Fish food security in Basrah governorate, Iraq: An assessment of fish availability and per capita supply in 2024

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Abstract

Fish food security is an essential component of overall food security as fish represent a rich source of healthy and high-quality animal protein. The current study was designed to assess the contribution of fishery resources to support the food security in Basrah Governorate. Monthly data on fish quantities available in markets were collected across 10 districts in Basrah throughout 2024 alongside official census data. The study employed both destructive and inferential statistical analysis including per capita calculations, coefficient or variation, temporal trend analysis, and seasonal variations. Total annual fish quantity available in the markets reached 45,519 tons for a population of 3,388,398 resulting in an average annual per capita consumption of 13.43 kg. The findings revealed substantial spatial disparities across districts, ranging from 9.00-31.07 kg/capita/year with a spatial coefficient of variation of 53.7% pronounced seasonal fluctuation.

Keywords: Food security, Per capita share, Seasonal variation, Basrah Governorate, Iraq

Introduction

Food security is considered one of the main challenges facing the world in light of increasing population growth. It is defined as a state in which all people, at all times, have access to sufficient, safe, and nutritious food that meets their dietary needs (FAO, 1996). Food security includes four main dimensions: food availability, access to food, food utilization, and the continuity of availability and access over time (FAO, 2021).

Fishery resources play acritical role in supplying communities with healthy food and occupy a strategic position within the global food security system, as they provide about 3.3 billion people with approximately 20% of their average animal protein intake (FAO,

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2022). Fish contribute fundamentally to global food security due to their nutritional value, as they are a rich source of high-quality protein, fatty acids, vitamins and minerals in addition to their ease of digestion and absorption (FAO, 2022). Fish also have economic importance by providing job opportunities for residence of villages, rural areas, and coastal cities, serving as a source income for poor household, and as a relatively affordable food product (Sachdeva *et al*., 2024).

In Basrah Governorate, fishery resources acquire strategic importance due to its distinctive geographic location on the Shatt Al-Arab and the Arabian Gulf. Basrah is considered the main source of marine fish in Iraq and contributes significantly to meeting the population's needs for high quality fish protein. Aquaculture represents an important source for supplying the government with carp fish cultured in earthen ponds and the floating cages which are profitable and highly productive projects in the absence of salinity intrusion (Ahmed, 2022). In recent years, instability of fish stocks in Iraqi marine waters has been observed (Mohamed & Abood, 2023), along with the degradation of the Shatt al-Arab ecosystem due to pollution and the decline in the freshwater inflows, which has led to a decrease in the quantities of local fish available in the local markets (Ahmed et al., 2020). Imported fish (fresh and frozen) play an important role in achieving food security for the community compensating for the shortage of local products available and diversifying sources of nutritional benefits (Obeed ,2025).

There are many factors that affect annual per capita fish consumption, and it appears that geographic location and population density are among the determining factors. In this context, a study by Ali and Abahussain, (2013) indicated that the annual per capita in the Kingdom of Bahrain (with its distinctive geographic location on the Arabian gulf) was about 25 kg/ capita/ year in 1980s, then decreased to less than 10 kg/ capita/ year in 1990s due to significant population of growth which puts pressure on natural resources. Environmental factors, particularly water temperature and chlorophyll concentration, play a critical role in shaping fish stocks and their productivity, and consequently influence per fish capita availability (Merino *et al*., 2012). Evidence from Dusaeva *et al*., (2025) indicated that average per capita consumption of fishery products is not determined solely by availability but is also strongly conditioned by economic access to these products. According to the food and agriculture organization, annual per capita fish consumption is further driven by rising population demand, increasing income levels, and the expansion and diversification of distribution channels (FAO, 2017).

The current study aims to evaluate the contribution of fish resources to supporting food security for the population of Basrah Governorate during 2024. This is achieved by calculating per capita fish consumption on both monthly and annual bases, analyzing spatial variation among different districts of the governorate, exploring seasonal patterns in fish availability, and assessing the relationship between population density and the availability of fish resources. This study is based on the quantities of fish accessible to consumers, regardless of wherever they are locally produced or imported.

Materials And Methods

Data on the quantities of available fish and population statistics were collected and analyzed. Basrah was divided into 10 main regions (Basrah city center, Al-Hartha, Shatt Al-Arab, Al-Qurna, Al-Midaina, Abu Al-Khasib, Al-Zubair, Al-Dayer, Safwan and Al-Faw. (Figure1). Data on the quantities of fish available in the markets measured in tons were collected daily throughout the year 2024 by field teams from the Directorate of Agriculture in Basrah. These data were gathered from wholesale Traders in the districts and sub-distracts of the governorate and were documented on daily basis in the relevant official departments. The population data of the districts and sub-distracts were obtained from the Central Statistical Organization in Basrah which is affiliated with the Iraqi Ministry of Planning.

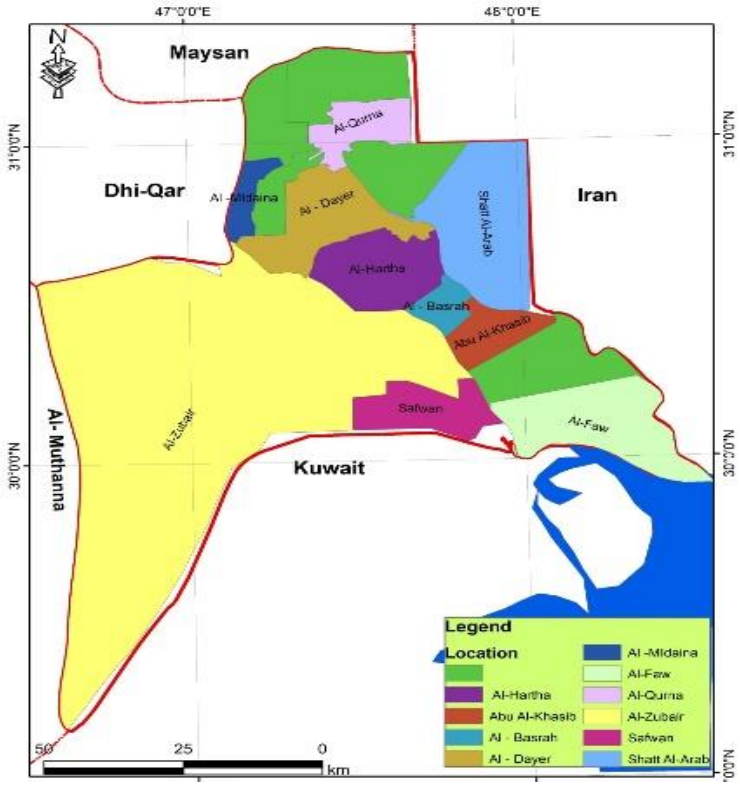

Figure 1. The administration map of Basrah Governorate shows all 10 study regions.

Calculated indices

1. Monthly per capita share (kg/ person/month)

= (Monthly fish quantity×1000) ÷ population

Total annual fish availability for each region

=Sum of monthly available fish quantities for each region (ton)

Step 2: conversion to kg

Step3: Dividing by the population to obtain the per capita share (kg /person /year)

2. Annual per capita share (kg/person/year) = Total annual quantity ×1000 ÷ population.
3. Coefficient of variation (CV)= (standard Deviation ÷ Arithmetic Mean) × 100.

Calculating seasonal variation

Step 1: Classify months by season:
Winter (December, January, and February)
Spring (March, April, and May)
Summer (Jun, July, and August)
Autumn (September, October, and November)
Step 2: Calculate the average per capital share for each season (kg /person/ month)
Step 3: Calculate the percentage of the annual average.

Statistical Analysis

The arithmetic means, standard deviation, minimum and maximum values, and percentage were calculated using Microsoft Excel 365. Analysis of variance and Pearson correlation coefficient were analyzed using IBM SPSS Statistics.

Results

The total population of Basrah Governorate is estimated at 3,388,398 inhabitants. The population is concentrated in three main areas: the governorate center, with 1,483,773 inhabitants, equivalent to 43.8% of the total, followed by Al-Zubair District, with 532,294 inhabitants (15.70%), and then Al-Midaina, with 273,353 inhabitants (8.10%). The least densely of populated areas are Safwan and Al-Faw, indicating a clear spatial disparity with the distribution skewed toward the larger areas, particularly the Basrah governorate center (Table 1).

Table 1: population count in each area of Basrah and its percentage of the total census.

Region	Population	%
Basrah center	1,483,773	43.80%
Al-Zubair	532,294	15.70%
Al-Midaina	273,353	8.10%
Abu-al Khaseib	260,583	7.70%
Al-Qurna	209,663	6.20%
Shatt al-Arab	203,144	6.00%
Al-Hartha	189,464	5.60%
Al-Dayer	123,614	3.60%
Safwan	63,286	1.90%
Al-Faw	49,224	1.50%
Total	3,388,398	100%

Total Fish Availability

The annual total of fish available in local markets reached 45.519 tons, with a monthly average of 3.793 tons /month, a standard deviation of 964 tons and coefficient variation of 25.4%

Total Per Capita Share

The results showed that the annual per capital share is equivalent to 13.43 kg/ person/ year with a monthly average of 1.12 kg/ person/ year.

Temporal Analysis

Monthly Distribution

As shown in Table 2, the largest quantity of fish was recorded in May (5.882 tons, 1.736 kg / person), while the lowest quantity was in February (3.006 tons, 0.887 kg / person) The difference between the highest and lowest amount was 95.6% and the temporal coefficient of variation was 25.4%

The temporal analysis reveals an upward trend from February to May (an increase of 95.6%), followed by relative stability from May to August (the peak period). A downward trend was observed from August to November (a decline of 41.2%) with a slight recovery in December (Table 2).

Table 2: Fish quantities available in the markets and the monthly per capita share

Month	Quantity (tons)	monthly per capita share (kg/capita/month)
Jan.	3,417	1.008
Feb.	3,006	0.887
Mar.	3,504	1.034
Apr.	4,094	1.208
May	5,882	1.736
Jun.	5,835	1.722
July	4,437	1.309
Aug.	5,414	1.597
Sep.	3,719	1.097
Oct.	3,497	1.032
Nov.	3,181	0.939
Dec.	3,533	1.042

Spatial Analysis

Classification by Food security Adequacy

The table above reveals relatively high spatial variation and the distribution of per capita share among the governorate's regions. The results indicated the following classifications:

Excellent category: (≥20 kg/person/year): 4 regions (40% of regions, 19.4% of the population), including Al-Faw (31.07 kg), Shatt Al-Arab (24.76 kg), Al-Midaina (23.64 kg) and Abu Al-Khasib (20.24 kg).

Good category: (15 to 20 kg/person/year) One region only (10 % of regions, 6.2% of the population), which is Al-Qurna (16.62 kg)

Acceptable category: (12 to 15 kg/person/year): Two regions (20% of regions, 17.6% of the population), namely Safwan (12.47 kg) and Al-Zubair (11.87 kg).

Below standard Category: (< 12 kg/person/year): Three regions (30% of regions, 56.8% of the population), namely Al-Hartha (10.95 kg), Al-Dayer (9.73 kg), and Basrah Center (9.00 kg) (Table 3).

These results indicate that 56.8% of the population (1.926.851 inhabitants) receive below standard fish allocations that fall short of the required level.

Table 3: Fish quantities available in the local markets, the population count for each region, and the annual per capita share.

Region	Annual availability (tons)	Population	per capita share (kg/year)
Al-Faw	1,529	49,224	31.07
Shatt Al-Arab	5,031	203,144	24.76
Al-Madiana	6,463	273,353	23.64
Abu Al-Khasib	5,275	260,583	20.24
Al-Qurna	3,484	209,663	16.62
Safwan	789	63,286	12.47
Al-Zubair	6,316	532,294	11.87
Al-Hartha	2,075	189,464	10.95
Al-Dayer	1,203	123,614	9.73
Basrah center	13,354	1,483,773	9.0

Seasonal analysis

Statistical analysis revealed highly significant seasonal differences (ANOVA: F= 8.91, p=0.004). The findings for each season were as follows:

Summer (June-August): The total fish available in the local markets was 15.686 tons (34.5% of the annual quantity), yielding a per capital share of 1.54 kg/person/year.

Spring (March - May): The second highest season, with a total available quantity of 13.480 tons (29.6% of the annual production) yielding a per capita share of 1.326 kg/person/year.

Autumn (September - November): Ranked third in terms of fish quantities available in the local markets with a total of 10.397 tons (22.8% of the annual quantity) yielding a per capita share of 1.023 kg/person/month.

Winter (December-February): The season with the lowest fish quantities in the markets, with a total of 9.956 tons (21% of the annual availability), yielding a per capita share of 0/979 kg/person/month.

Table 4: Average per capita fish share by season.

Season	Average per capita (kg/person/month)	Standard deviation	The percentage of the annual average
Winter	0.979	0.083	87.40%
Spring	1.326	0.366	118.40%
Summer	1.543	0.216	137.70%
Autumn	1.023	0.08	91.30%

Correlation analysis between population size and available fish quantities

The Pearson correlation coefficient (r= 0.848, p= 0.16) indicate a moderate positive correlation that is not statistically significant, meaning there is no strong linear relationship between population size and available fish quantities.

Discussion

The results showed that Basrah has a relatively acceptable status in fish food security at the overall level with an average annual per capital share of 13.43 kg. This exceeds the Iraqi national average of 7 kg/ year (Al-Hilali *et al*., 2020) reflecting the importance of the governorate's geographic location and its rich water resources compared to other Iraqi provinces. However, it remains lower than the global average per capita consumption of fish and other aquatic organisms which reached 20. 7 kg/ year in 2022 (FAO, 2024).

Statistical analysis revealed significant special variation (CV=53.7%), indicating inequality in fish distribution across the governorate. Basrah center is considered one of the most disadvantaged areas despite being the largest population center (43.8% of the population) recording the lowest per capita share (9.00 kg per year). This may be

attributed to high population density, weak local distribution network or the distance of some neighborhoods from major markets (FAO, 2017). In contrast some areas are distinguished such as Al-Faw which recorded the highest per capita share (31.07 kg/year), likely due to its direct proximity to marine fishery and the Shatt Al- Arab. These findings are consistent with the study of Younis *et al.* (2023), which covered the period 2016 to 2018 and showed that per capita share in Basrah center did not exceed 6.5 kg/ year while it exceeded 36 kg /year in Al-Faw District.

Although the continuous population growth increases demand for fish, it does not guarantee availability or access, as other factors play a more influential role. These include the capacity of fisheries and aquaculture projects to supply required quantities, proximity to rivers and water bodies, and consumer purchasing power (Rice and Garcia, 2011; Tacon and Shumway, 2024). In the present study, statistical analysis using the Pearson correlation ($r= 0.48$, $p > 0.05$) confirmed that population size is not determining factor for fish availability; rather, proximity to fishing grounds is more important. Coastal areas benefit from key advantages such as storage facilities, cold transport, active local economies and specialized fish markets (Merino *et al.*, 2012). This is supported by the study findings, where residents of Al-Faw district receive a high per capita share compared to other regions.

Previous studies have indicated that fishery productivity varies seasonally, with summer being the most productive season and winter the least (Ahmed, 2017). The present study showed that seasonal variation (CV= 25.4) is moderate compared to special variation, yet still statistically significant ($p=0.004$). Fishery productivity is influenced by multiple seasonal factors, Summer represents the peak of fish abundance, possibly due to higher temperature, increased primary productivity, and its role as a migration and spawning season for important fish species (Shi *et al.*, 2024; Pratama *et al.*, 2025). Stable weather conditions during Summer may also facilitate fishing activities. In contrast, fish quantities in the markets declined significantly during winter and autumn. This reduction may be due to harsh weather conditions such as winds affecting nutrient transport, leading to reduced phytoplankton levels and consequently impacting fish growth and availability (Whitney, 2015). Additionally, winds may impede fishing operations and reduce working hours, along with fish migration to warmer waters and decreased biological activity, including slower growth and reproduction rate (Brown *et al.*, 2011; Yáñez *et a*l., 2017)

Conclusions and Recommendations

The findings of the present study indicate that the overall situation is acceptable but uneven. The average per capita fish share in Basrah is 13.43 kg/ person/ year, exceeding the Iraqi national average of 7 kg/ year (Al-Hilali *et al.*, 2025), confirming the importance of geographical factors. Proximity to fisheries appears to be more influential than population size. The study also found that 56. 8% of the population receives fish quantities

below the recommended level, with substantial variation among regions (9.00-31.05 kg), indicating inequity in distribution.

The current study recommends addressing the pronounced special disparities to improve conditions in Basrah center (1.48 million inhabitants) with a per capita share of 9 kg/ year. This can be achieved by establishing specialized fish markets in large urban neighborhoods, supporting cold-chain transport from fishing areas to populations centers, developing refrigerated storage facilities in the city center, and implementing support programs targeting low-income households to improve access to fish.

To reduce seasonal variation, it is necessary to develop fish storage methods during peak seasons for use in low-supply periods, and enhance fish processing industries such as drying, salting, canning and freezing. Encouraging aquaculture is also essential as it provides stable year-round production and reduces pressure on natural fisheries.

The high fishing intensity during summer highlights the need for an effective and sustainable fisheries management strategy. This includes implementing a quota system, establishing seasonal fishing bans during critical spawning periods, and designating marine protected areas to allow for fishes' stock regeneration.

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الأمن الغذائي السمكي في محافظة البصرة، العراق: تقييم للوفرة السمكية وحصة الفرد من الإمدادات في عام 2024

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المستخلص

يُعد الأمن الغذائي السمكي أحد المكونات الحيوية للأمن الغذائي الشامل، حيث توفر الأسماك مصدراً غنياً بالبروتين الحيواني عالي الجودة. تهدف هذه الدراسة إلى تقييم مساهمة الموارد السمكية في دعم الأمن الغذائي لسكان محافظة البصرة. تم جمع بيانات شهرية لكميات الأسماك المتاحة في الأسواق عبر 10 مناطق في محافظة البصرة على مدار عام 2024، إلى جانب بيانات التعداد السكاني الرسمية. استخدمت الدراسة التحليل الإحصائي الوصفي والاستدلالي، بما في ذلك حساب نصيب الفرد ومعامل التباين وتحليل الاتجاهات الزمنية والتحليل الموسمي. بلغ إجمالي الإنتاج السمكي السنوي 45,519 طناً لعدد سكان يبلغ 3,388,398 نسمة، بمتوسط نصيب فرد سنوي قدره 13.43 كغم/فرد/سنة. أظهرت النتائج تباينات مكانية كبيرة بين المناطق (تراوحت من 9.00 إلى 31.07 كغم/فرد/سنة) مع معامل تباين مكاني 53.7% وتباينات موسمية واضحة. تتمتع محافظة البصرة بوضع مقبول في الأمن الغذائي السمكي على المستوى الإجمالي، لكن التباينات المكانية الكبيرة والموسمية تتطلب تدخلات سياسية مستهدفة لضمان التوزيع العادل والاستدامة طويلة الأمد

الكلمات المفتاحية: الأمن الغذائي، نصيب الفرد، التباين الموسمي، محافظة البصرة، العراق.