the indicators of pollution in the aquatic environment of the Tigris River indicate a weakness in the environmental management practiced by Stakeholders in dealing with and benefiting from the Tigris River, as evidenced by the lack of opportunity for the river to replenish the fresh water provided by this river, which will lead to the inability of the river to replenish its waters, the extinction of aquatic and plant
- The current research has been able to explain 99% of the reasons for the decline of fish wealth in Iraq and Nineveh from an economic point of view.

- The inability of fish to regenerate as a result of fishing campaigns at a young age as a result of illegal fishing methods or during breeding times, and as a result, these practices will lead to the complete extinction of fish in the Tigris River specifically.(Ben-Hasan, et al, 2017)
- Weak environmental management of river water, the most important of which is the formation of water management systems, the use of modern technology, reducing irregularities and encroachments on river water, water networks and irrigation, the adoption of drip irrigation and the optimal investment of water in order to preserve the water environment in the Tigris River from decreasing or completion
- An increase in fish production was observed between 2011 - 2014. Of the total fish production in Iraq amounted to about 80,000 and 85,000 tons in 2012 to 2014, respectively. An indication of the high demand for fish consumption in Iraq
- Self-sufficiency has been achieved in the field of production and consumption of fish wealth in Iraq until 2020, but this production is inversely proportional to the amount of water available in the Tigris River, as the less the flow of River Water leads to the closure of many fish breeding ponds, especially those that are not licensed due to the depletion of river water in the summer season, and
- The higher the risks for this type of market, the greater the volume of employment in the river fisheries industry.
- There is a direct correlation between the water levels of the Tigris River and the economic indicators of the fish industry in Iraq in general and in Nineveh Governorate.
- Weak environmental management of river water, the most important of which is the formation of water management systems, the use of modern technology, reducing irregularities and encroachments on river water, water networks and irrigation, the adoption of drip irrigation and the optimal investment of water in order to preserve the water environment in the Tigris River from decreasing or completion.
- It requires the provision of infrastructure, laboratories and specialized farms according to a well-thought-out system that works to revive rare species and monitor fishing operations in the breeding season between the months of April to June to prevent the extinction of fish in Iraq in general(Jawad, 2013)
- Developing an integrated plan between the Ministry of Water Resources, the Ministry of Agriculture and the Ministry of Commerce to reduce the environmental and economic impacts in Nineveh governorate to reduce pollution and extinction of Fisheries and prevent

the loss of the direct and indirect economic value of the river. the plan is distributed at specified annual intervals of five years and then ten years.

- To prevent overfishing, especially fishing with explosives and poison, because of the corruption and destruction of fish resources in the Tigris River
- The current research recommends the need to strengthen monitoring in the Tigris River, achieve a balance in river water consumption and prevent waste in water use, especially in agriculture, and develop specialized programs to purify river water through the construction of dams and transfers of pollutants to polluted lands and desert areas.
- The research recommends the need to install systems to filter wastewater by erosion and plant plants in the places of sewage passage to reduce pollution rates before it reaches the river water.
- The need to oblige laboratories, factories and production and service organizations to develop strict systems for the treatment of heavy water, especially chemical ones, and to put periodic monitoring on them and to update them.
- The need to build a canal connecting the Tigris River to the Khosrau River from the Mosul Dam, as there is a distance of up to 65 kilometers between them, which helps to purify the sewage flowing into the Khosrau River and dilute it before reaching the Tigris River.
- The formation of an independent body working to provide consultations and research (called the Tigris River Water Management Authority) that solves problems between the various bodies supervising water wealth, agriculture and the environment, in addition to its task to bring closer views on the problems that are exacerbated in the Tigris River as a result of various pollutants and the negative human impact on the waters of this great river.

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