

## REPRODUCTION BIOLOGY OF THE ARABIAN YELLOW FINE SEABREAM (*ACANTHOPAGRUS ARABICUS*) IN THE IRAQI MARINE WATERS

Audai M. Qasim<sup>1</sup>, Faleh M. Al-Zaidy<sup>2</sup>

Department of Marine Vertebrate, Marine Science Center, University of Basrah, Basrah, Iraq 1,2

### ABSTRACT

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#### Correspondence Email:

[audai.qasim@uobasrah.edu.iq](mailto:audai.qasim@uobasrah.edu.iq)

The Arabian yellow fine Seabream, *Acanthopagrus arabicus*, was collected by floating gillnets from Iraqi marine waters in the northwest Persian Gulf. A total of 422 fish were collected, of which 163 were male and 259 were female. The lengths and weights of the fish, sex ratio, gonadal somatic index (G. S. I.), gonad maturity cycle development, and the first maturational length were measured. The lengths ranged between 18.5-41.5, and males recorded the lowest length in February, and the females recorded the largest length in the samples collected in January. The length group 30 cm was dominant over the other lengths in the whole sample. The G.S.I. for both sexes recorded one peak, which refers to one period of spawning during February, with a gradual increase from December to reach its highest peak, it was followed by a gradual decline during the months of March and April, and its lowest value was recorded in August for females. The sex ratio was in favor of females. Five stages of maturity were identified with the difference in the size of the eggs, their behavior in spawning in one batch, and their breeding season extending from February to April, and the peak of reproduction is in March.

### INTRODUCTION

The species *Acanthopagrus arabicus* belongs to the family Sparidae [1] It was renamed from *A. latus* [2]. It is one of the important commercial species with high economic value in the region [3]. It is also considered one of the most common species of the family (Sparidae) in Iraqi marine waters, especially in the waters affected by the flows of Shatt al-Arab waters. Its juveniles and immature stages enter the waters of the Shatt al-Arab [4]. The total catch of species of the Shank family during 2019 amounted to about 1439 tons, which constituted 12.7% of the Iraqi marine catch [5]. *A. arabicus* is widespread in the Persian Gulf and along the coast of India to the Philippines, north to Japan, and south to Australia, and its diet consists mainly of echinoderms, worms, crustaceans, and molluscs. Exploiting *A. arabicus* in particular with a variety of nets including hook and thread [6]. The biology of these fish has been studied by many researchers, [7] found the spawning of *A. arabicus* in the waters of the Arabian Gulf once a year during the period from January to April. [8] also studied the biology of the Shank family fish populations in Qatari waters in the Arabian Gulf, they mentioned that the period of spawning was very short and extended from mid-April to the end of it. [9] examined some aspects of the reproductive biology of *A. arabicus* in Japan. There are preliminary reports on reproduction in *A. latus*, and *A. cuvieri* from Kuwait [10, 7]. [11] studied the reproductive biology of the *A. arabicus* in Iranian waters in the Persian Gulf, and determined the spawning period from February to June.

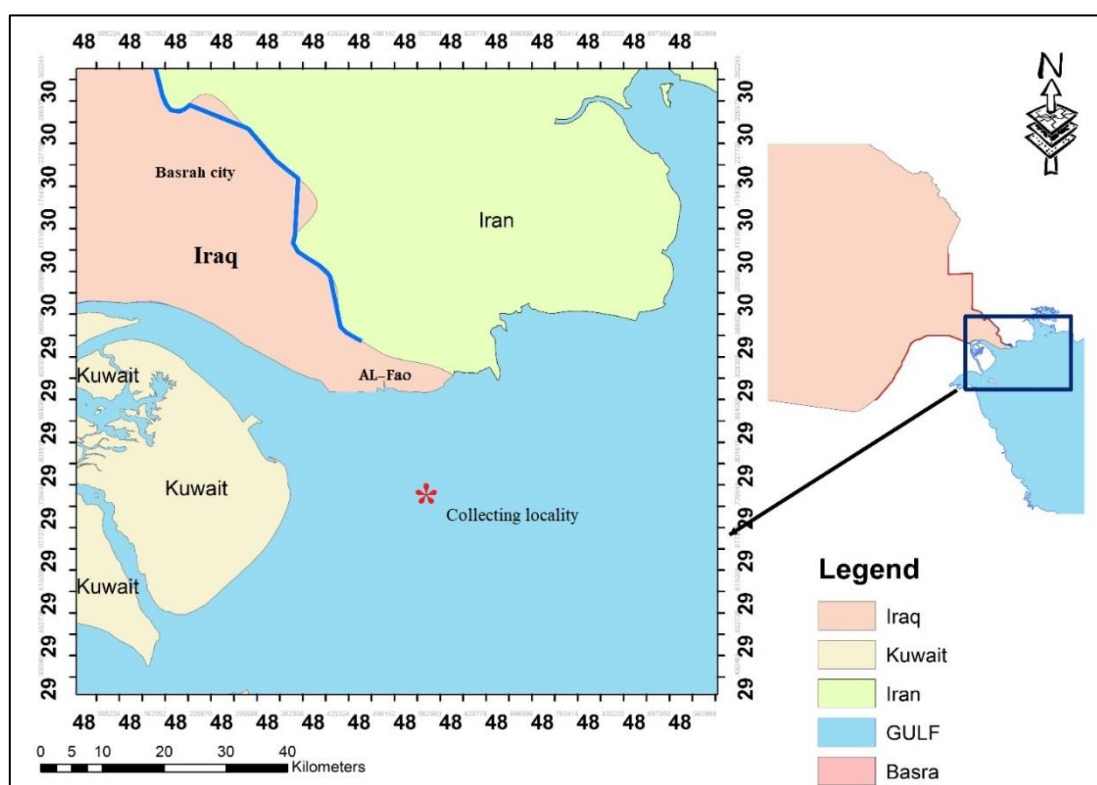
This study aims to determine the breeding period of the economically important *A. arabicus*, its breeding pattern, and some of its life characteristics in Iraqi

marine waters, which are necessary to provide support for studies of stock dynamics for sustainability, as well as aquaculture [12].

## MATERIALS AND METHODS

### Study Area

The Iraqi marine waters are located northwest of the Persian Gulf and constitute the maritime borders with the State of Kuwait and the Islamic Republic of Iran (Fig. 1). The Al-Fao Peninsula, in southern Iraq, is the only marine fish landing site [13].



**Figure (1): A map showing the area for collecting samples of *A. arabicus* in Iraqi marine waters.**

### Sample Collection

The *A. arabicus* was collected monthly and randomly from Iraqi marine waters northwest of the Arabian Gulf. *A. arabicus* was collected monthly and randomly from Iraqi marine waters northwest of the Persian Gulf by artisanal fishing boat using gill nets. It included 163 males, 259 females, and 41 hermaphrodites. Total length (TL) was measured to the nearest 0.1 cm using a measuring plate, body weight, and gonadal weight to the nearest 0.01 g using a type balance. Then the sex of the fish was determined by microscopic examination of the dissected gonads and then weighed to 0.1 grams using an electronic balance. To clarify the seasonal progression of gonads, the stages of gonad maturity were studied by macroscopic phenotypic examination using the characteristics of the physical sensory examination, which is represented by the degree of transparency degree of opacity, consistency, presence of blood vessels vascularization, a vision of eggs and sperm, and the form of coloration

of the gonads [14,15]. Changes in the gonadal index (G.S.I.), which expresses a function of maturity, were determined as a monthly rate based on the formula [16]:

$$\text{G.S.I. (\%)} = \text{Gonad weight} / \text{Body weight (g)} \times 100$$

### Sex Ratio

The sex ratio was calculated using [17]. to test the deviation of the sex ratio from the expected ratio of 1:1 using the Chi-square test. The length of maturity ( $L_m^{50}$ ) is based on the smallest length in which 50% of the individuals are in a state of maturity [18]. Absolute Fecundity was measured as the total number of mature eggs in the ovaries at the stage of maturity. completely, as it was preserved in a modified glycine solution [19].

## RESULTS AND DISCUSSION

Table (1) shows the monthly sex ratio (ratio of males: females) of *A. arabicus* caught in Iraqi marine waters during the study period. The results of the study showed that there were significant differences at the level of 5% for the months of January, February, October, and December, if the percentage of females present in the sample was 82, 77, 71, and 71%, respectively. The sex ratio (females: males) reached its highest value in January, 4.5: 1 in favor of females.

**Table (1): Monthly sex ratio of *A. arabicus* collected from Iraqi marine waters.**

Month	No. of fish	Female Observed value		Male Observed value		Sex Ratio M: F	p-value
		No.	%	No.	%		
Jan.	22	18	82	4	18	1:4.5	0.003*
Feb.	26	20	77	6	23	1:3.33	0.006*
Mar.	33	18	55	15	45	1:1.2	0.439
Apr.	30	10	33	20	67	1:0.5	0.071
May	31	15	48	16	52	1:0.94	0.796
Jun.	30	18	60	12	40	1:1.5	0.13
Jul.	37	22	59	15	41	1:1.47	0.136
Aug.	44	25	57	19	43	1:1.32	0.365
Sep.	45	27	60	18	40	1:1.5	0.143
Oct.	42	30	71	12	29	1:2.5	0.004*
Nov.	40	26	65	14	35	1:1.86	0.058
Dec.	42	30	71	12	29	1:2.5	0.005*
	422	259		163		1:1.59	0.001

\*Significant at the 5% level of error or 95% confidence.

Figure (2) shows the longitudinal distribution of *A. arabicus* during the sampling period. The lengths ranged between 18.5-41.5 cm, and males recorded the lowest length of 19.5 cm in February. In January, females recorded the largest length in the collected samples, 41.5 cm. And the dominance of the height group was 30 cm and by 60% over the other lengths in the total sample.

Figure (3) shows the changes in the Gonadal Index (G.S.I.) during the months, as the gonad function for both sexes recorded a gradual increase from December to reach its peak in February, followed by a gradual decline during the months of March and April, and recorded Its lowest value is in IB 0.32 for females.

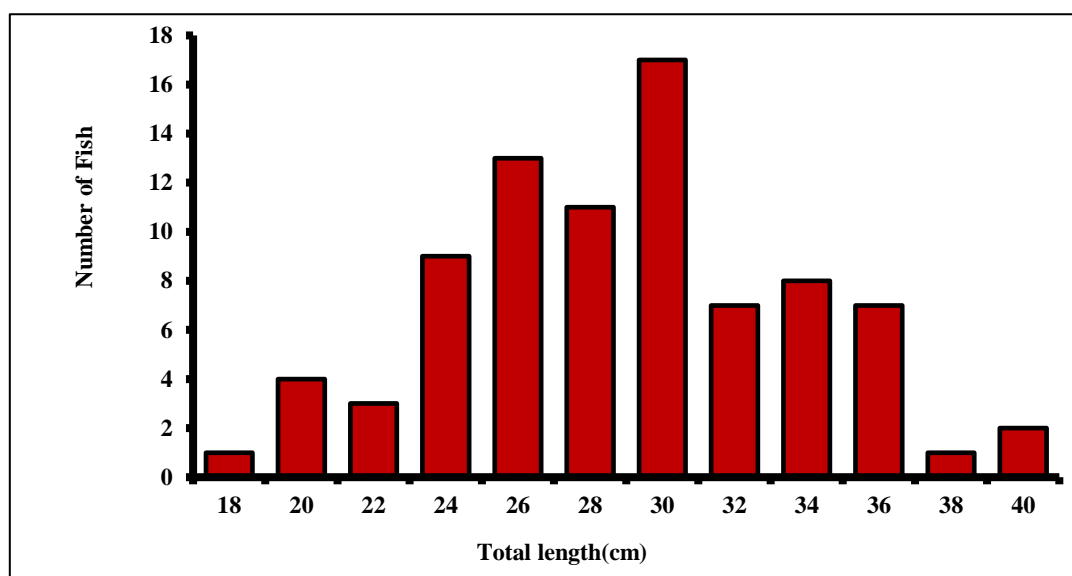


Figure (2): The longitudinal distribution of *A. arabicus* collected from Iraqi marine waters.

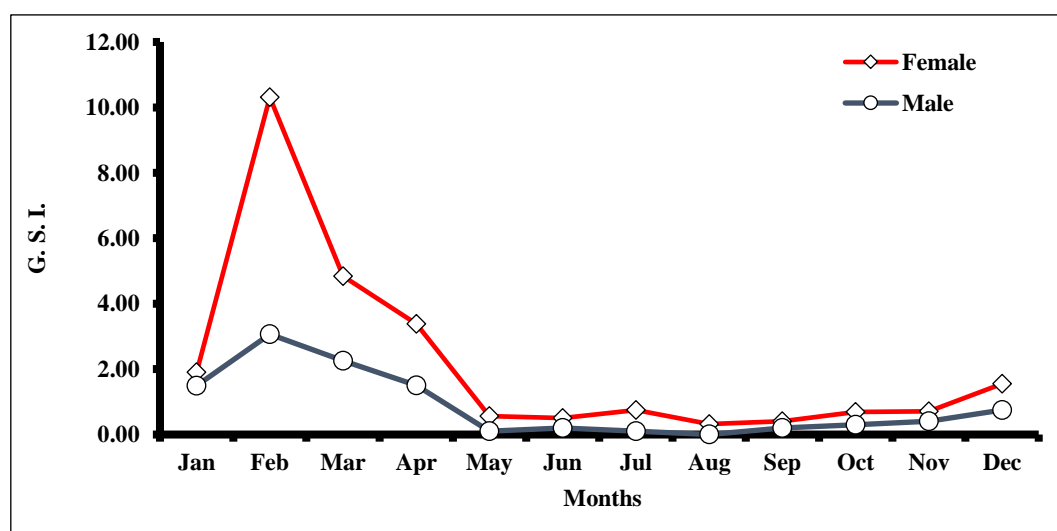


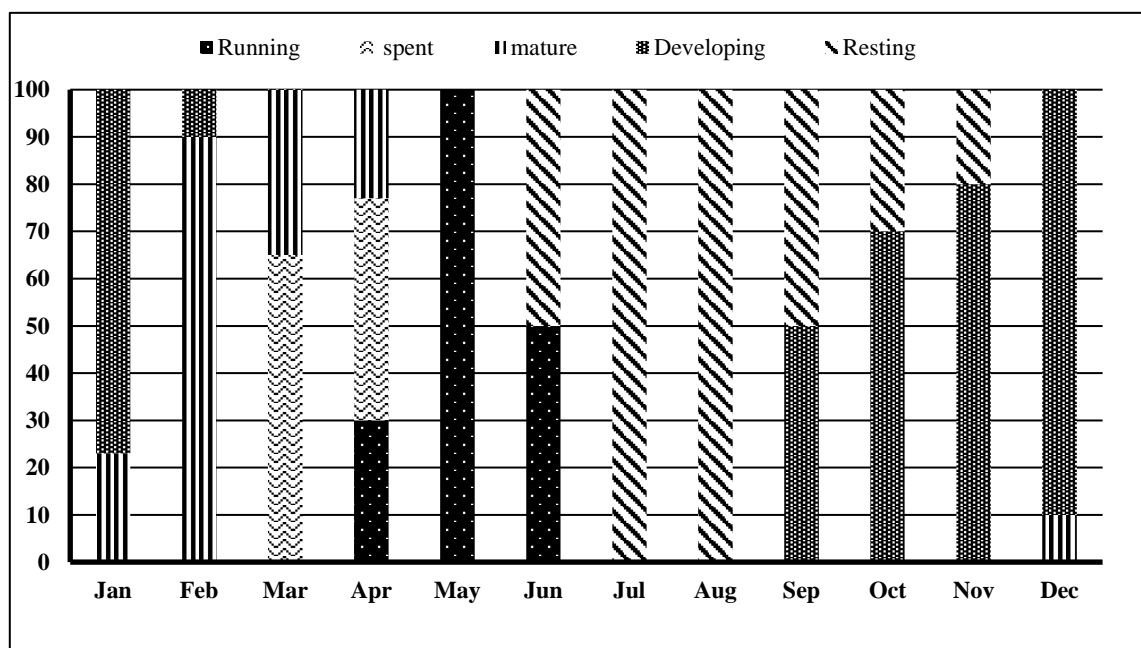
Figure (3): Average gonadal function of *A. arabicus* caught in Iraqi marine waters.

Figure (4) presents the percentage of the different stages of maturity of the offspring of different female *A. arabicus*. As the percentage of females with immature gonads appeared in the months of July and August 100% and in the months of June and September 50%, while in the months of October 1 and November it was 30 and 20%, respectively. As for the second stage of maturity (developed), its appearance was in September, 50% increased to 70, 80, and 90% on October 1, November, and

December 1, respectively, and decreased to 77, 10% on January 2 and February, respectively. While fish with mature offspring represented 10% of the total fish caught on January 1, it increased to 23% on January 2, reaching 90% in February, then decreased to 35 and 23% in March and April, respectively. The percentage of released fish was 65 and 47% in March and April, respectively, and it did not appear in the rest of the year. The released fish appeared in the months of April, May, and June, with percentages of 30, 10, and 50%, respectively. The length of the smallest mature male was 18 cm, and the smallest mature female was 18.5 cm.

**Table (2): Phenotypic description of the stages of development of gonads of *A. arabicus* collected from Iraqi marine waters.**

Stage	Stage name	Description
I	immature	gonads are light-colored, translucent, filamentous, and ovules are not visible through the ovarian wall or are very small at rest.
II	developed	the gonads form about a third of the body cavity, pink in color, and tend to be yellow, and the eggs are inconspicuous
III	mature	ovaries are yellow to orange in color, occupying almost half of the body cavity, and the eggs are clear
VI	spawning	The ovary is transparent. The ovary occupies the entire body cavity. The eggs are large and clear
V	spent	gonads tend to be reddish in color and flabby. It makes up two-thirds of the ovarian body cavity. The remaining eggs will be opaque



**Figure (4): The percentage stages of gonads development for females in Iraqi marine waters.**



The present study provides information about the seasonal gonad development and reproductive strategy of *A. arabicus* fish in Iraqi marine waters. As the results of the sex ratio showed closeness to the ideal sex ratio of 1:1 during the reproductive period, and the total was significant in favor of females at 5%. [20]. found that the sex ratio (males: females) in the community was 1: 0.89, while [21] recorded the sex ratio for *A. arabicus* fish as 1: 0.90 in favor of females. And [22] recorded the sex ratio of *A. arabicus* as 1: 0.88 in favor of females. In the study of [23], fish males were dominant in the smaller length groups (17–23 cm) while females dominated in the larger size group (24–43 cm). This observation was similar to that of [24]. for *A. berda*, with male-exclusive dominance in the shorter length classes and female dominance in the larger length classes.

[25] also reported male dominance in the smaller group (22.3–24.2 cm) and female dominance in the larger group (24.3–26.2 cm) for *A. latus*. The monthly changes in the G.S.I. showed that the *A. arabicus* fish have a seasonal breeding period, as the G.S.I. recorded its highest value in February at 3.07 and 10.3 for males and females, respectively, and that the increase in the GSI started in December. While [21, 20] indicated that the increase in the G.S.I. starts in September, while the study of [27] indicated that the GSI increases from the first month of drinking and reaches its peak in March, but the current study agrees with them in terms of The *A. arabicus* fish has a seasonal reproductive cycle, despite the difference in the environment in which this type of fish, which is a protandrou, was studied. [21] mentioned that protandrou fish develop in the stages of maturity as active males, then become active females with age, as the ratio of males to females decreases with age. [27] indicated that protandrou silver fish grow in male form, then a sexual transformation occurs for lengths between 140–200 mm, and sexual transformation takes place at the beginning of July and extends to the end of August, it happens that they mature in the month of November and continue until spawning. The gonads of some fish are not divided into male and female parts, but they can completely change from one form to another, and all young individuals in the fish community can be males until they reach maturity and turn into females.

[28] A sexual reversal takes place after the males reach sexual maturity, and the dominant females are similar in size, and the female gonads gradually accumulate weight in the form of growth, and this result gives evidence that the stocked quantities reach their peak in the breeding season, as confirmed by [29]. Regarding the optimal management of the *A. arabicus* fishery and based on the results obtained regarding the breeding season, we recommend the application of the fishing lock according to the breeding time of this species during March. The fact that this species is one of the targeted species by fishermen, and to achieve sustainable exploitation of the *A. arabicus* fishery.

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