

Contribution of integrated aquaculture with agriculture to the development of fish production and the promotion of food security policies in Algeria

مساهمة تربية المائيات المدمجة مع الفلاحة في تطوير الإنتاج السمكي و تعزيز سياسات الأمن الغذائي في

الجزائر

Boukeltoum Mohamed^{1,*}

¹ university center of Tipaza

Laboratory: Entrepreneurship and Tourism Development

Received: 2023/06/01; Accepted: 2023/06/14

Abstract: In recent years, the world has seen a significant increase in food demand, with food security becoming an important public policy priority. Algeria, like all the countries of the world, seeks to support the various mechanisms that contribute to achieving food security. Integrated aquaculture with agriculture today is an important choice around the world by preserving the environment, biodiversity and meeting communities' nutritional and economic needs. Through this study, which examines the contribution of integrated aquaculture to the development of fish production and the promotion of food security policies, we have found that this integrated approach plays a major role in increasing and sustaining fish mass and promoting the culture of aquaculture consumption among the population, as well as the provision of high quality and highly productive agricultural products, thereby contributing to the promotion and support of food security policies in Algeria.

Keywords: Aquaculture; Agriculture; Fish production; Food security; Algeria.

Résumé : Ces dernières années, le monde a connu une augmentation significative de la demande alimentaire, la sécurité alimentaire devenant une priorité de politique publique importante. L'Algérie, comme tous les pays du monde, cherche à soutenir les différents mécanismes qui contribuent à la sécurité alimentaire. L'aquaculture intégrée à l'agriculture est aujourd'hui un choix important dans le monde en préservant l'environnement, la biodiversité et en répondant aux besoins nutritionnels et économiques des communautés. A travers cette étude, qui examine la contribution de l'aquaculture intégrée au développement de la production halieutique et à la promotion des politiques de sécurité alimentaire, nous avons constaté que cette approche intégrée joue un rôle majeur dans l'augmentation et le maintien de la masse de poissons et la promotion de la culture de la consommation de poissons d'élevage parmi la population, ainsi que la fourniture de produits agricoles de haute qualité et hautement productifs, contribuant ainsi à la promotion et au soutien des politiques de sécurité alimentaire en Algérie.

Mots-clés : Aquaculture; Agriculture; Production Halieutique; Sécurité Alimentaire; Algérie.

ملخص: يشهد العالم في السنوات الأخيرة زيادة كبيرة في الطلب على الغذاء حيث أصبح تحقيق الأمن الغذائي من الأولويات المهمة في السياسات العمومية، حيث تسعى الجزائر على غرار جميع دول العالم في دعم مختلف الآليات التي تساهم في تحقيق الأمن الغذائي، حيث تعتبر تربية المائيات المدمجة مع الفلاحة اليوم من بين الخيارات والآليات المهمة في جميع أنحاء العالم من خلال محافظتها على البيئة والتنوع البيولوجي و تلبية الاحتياجات الغذائية و الاقتصادية للمجتمعات، ومن خلال هاته الدراسة التي تتناول مساهمة تربية المائيات المدمجة مع الفلاحة في تطوير و زيادة الإنتاج السمكي وصولا إلى دعم و تعزيز سياسات الأمن الغذائي

* Boukeltoum Mohamed. boukeltoum.mohamed@cu-tipaza.dz.

توصلنا أن لهاته المقاربة المدججة دور كبير في زيادة الكتلة السمكية و استدامتها و تشجيع استهلاك هذا النوع من الأسماك بين المواطنين بالإضافة إلى توفير منتجات فلاحية ذات جودة عالية و بمردودية كبيرة وبالتالي فهي تساهم في دعم سياسات الأمن الغذائي في مختلف الدول لاسيما الجزائر.

الكلمات المفتاح : تربية المائيات ؛ الفلاحة؛ الإنتاج السمكي؛ الأمن الغذائي؛ الجزائر.

I- Introduction :

The agricultural sector is one of the world's most important food producers rely on the continuous mobilization of water resources by increasing water areas and reclaiming land . Water used in aquaculture and fish is very rich in the elements necessary for the growth of plants. Various studies have shown that the exploitation of these waters in agricultural watering has increased the production rate of many peasant people and the quality of their products. The agricultural sector also faces significant challenges due to the scarcity of land and water used in farming. And with increasing demand for water, especially on the industrial side and household needs, The share of water destined for the agricultural sector decreases significantly, especially in arid and semi-arid areas. Thus, it has become necessary to find viable techniques that can sustain agricultural production. In this context, an integrated system has been proposed among potential alternatives such as aquaculture integrated with peasants, where it includes fish farming and contributing to agricultural crop production. These mechanisms are considered to be very appropriate for developing countries by supporting the agricultural sector through aquaculture of plants and animals. in addition to controlling the water generated by these processes and rich in bio-fertilizer and proteins through their use in cultivated areas, which contributes to increasing production and reducing the use of chemical fertilizer in the agricultural sector (Reduce the costs of buying chemical fertilizer and provide high-quality, natural protein-rich peasant products). In this context most countries in today's world are seeking to achieve and maintain food security through the search for resources and mechanisms to sustain the food security of the world's people, Fisheries integrated with agriculture is a privileged food resource that plays prominent economic and social roles, especially contributing effectively to food security, job creation and wealth creation through the provision of fisheries and contributing to the revitalization of the agricultural sector, which is considered a critical strategic activity due to the major problems in nutrition in view of the dramatic increase of human clusters. Where this activity contributes to the provision of an important stock of peasant resources directed towards human consumption, as a catalyst for peasant industries, it plays a role in achieving current and future economic development and thus contributing effectively to achieving food security and sustainability.

-Study Question :

How much has integrated aquaculture with agriculture contributed to the development of fish production and the promotion of food security policies in Algeria?

--Study Hypothesis :

To answer the problematic, we will set a key premise for our study: Integrated aquaculture with agriculture is one of Algeria's most important qualifications for achieving and enhancing food security. which contributes through its various activities represented in aquaculture to the provision of fishery resources and the realization of real fishery industries in exchange for the provision of permanent employment positions for workers and the achievement of sustainable development in

the sector, In addition to providing and producing various fertilizers resulting from aquaculture to contribute to the development of the agricultural sector and thereby support the policies produced by Algeria in order to achieve the food security and preservation of fishery resources and agricultural products.

-Study aims and objectives: The importance of this study is to highlight the role played by aquaculture in Algeria through the provision of various fisheries resources. Which effectively contribute to their provision in various markets at affordable prices for citizens, the use of fish products during breeding as a vital fertilizer with excellence in the development of the Division of Agriculture and thus support the various policies pursued by the Algerian State in order to achieve food security in the various people, especially fisheries and peasants.

-Research Methodology: The descriptive analytical method was used in this research, where theoretical concepts were used related to the integrated aquaculture approach with agriculture, as well as the presentation of a mathematical computational experience showing how this approach contributes to increased fish production in Algeria.

-Organization of the study: In order to familiarize ourselves with all aspects of the study, we considered the following division:

- **Concepts about aquaculture integrated with agriculture.**
- **Aquaculture integrated with agriculture in Algeria.**
- **The experience of the states of Jijel and Ouargla in aquaculture integrated with Agriculture.**
- **Aquaculture integrated with agriculture as a mechanism to enhance food security in Algeria.**

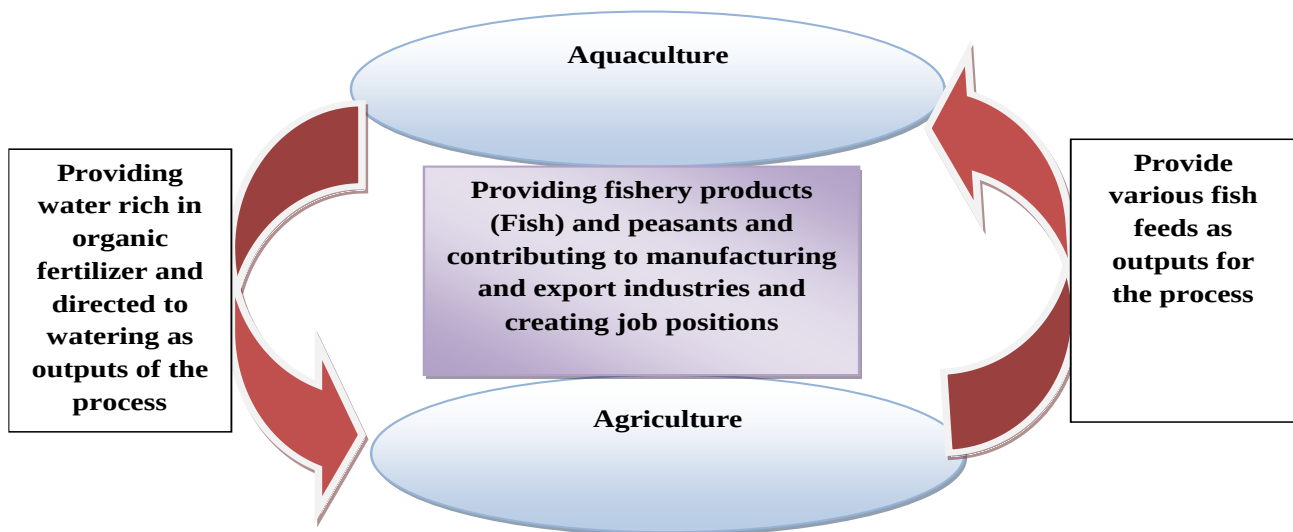
II -Concepts about aquaculture integrated with agriculture

II.1 Definition: Aquaculture integrated agriculture systems are a type of sustainable intensification that produces more food from the same land area and uses water without ecological effects, including combining fish, fruits, vegetables, livestock and even chicken. Waste is recycled from one system as inputs to another system, thus pollution is reduced. Increased sustainability, productivity, profitability, efficiency and maximum benefits from water, land and employment have benefits in increasing food production and reducing risks related to water shortages, (Ibrahim, Abu-Hashim, Shaghaleh, Elsadek, Hamad, & Hamoud, 2023), Farming activity includes human intervention in the care process, development of improved production and regular storage, nutrition and protection enabling predators, as well as the cultivation of individual or shared ownership of the stock under cultivation (FAO, 2009). Thus, fish farming PISCI-Culture can be defined as the process of breeding fish of various kinds, both saltwater and freshwater fish, which are used as human food under tight conditions and under human control, and in certain areas, both breeding basins and cages, with a view to developing production and stabilizing farm ownership of products. Through previous definitions we note that aquaculture depends on various resources, fish, land and water, where there can be competition for land use for farming, or competition for water use in irrigation, energy, industry and human consumption.

This integrated approach to agricultural crops and fish production is mainly to dispose of aquaculture liquid waste and provide various agricultural bio-organic fertilizers to agricultural crops. This is particularly important in arid and semi-arid areas where water is used for agricultural irrigation in addition to contributing to manufacturing and strengthening the input industry in fish

feed, As well as providing and exporting fishery and peasant products and creating positions of occupancy (Melaku & Natarajan, 2019). The process of aquaculture integrated with agriculture can be explained in Figure 01 below:

Figure (1): Explain the process of aquaculture integrated with agriculture



The source : prepared by the researcher.

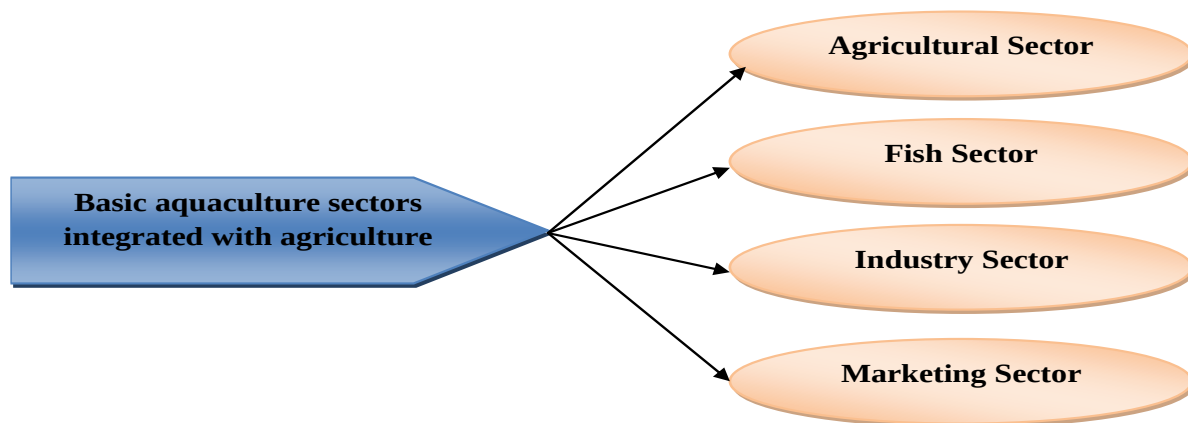
* Aquaculture integrated with agriculture in rural areas is the introduction of fish farming into the agricultural environment with a view to developing these sectors in parallel to each other's benefits. By strengthening the idea of production and the culture of freshwater consumption among peasants and citizens at large this activity also provides an additional supply of high-quality protein for the agriculture sector and its derivatives, where the Division can achieve the following objectives (Guedri, 2021):

- Ensure additional supply of proteins.
- Reduce malnutrition by providing high nutritional value food.
- Improve the livelihood of peasants, diversify their sources of income, especially in small peasant investors.
- Encouraging the use of natural and artificial water lamps.
- To create a precise and integrated ecosystem in which it is possible to recycle agricultural waste in organic pollution.

- Reduce the use of chemical fertilizer.
- Reducing the cost of fish for peasants.
- Increase the productivity of agricultural crops.
- Developing sustainable organic cultivation.

From the foregoing, the basic sectors involved in the process of breeding integrated with farming can be mentioned in Figure 02 below:

Figure (2): Key sectors in the aquaculture process integrated with agriculture



The source : prepared by the researcher.

II. 2 Objectives of aquaculture integrated with agriculture: This integrated approach aims to:

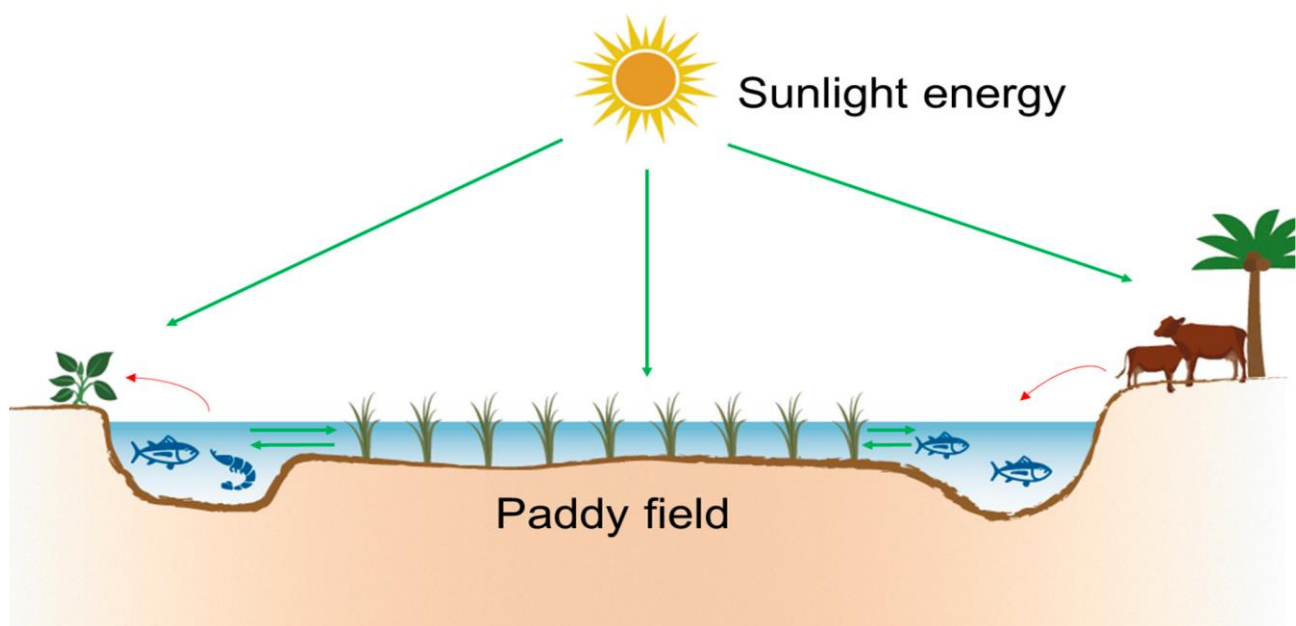
- Provide high-protein and vitamin food for human consumption.
- Increase income in rural and isolated areas especially.
- Reduction of the unemployment rate.
- Breeding special varieties of fish, especially fish destined for decoration and beautification.
- Control the growth and reproduction of fish in terms of quantity and species.
- Control aquatic herbs and insects harmful to humans or to the crop.
- Contributing to the enrichment of peasant land and soil, raising its rate of return.

II.3 Aquaculture methods integrated with agriculture: Aquaculture production methods have been developed in different regions of the world and adapted to each region's environmental specificities. Aquaculture includes the following systems:

- Open water systems: such as floating cages, long ropes, breeding in watercourses and flowing waterways.
- Closed farming systems: or closed water systems in which water is reused for fish after cleaning and filtering. Here can benefit from the efficiency offered by the integration of aquaculture in closed water systems on the one hand and hydroponics systems or the endothelial agriculture that is based on the farming system without soil aquaculture ", where hydroponics are defined as the integration and integration of aquaculture with closed systems and aquaculture into a single production system, In the ischemic farming unit, water circulates through the aquarium, through filters and the media in which plants grow (2017، صالحی و قداش) .

Where the idea of fish cultivation arose integrally with plants, as wastewater in breeding is changed due to the presence of ammonia in abundance, which is at the same time a source of nitrogen that different agricultural crops need, Thus, when the fish water containing ammonia continues on the roots of the plants, it absorbs the ammonia dissolved in the water. The water again returns free of ammonia to the fish rearing basin, and this is how the process is always done. The following pictures illustrates the process and materiel follow in integrated agriculture-aquaculture foe example from paddy field:

picture (1): materiel follow in integrated agriculture–aquaculture



The source: (Sangchoul, 2019)

III- Aquaculture integrated with agriculture in Algeria.

III.1 Aquaculture in Algeria: Algeria is characterized by rich natural resources, diverse terrain, and a mild climate that helps it provide a suitable ecological environment for aquaculture. Algeria has prepared a national strategy for the development of the aquaculture division that revolves around the following axes (Ministry of Fisheries and Fisheries Resources MFFR, 2003-2007):

- Rational exploitation of natural resources for aquaculture, thus valuing them while protecting the environment from pollution.
- Planning aquaculture projects with simple and special technology in coastal areas.
- Valuation of water, natural and artificial bodies based on a national reconstruction and reconstruction program aimed at establishing economic units.
- Development of industrial aquaculture projects near vital centers to raise some crustacean species based on foreign partnership.
- Planning of industrial aquaculture projects by relying on several strategic sectors.

III.2 Accredited aquaculture communities in Algeria: Algeria's aquaculture relies on two main mediums:

1-Sea: By relying on several mechanisms such as: floating or submerged cages, underwater particles and earthy pools.

2-Freshwater: Floating cages are used at the level of dams, water and hill barriers, ponds, aquariums and hot water (Great South).

These can be explained in the following table:

Table (1) : Aquaculture communities and species in Algeria

Aqueous Media	Main aquaculture divisions	Types
Aquaculture at Sea	1- Floating or submerged cages	*Mediterranean wolf fish or bass. * Royal Al-Jawj or Al-Durad * land fish
	2- Subwater particles	*Psoriasis: mussels, oysters and concave
	3-Earthy pools	* Shrimp
	1- Floating cages at the level of dams and water and hill barriers	*Freshwater fish

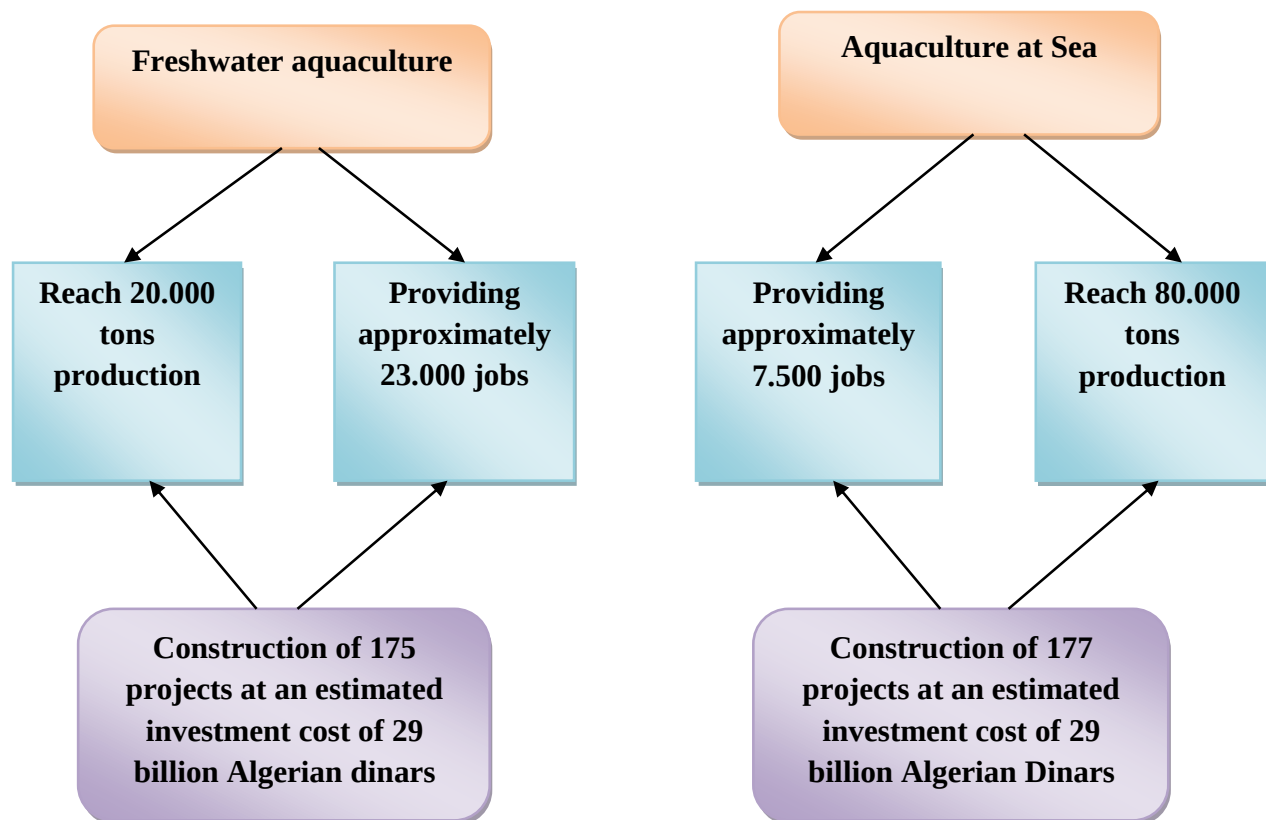
Freshwater Aquaculture	2- Ponds and basin	*African cat fish * Chinese carp * Red tilapia Fish or tilapia * Tilapia Nile fish
	3-Hot water in the big south. 4- Static or stable aquaculture 5- Fish husbandry in desert areas	*White-footed shrim

The source : prepared by the researcher based on the Sustainable Aquaculture Development Scheme of Algeria
Ministry of Fisheries and Fisheries Resources for 2017

III.3 Contribution of aquaculture to the national economy:

The Aquapêche 2020 project includes priority actions to be undertaken under four intervention pillars and identifies sources of funding to be made available, and this project is based on the outcome prepared at the end of the five-year period 2010-2014, highlighting the work done and those not yet completed but also the dynamic inspired by the guiding strategy for the fishing and aquaculture sector at the horizons of 2030 (قدي، 2017). This is what we're showing in the following form:

Figure (3): Aquaculture scheme in Algeria in the horizon of 2030

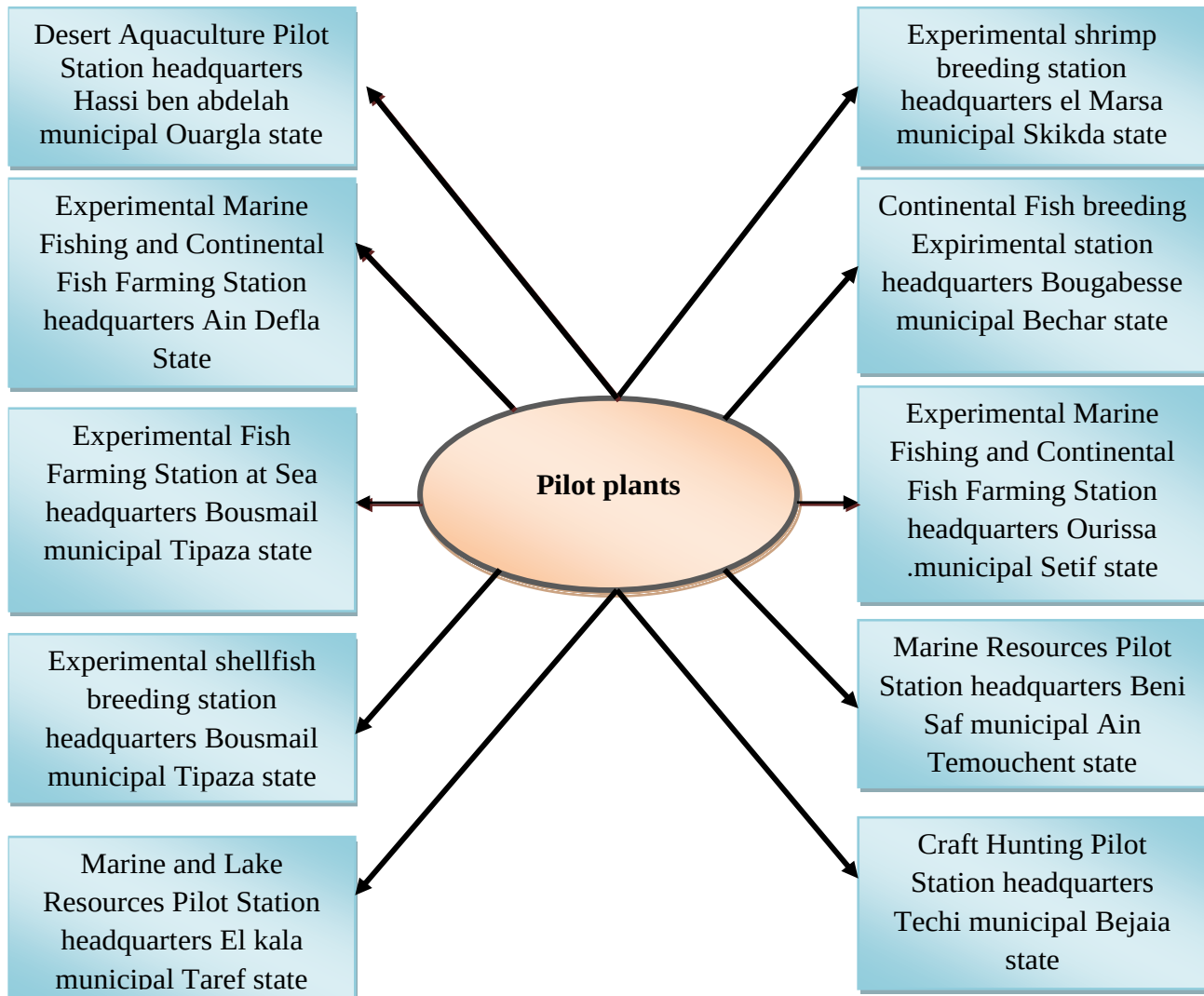


The source: prepared by the researcher based on Plan Aquapêche 2020 scheme of the Ministry of Fisheries and Fisheries Resources

III.4 Legislative basis for sustainable aquaculture in Algeria: The public authorities in Algeria have issued a series of laws and regulatory decrees governing Algeria's Aquaculture Division, which guarantee their sustainability without prejudice to the preservation of the environment from pollution.

A- Establishment of experimental aquaculture plants: Pilot stations for the National Centre for Research and Development in Fisheries and Aquaculture have been established in accordance with the Joint Ministerial Decision of 10 September 2013, published in the Official Journal No. 27 of 2014, p. 30-31, as follows:

Figure (4): Pilot stations of the National Centre for Research and Development in Fishing and Aquaculture



The source prepared by the researcher based on the article 2 of the Joint Ministerial Decision of 10 September 2013, published in the Official Journal No. 27 of 2014, p. 30-31

B- Management and management of aquaculture in Algeria: This consisted in the enactment and drafting of laws and decrees through the promulgation of a set of laws and regulatory decrees as follows:

01-Law No. 15-08, dated 12 Jumada II, 1436, corresponding to 2 April 2015, amends and supplements Act No. 01-11, dated 11 Rabi II, 1422, corresponding to 3 July 2001, on fishing and aquaculture, Official Journal No. 18 of 2015. and subsequent implementing texts represented in organizational decrees and ministerial decisions.

02-Executive Decree No. 04-86 of 26 Muharram of 1425, 18 March 2004, establishes the minimum commercial volumes of modified and supplemented biological resources. Official journal No. 18 of 2004.

03-Executive Decree No. 07-208 of Jumada II 15 of 1428 of 30 June 2007 establishes the conditions for the exercise of breeding and transplantation activities in aquaculture and various types of institutions and the same conditions for their establishment and the rules for their exploitation. Official Journal No. 43 of 2007, and the following ministerial explanatory and interpretative decisions.

04-Executive Decree No. 10-93 of 28 Rabi'i01, 1431 of 14 March 2014 amends and supplements Executive Decree No. 04-373 of 8 Shawwal of 21 November 2004, which establishes the conditions for the granting of concessions for the establishment of an aquaculture institution, Official journal No. 18 of 2010.

05-Executive Decree No. 12-215 of 23 Jumada II of 1436, of 15 May 2012, establishes the National Laboratory for the Monitoring and Analysis of Fisheries, Aquaculture and Community Hygiene Products, organizes and conducts Official journal No. 31 of 2012, and ensues explanatory and interpretative ministerial decisions.

06-Executive Decree No. 14-331 of 4 0 of 1436, 27 November 2014 Amend and supplement Executive Decree No. 02-304 of 21 Rajab 1423 of 28 September 2002, which establishes the organization, functioning and functions of the National Chamber of Fisheries and Aquaculture, Official journal No. 71 of 2014, and subsequent ministerial decisions.

07-Executive Decree No. 22-405 of 29 Spring II of 1444 of 24 November 2022, concerning cooperatives for fishing and/or aquaculture, Official journal No. 79 of 2022.

IV-The experience of the states of Jijel and Ouargla in aquaculture integrated with Agriculture.

A. For the state of Jijel: The Integrated Aquaculture Division with the State of Jijel Positive results, excited by the launch of numerous investment projects in many municipalities of the state for the purpose of revitalizing this type of fishery product This mandate has tremendous aquaculture potential to play leading roles in continental aquaculture, especially in relation to the Aquaculture Division, which is integrated with farming. (05) Dams and twenty-eight (28) water barriers in addition to valleys' estuaries and various aquifers used in watering operations with peasant investors (Direction de la pêche et des ressources halieutiques de la wilaya de Jijel, 2022) As the aquaculture division integrated with agriculture has many advantages by providing an additional source of protein In addition to diversifying the revenues of peasant investors, improve peasants' living standards reducing the use of chemical fertilizer and providing various fish species to consumers at competitive and affordable prices, As well as raising the investor's peasant resilience, developing healthy and sustainable farming by relying on an integrated ecosystem characterized by the recycling of peasant residues in fish husbandry which undoubtedly allows the reduction of organic pollution.

1- Strategy adopted by the Directorate of Marine Fisheries and Fisheries Resources of the State of Jijel in the Aquaculture Division integrated with agriculture:

1.1 Focus on the composition of peasants in aquaculture activity integrated with farming: In view of the State's water capabilities, the State Directorate of Fisheries and Fisheries Resources, In coordination with the Directorate of Peasant Interests, the Marine Fishing and Aquaculture Chamber and the same Peasant Room, 280 peasants in this activity have been formed free of charge since 2017, the beginning of this activity in the state. And the process within the peasant investors was by explaining the process and the necessary conditions, including the possession of a water

basin with a capacity equal to or greater than 100 cubic liters, With the availability of a permanent and pure source of water and electricity, Tilapia cultivation as a first species through the provision of young people by the Directorate of Marine Fisheries and Fisheries Resources, The result was a census of 44 valid fish farming basins integrated with farming. And that has greatly contributed to the provision of this kind of fish for human consumption, During 2021, about 500 tons of tilapia fish were produced in both Nile and Red species statewide. and marketed at retail prices ranging from 450DA to 550DA (Direction de la pêche et des ressources halieutiques de la wilaya de Jijel, 2022)

1.2 Evaluation of projects established in the same division: According to the statistics of the Directorate of Marine Fisheries and Fisheries Resources of the State of Jijel for 2022, there are currently 8 successful projects at the state level in the exercise of fisheries husbandry activity integrated with farming and consisting of a basin (01) to (08) distributed through the municipalities of the state, including (01) a farming investor in the municipality of Ouled Rabeh, (03) Agricultural investors in the municipality of Sidi Marouf, (01) Agricultural investors in the municipality of Emir Abdelkader, (01) A peasant investor in Tahir Municipality (02) two peasant investors in Lawana municipality, all successful projects.

1.3 Seek to launch new projects in this activity: The Directorate of Fisheries and Fisheries Resources of the State of Jijel seeks to expand this activity at the state level by accompanying the launch of new projects In the second tripartite of 2022, 03 new projects entered into service with a production capacity of approximately 35 tons as the first phase, at the level of medium and small peasant investors in rural areas, Due to the availability of these investors on significant food additives of animal protein.

1.4 Prospects for integrated aquaculture activity with farming at the state level: The Directorate of Fisheries and Fisheries Resources of the State of Jijel seeks to reach a production rate equal to 10% of the state's fisheries production in 2023 With more than 20% of production beyond 2024, This is how we support the various input industries in fish feed, manufacturing industries, Create new positions of employment, encourage consumption of this type of fish and work in the future on the export of fish and peasant products produced from this division.

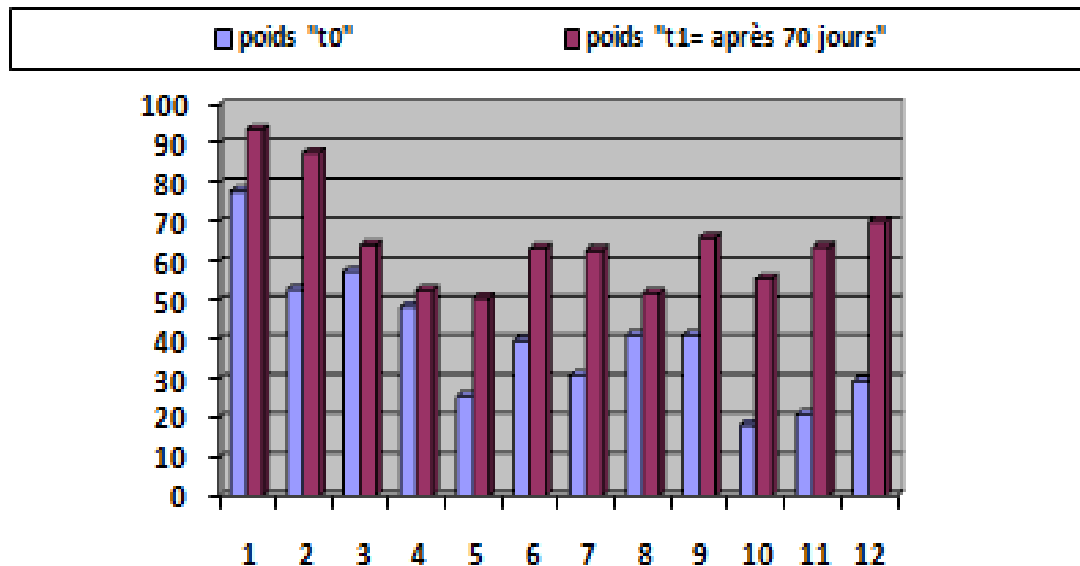
B-For the state of Ouargla: There is a mandate and a large water capacity to develop the field of aquaculture integrated with the peasant through groundwater and various lakes known for their environmental importance, such as Lake Hussi bin Abdullah, In order to expand and develop the Division, a supplement to the National Centre for Aquaculture and Marine Fishing Development was established in Hassi ben Abdallah, in accordance with the Joint Ministerial Decision No. 162 of 17 October 2005. in order to provide technical and scientific framing in line with aquaculture projects, A number of experiments have emerged at the state level, the most important of which is the breeding of freshwater fish and the breeding of shrimp in Ouargla (2017، صالحى و قداش).

-Shrimp breeding boat in Ouargla: This vessel is located at the level of the municipality of Hassi ben Abdallah, Ouargla State (20 km North of Ouargla), established in partnership with the State of South Korea with an estimated Algerian contribution of 6 million dollars and a Korean contribution of about 5 million dollars, this important project consists of an area of 10 hectares, with four units (04) Represented in Management and Stoves Unit, Pre-Fattening Education Unit, Food Processing Unit and Fattening Unit as well as Research Centre. This project has contributed to the production of approximately (01) tons of shrimp thickness during 2016, and it is expected to reach the

production of approximately 20 to 30 tons per year in the future of white man shrimp fish (Direction de la pêche et des ressources halieutiques de la wilaya de Ouargla, 2023)

Afin de déterminer dans quelle mesure l'aquaculture intégrée à l'agriculture contribue au développement de la Division des pêches, nous aborderons la présentation de cette étude, qui a été réalisée dans un délai estimé à 70 jours pour déterminer l'évolution du poids des poissons, et le résultat de l'étude est montré dans la figure suivante (Guedri, 2021) :

Figure (5): Evolution of fish weight during the study period



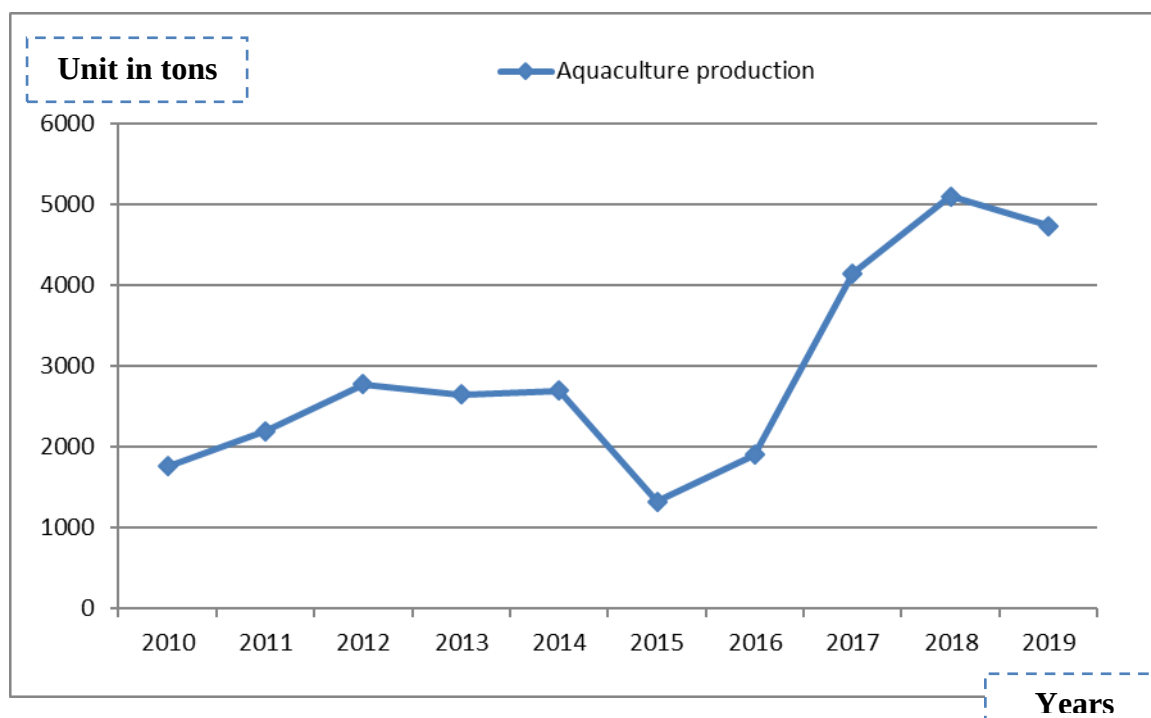
The source : (Guedri, 2021)

From the previous chart we have found that there has been a significant development between the first and second weight of fish, with an average daily rate of 0.31 g/day in the weight of fish, which confirms the benefits of the approach to integrated aquaculture with farming by diversifying the sources of farmers' income on the one hand and increasing peasant yields on the other.

V- Aquaculture integrated with agriculture as a mechanism to enhance food security in Algeria.

Through the above, fish are an important source of animal protein with a protein content of 18-23%, as well as the amino acids necessary for the human body, in addition to being rich in iodine and other vitamins, she said that in the framework of the five-year scheme (2015-2019) Approximately 20,000 tons of freshwater fish produced The production of 5,100 tons was reached in 2018 and 4,735 tons in 2019 and is the result of more than 410 projects distributed across the national territory in addition to creating nearly 9,000 direct and indirect occupancy positions. This is demonstrated by aquaculture and fish farming projects. The development of aquaculture production in Algeria between 2010 and 2019 can be explained as follows:

Figure (6): Development of aquaculture production in Algeria during the years 2010–2019



The source : prepared by the researcher based on the National Statistical Office
(Office National des Statistiques ONS, 2022)

As shown in figure 07 below, the average production of aquaculture in the Algerian states during the years 2010-2019, which we have prepared by drawing on the statistics of the National Statistical Bureau for the year 2022:

Table (2): Average aquaculture production in some Algerian States during 2010–2019

States	Average aquaculture production during the period 2010-2019 (Unit in Tons) $\bar{X}$
Chlef	293.10
Béjaia	21.20
Bechar	166.00
Tlemcen	106.30
Tizi ousou	169.00
Alger	9.80

Jijel	215.20
Setif	152.40
Skikda	46.40
Sidi BelAbbes	37.10
Guelma	68.40
Mostaganem	72.70
Ouargla	161.40
Oran	118.10
Boumerdes	172.10
El Tarf	30.20
Tipaza	90.00
Ain Defla	334.10
Ain temouchent	104.80
Relizane	488.10

The source prepared by the researcher based on the National Statistical Office
(Office National des Statistiques ONS, 2022)

Applying the rate of increase in fish weight set out in Figure 05 above and estimated at 0.31 grams per day and set out in the study conducted in the state and earlier, we find the results identified in the following table for all the states mentioned in Figure 07 in the case of application of the integrated aquaculture approach with agriculture, after circulation to each:

X : Average aquaculture production during the period 2010-2019 in 10 years (Unit in Tons).

Y : Production with rate of 0.31 grams in day multiplied by 365 day in 10 years (Unit in Tons).

Z : X+Y : new production in 10 years

Table 3): Average increase in aquaculture production in some Algerian states during 2010–2019

States	Average aquaculture production during the period 2010-2019 (Unit in Tons) X	Production with rate of 0.31 grams in day multiplied by 365 day (Unit in Tons) Y	new production in 10 years (Unit in Tons) Z
Chlef	293.10	0.33	303.33
Béjaia	21.20	0.02	21.22
Bechar	166.00	0.18	166.18
Tlemcen	106.30	0.12	106.42
Tizi ousou	169.00	0.19	169.19
Alger	9.80	0.01	9.81
Jijel	215.20	0.24	215.44
Setif	152.40	0.17	152.57
S studySkikda	46.40	0.05	46.45
Sidi BelAbbes	37.10	0.04	37.14
Guelma	68.40	0.07	68.47
Mostaganem	72.70	0.08	72.78
Ouargla	161.40	0.18	161.58
Oran	118.10	0.13	118.23
Boumerdes	172.10	0.19	172.29
El Tarf	30.20	0.03	30.23
Tipaza	90.00	0.10	90.10

Ain Defla	334.10	0.37	334.47
Ain temouchent	104.80	0.11	104.91
Relizane	488.10	0.55	488.65

The source :The results of research's study

Note that the average fish production over 10 years increases at varying rates of up to 0.55 tons in the state Relizane and 0.33 tons in the state of Chlef, when applying the integrated aquaculture approach with agriculture.

Through the above, we have concluded that the merger of the Aquaculture Division with the Agriculture Division has resulted in both divisions benefiting from each other through the phenomenon of reverse feeding. In return for the provision of high quality agricultural products, this approach has also resulted in the provision of high nutritional value fishery resources, In addition to the increase in fish weight by an average of 0.15 tons in 10 years for the 20 States studied and mentioned in table 03 above, we have come to the conclusion that aquaculture combined with farming contributes to the provision of additional fish stocks, thereby promoting food security policies in Algeria through the Division of Fish without dependence on fishing.

VI- Conclusion:

What has been addressed in this study We have reached the following conclusions: the Aquaculture Division, which is integrated with agriculture, is now considered an important option throughout the world in general and Algeria in particular. This approach is now providing fish to consumers at the right price, especially in landlocked areas. desert and remote isolated areas contribute to sustainable consumption of fishery and peasant resources and has a significant contribution to the national economy, increasing national wealth, national income and levels of economic output, It is also a tool to enhance food security in the Division of Fisheries and Peasant Resources and creates functional opportunities and steady income for individuals, by regulating farming and providing vital natural fertilizers rich in animal routine with fish farming and water resource control Algeria is working today to give effect to the legal provisions on the establishment of aquaculture farms integrated with agriculture. Because this policy creates self-sufficiency in the consumption of fishery resources and the provision of various peasant resources and reductions in imports in addition to creating a real transformative industry in these resources, Algeria is also working to export fish products and peasant products produced from these people in the future.

Recommendations Proposed: As recommendations, we propose to sustainably integrate aquaculture with peasants and contribute to the development of fish production, thereby supporting Algeria's food security policies:

-Utilize water used in aquaculture basins for watering and peasant irrigation operations because it is rich in the natural fertilizer needed by various agricultural crops.

-Take advantage of the waste of peasant resources that are unfit for human consumption by using them as feed in fish farming.

-Focus on the exploitation of arable land and desert land for biology projects integrated with farming.

-The achievement of self-sufficiency in fishery resources and in peasant products and food security in this division must have integrated management among the interests of the State represented in the government, investors and peasants.

-Focus on the formation of peasants in this division and encourage investment in this field, and work to create specializations at the level of vocational training centers and universities that keep pace with this activity and develop it.

-Focusing on the preparation of other legal texts defining the organization of this division within the various regions across the national territory, focusing in particular on isolated areas and desert areas to create an investment dynamic and reach the provision of many job positions and ensure their sustainability.

-To coordinate the various sectors active in this area, such as fishing, agriculture and water resources, in order to sustain this activity and to support policies for achieving food security in order to export these products and thus achieve a difficult currency for the public treasury outside the incinerator sector.

Bibliography:

1.Ibrahim, L. A., Abu-Hashim, M., Shaghaleh, H., Elsadek, E., Hamad, A. A., & Hamoud, Y. A. (2023). A Comprehensive Review of the Multiple Uses of Water in Aquaculture integrated Agriculture Based on International and National Experiences I. *Water* , pp. 1-21.

2.Guedri, Salah Eddine. (2021). Contribution de la Trilogie "Psciculture-Agritourisme-Pescatourisme" à la Diversification Socio-économique des Zones Cotières Algériennes. *Al -Bashaer Economic Journal* , pp. 1195-1206.

3.Melaku, S., & Natarajan, P. (2019). Status of integrated aquaculture-Agriculture systems in Africa. *International Journal of Fisheries and Aquatic Studies* , pp. 263-269.

4.Sangchoul, Y. (2019). Contingent Valuation of Sustainable Integrated Agriculture-Aquaculture products: The case of Rice-Fish farming systems in South Korea. *Agronomy2019- Korea Maritime institute* , pp. 1-17.

5.Office National des Statistiques ONS. (2022). *Les statistiques de la peche Retrospective 2010-2019*. Alger.

6.Ministry of Fisheries and Fisheries Resources MFFR. (2003-2007). *National Plan for the Development of Marine Fisheries and Aquacul*. Algiers -Algeria-.

7.Direction de la pêche et des ressources halieutiques de la wilaya de Jijel. (2022, janvier 23).

8.Direction de la pêche et des ressources halieutiques de la wilaya de Ouargla. (2023).

9.FAO, Food and agriculture organization. (2009). Roma .

10. صلاح الدين قدرى. (2017). التنمية المستدامة لقطاعي السياحة و الصيد البحري في الجزائر: مقارنة مدمجة -دراسة حالة -(أطروحة دكتوراه). كلية العلوم الاقتصادية التجارية و علوم التسيير، جيجل: جامعة محمد الصديق بن يحيى.

11. سميرة صالحى، و سمية قداش. (2017). الاستزراع المائي بالصحراء الجزائرية بين تحقيق الأمن الغذائي و الاستدامة. مجلة /داء المؤسسات الجزائرية ، الصفحات 379-388.