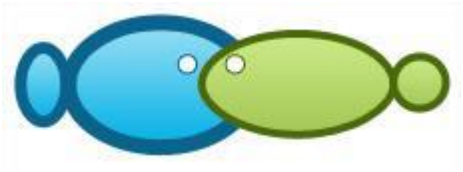

Sex ratio and length at first maturity of berber ponyfish, *Leiognathus berbis,* at Takalar waters, South Sulawesi, Indonesia

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Abstract. Berber ponyfish, *Leiognathus berbis*, is one of the dominant species of Leiognathidae caught in Takalar waters, southern part of Makassar Strait, South Sulawesi. *L. berbis* is a demersal fish with both economic and ecological value. Its population is believed to have an impact on the food chain within the ecosystem. The current study aimed to analyze the sex ratio and size of first mature gonads of *L. berbis* caught in the Takalar waters, for a better and more sustainable management of these fish resources. During the study, 900 *L. berbis* were obtained, with an unbalanced male to female sex ratio, of 1.49:1.00. The size at which male fish first matured was 124.8 mm in body length, while female fish first matured at 107.9 mm. Female fish mature gonads at a smaller size than male fish. In conclusion, *L. berbis* in Takalar waters showed fewer female fish and faster gonad maturity compared to male fish.
Key Words: Leiognathidae, peperek, Makassar Strait, mature gonad, population.

Introduction. The Leiognathidae family comprises fish species that share similar body morphology, characterized by a laterally compressed shape, small to medium size, silvery color, and a mouth that can form a tube pointing up, forward, or down when extended (Woodland et al 2001). Woodland et al (2001) reported the presence of 22 species of Leiognathidae in Indonesian waters, 16 of which are found in Makassar Strait. Wedjatmiko (2007) discovered 13 species of Leiognathidae in the western waters of Sumatra. In Makassar Strait, 12 species were found (Wedjatmiko et al 2007). Asriyana et al (2011) found 10 species of Leiognathidae in Kendari Bay, while in the waters of Bontang, East Kalimantan, 7 species were discovered (Suyatna et al 2016). There have been recent changes in the nomenclature of Leiognathidae genera. Previously, only 3 genera (*Gazza*, *Leiognathus*, and *Secutor*) were recognized, but now there are 10 genera (*Aurigequula, Deveximentum, Equulites, Eubleekeria, Gazza, Karalla, Leiognathus, Nuchequula, Photolateralis*, and *Photopectoralis*) comprising a total of 51 species (Froese & Pauly 2023). The family Leiognathidae comprises slipmouths or ponyfishes. In Indonesia, they are known as bete-bete, peperek, pepetek, and petek, as reported by (Schuster & Djajadiredja 1952; Burhanuddin et al 1998; and Wiadnya et al 2014).

Berber ponyfish (*Leiognathus berbis*) is one of the dominant species of Leiognathidae caught in Takalar waters. It is consumed fresh by the community and is also sold as salted fish. As a result, fishermen in Takalar frequently catch this type of fish. *L. berbis* is classified taxonomically under the kingdom Animalia, phylum Chordata, subphylum Craniata, infraphylum Vertebrata, superclass Gnathostomata, class Osteichthyes, subclass Actiniopterygii, infraclass Holostei, division Teleosteomorpha, subdivision Teleostei, superorder Acanthopterygii, order Perciformes, family Leiognathidae, subfamily Leiognathinae, genus *Leiognathus*, and specific name *Leiognathus berbis* (Nelson et al 2016; Fricke et al 2023). The local name for this species is petah (Schuster & Djajadiredja 1952; Pauly 1977).

Information on *L. berbis* in Indonesia is limited to its distribution. Woodland (2001) is the last literature that discusses the distribution of Leiognathidae in the waters of the Makassar Strait, while Pauly (1977) and Wedjatmiko (2007) are the last to discuss the distribution of Leiognathidae in the waters of western Indonesia. This study aims to provide the first data on the sex ratio and size at first gonad maturity of *L. berbis* in Indonesian waters, particularly in Takalar waters. For the purpose of better and sustainable management of these fish resources, the aim of this study was to analyze the sex ratio and size of first mature gonads of *L. berbis* caught in Takalar waters

Material and Method

Description of the study sites. *L. berbis* sampling was conducted once a month from April to September 2023 in Takalar waters, South Sulawesi, Indonesia, located in the southern part of the Makassar Strait (Figure 1). The fish were obtained from the catch of fishermen who landed at Beba Fish Landing Base, Takalar District, South Sulawesi. The fish samples were analyzed at the Fisheries Biology Laboratory, Fisheries Department, Faculty of Marine Sciences and Fisheries, Hasanuddin University, Makassar, Indonesia.

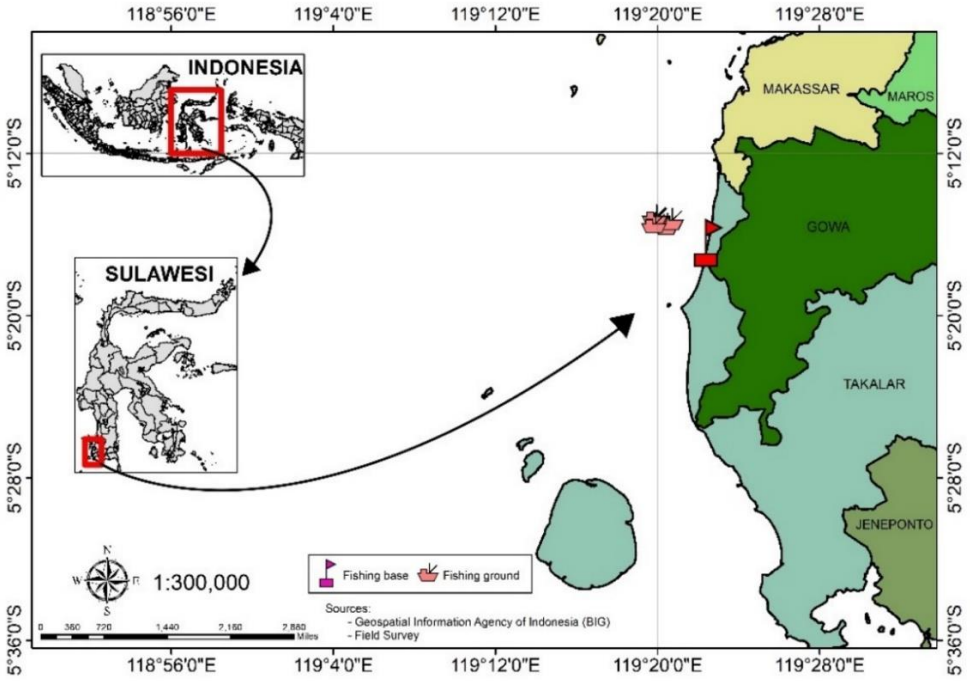

Figure 1. Sampling locations of *Leiognathus berbis* at Takalar waters, South Sulawesi.

Data collection. The *L. berbis* fishing area is located approximately 2-3 miles from the coastal waters of Takalar. Fish samples were collected using a net with a mesh size of 0.5-1 inch. A total of 150 fish samples were observed each month. The length (L) of fish samples was measured using a digital caliper with an accuracy of 0.01 mm, while the body weight (W) was weighed using a digital scale with an accuracy of 0.01 g. The data for total length and body weight were separated by gender. Additionally, the sex of the fish was determined by dissecting the abdomen using a dissecting set apparatus. The fish gonads were removed and morphologically observed to confirm their sex. Gonad maturity stages were determined following the method described by Maung et al (2019), with adjustments made based on observations of the gonads of *L. berbis* obtained during this study.

Data analysis. The sex ratio was calculated by determining the number of male and female fish samples obtained at each sampling time and using the formula provided by Omar (2013).

$$SR = \frac{\sum F}{\sum M}$$

Where:
SR – sex ratio;
Σ F – number of females fish (ind);
Σ M - number of males fish (ind).

Chi-squared analysis was performed to determine whether or not the sex ratio of female to male fish was balanced at each sampling time and gonadal maturity stage, using the equation (Maung et al 2019):

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where:
χ^2 - chi-square value;
O - observed frequency of male or female fish;
E - expected frequency of male or female fish.

In this study, the size at which 50% of the fish (male or female) in a population become sexually mature is considered as the size at first gonadal maturity. To estimate this size, the body lengths of all fish samples collected during the study were grouped by sex and total fish length size groups were considered at 0.4 cm intervals. To estimate the length at which 50% of individuals reach sexual maturity, we matched the point where the total length of the fish (X-axis) and the 50% maturity level (Y-axis) meet. For each class, we calculated the proportion (Pm) of individuals whose total length at the stage of sexual maturity is greater than or equal to their total length at the gonad maturity stage 3 (Ismaïla et al 2021). The pairs of values (length, Pm) were adjusted by a logistic curve with the following mathematical expression (King 2013):

$$Pm = 1/(1+\exp[-r(L-L_{50})])$$

Where:
Pm - the proportion of mature individuals;
r - the slope;
L - the length of the fish in mm.

Results. During the study conducted in Takalar waters from April to September 2023, a total of 900 *L. berbis* were captured, comprising 539 males and 361 females. The male fish had a length range of 80-129 mm with an average of 101.39 ± 0.32 mm, while the female fish had a total body length ranging from 83-125 mm with an average of 105.86 ± 0.45 mm. The male fish had body weights ranging from 7.60-29.18 g, with an average of 15.06±0.13 g, while the female fish had body weights ranging from 7.40-29.47 g, with an average of 17.10±0.20 g. Statistical tests revealed significant differences in both total length and body weight between male and female fish at each sampling time (Table 1). Figure 2 displays the frequency distribution of *L. berbis* based on total length and body weight. The data indicates that larger total length and body weight are associated with a higher frequency of female fish.

Sex ratio. The sex ratio of *L. berbis* during the study suggests population instability. Over the 6-month study period, 539 male fish (59.89%) were obtained compared to 361 female fish (40.11%), resulting in a male to female sex ratio of 1.49:1.00. The chi-square test yielded significant results ($P<0.05$). There appears to be a difference in the number or distribution of male and female fish. Table 2 shows that, temporally, fewer female berber ponyfish were obtained than males, except in September 2023.

Table 1

Distribution of total length (mm) and body weight (g) of *Leiognathus berbis* at Takalar waters, South Sulawesi, based on sex and monthly period

Parameter	*Month*	*Female*			*Male*			t_{value}	*Significant or not at 5% level*
		n	*Range*	*Mean±SE*	*n*	*Range*	*Mean±SE*		
Total length (mm)	April	55	89-125	100.00±0.96	95	90-125	99.71±0.69	0.25	S
	May	48	88-115	101.31±0.89	102	85-115	100.35±0.60	1.25	S
	June	37	90-121	104.73±1.20	113	89-124	103.20±0.70	0.78	S
	July	67	91-120	106.07±0.87	83	85-120	103.19±0.85	2.35	S
	August	34	88-112	99.47±1.04	116	80-115	97.90±0.55	1.35	S
	September	120	83-125	112.41±0.66	30	96-129	112.03±1.33	0.25	S
	Total	361	83-125	105.86±0.45	539	80-129	101.39±0.32	8.02	S
Body weight (g)	April	55	12.41-24.76	15.13±0.29	95	11.38-29.18	14.82±0.24	0.81	S
	May	48	10.03-19.76	15.38±0.33	102	10.29-19.28	14.28±0.18	3.68	S
	June	37	10.07-24.65	15.97±0.52	113	9.22-26.24	15.34±0.30	1.09	S
	July	67	10.60-24.70	17.62±0.46	83	10.38-25.05	16.10±0.36	2.64	S
	August	34	9.01-21.20	14.82±0.49	116	7.60-23.20	13.85±0.25	1.84	S
	September	120	7.40-29.47	19.40±0.36	30	11.95-25.01	19.15±0.58	0.35	S
	Total	361	7.40-29.47	17.10±0.20	539	7.60-29.18	15.06±0.13	9.05	S

S = significant

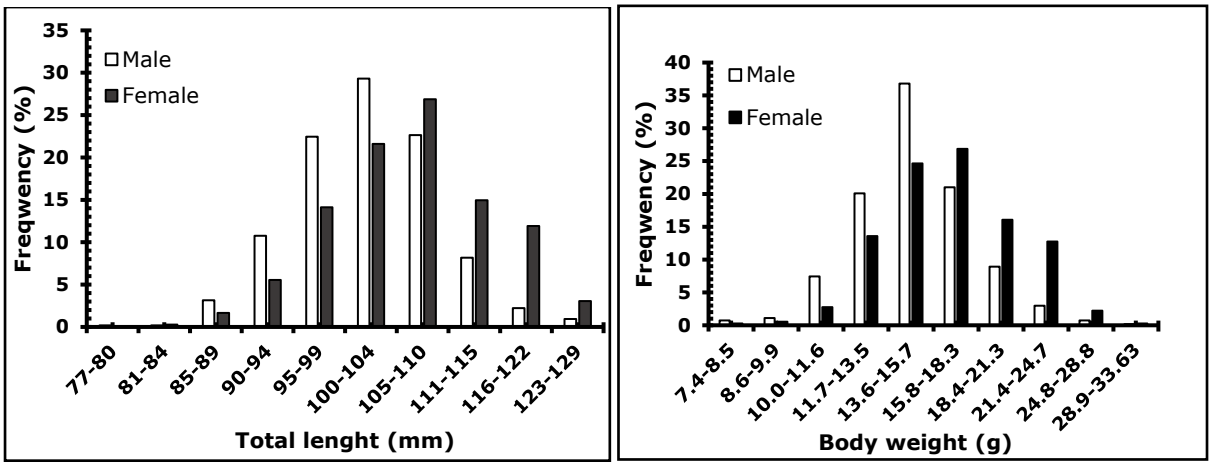

Figure 2. Frequency distribution of total length (mm) and body weight (g) of *Leiognathus berbis* at Takalar waters, South Sulawesi.

Table 2

The sex ratio of *Leiognathus berbis* at Takalar waters, South Sulawesi, based on monthly period

Month	*Number of fish*				*Sex ratio*	χ^2_{value}	*Significant or not at 5% level*
	Female		*Male*				
	ind	*%*	*ind*	*%*			
April	95	63.33	55	36.67	1.73:1.00	10.67	S
May	102	68.00	48	32.00	2.13:1.00	19.44	S
June	113	75.33	37	24.67	3.05:1.00	38.51	S
July	83	55.33	67	44.67	1.24:1.00	1.71	NS
August	116	77.33	34	22.67	3.41:1.00	44.83	S
September	30	20.00	120	80.00	0.25:1.00	54.00	S
Total	539	59.89	361	40.11	1.49:1.00	35.20	S

Degrees of freedom: 1 in all cases; S: significant; NS: not significant

The sex ratio of *L. berbis*, based on gonad maturity stage (GMS), indicates that male fish were caught more frequently than female fish in GMS I and II, while the opposite was observed in GMS III and IV. The chi-square test results were significant ($P<0.05$), indicating that there were differences in the number or distribution of male and female fish at each GMS (Table 3).

Table 3

The sex ratio of *Leiognathus berbis* at Takalar waters, South Sulawesi, based on gonad maturity stage

Gonad maturity stage	*Number of fish*				*Sex ratio*	χ^2_{value}	*Significant or not at 5% level*
	Male		*Female*				
	ind	*%*	*ind*	*%*			
I	135	56.25	105	43.75	1.29:1.00	3.75	NS
II	376	65.85	195	34.15	1.93:1.00	57.37	S
III	22	31.43	48	68.57	0.46:1.00	9.66	S
IV	6	31.58	13	68.42	0.46:1.00	2.58	NS
Total	539	59.89	361	40.11	1.49:1.00	34.81	S

Degrees of freedom: 1 in all cases; S: significant; NS: not significant

Length at first maturity. The gonads of *L. berbis* reached first maturity at a specimens' size of 124.8 mm in males and at 107.9 mm in females (Figure 2). These findings suggest that female fish reach maturity earlier than males.

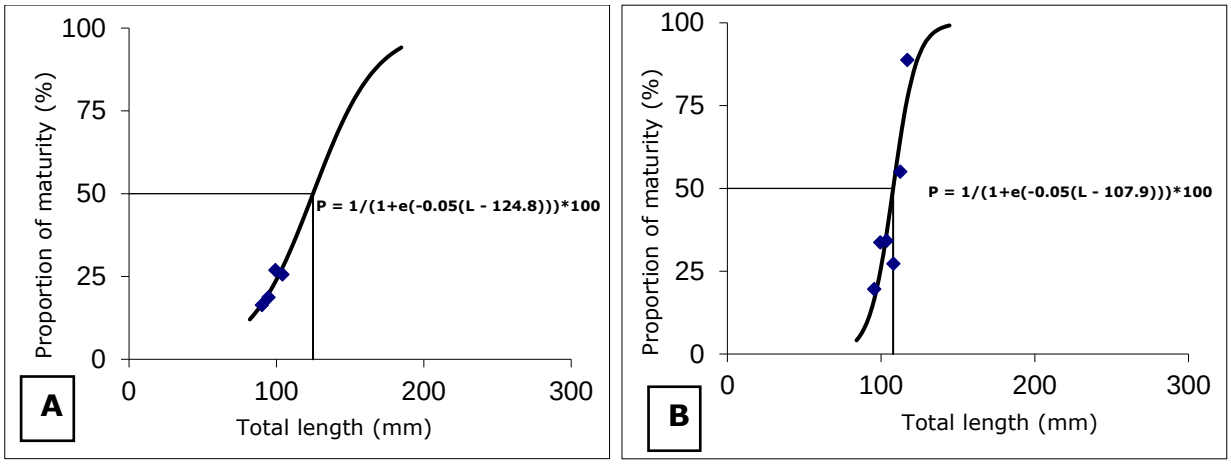

Figure 2. Relationship between mature percentage and total length of *Leiognathus berbis* (A). Male (B) Female.

Discussion. *L. berbis* with a total length of 80-129 mm for males and 83-125 mm for females were obtained during the study in Takalar waters. Woodland et al (2001) reported that the maximum total length of *L. berbis* is 110 mm, with a common length of 90 mm. The fish size obtained in Takalar waters exceeds the measurements reported by Woodland et al (2001). However, it is not possible to verify the total length data obtained during the study against the same species from other Indonesian waters, as no similar study has been reported to date. The study found that ponyfish caught in western Indonesian waters have larger body sizes compared to previous catches. Saadah (2000) reported *Eubleekeria splendens* with a total length of 49-161 mm in Labuan waters, Banten, while Ramadhan (2019) found fish measuring 81-210 mm in Sunda Strait, West Java. Several studies have reported different total body lengths for *Leiognathus equula*. In Mayangan, Subang, West Java: Novitriana et al (2004) found a range of 45-208 mm, while Shidqi (2016) reported a range of 78-260 mm in Sunda Strait. Solichin et al (2021) found a range of 100-245 mm in Semarang Bay, Central Java, and Permatasari et al (2022) reported a range of 53-152 mm in Kendal, Central Java. It is worth noting that berber ponyfish caught in Takalar waters were larger than those caught in Kendari Bay, Southeast Sulawesi. Asriyana et al (2011) and Asriyana et al (2018) recorded lengths for the following species: *Aurigecuula fasciata* (48-94 mm), *Deveximentum indicium* (58-103 mm), *Equulites leuciscus* (82-106 mm), *Eubleekeria splendens* (53-117 mm), *Gazza minuta* (59-102 mm), *Karalla dussumieri* (76-101 mm), *Leiognathus equula* (76-113 mm), *Leiognathus ruconius* (34-100 mm), *Nuchequula blochii* (45-119 mm), and *Photopectoralis bindus* (67-84 mm). The variation in size among these Leiognathidae species is believed to be caused by differences in fishing location, fishing gear, and fishing exploitation levels. Each fishing location is affected by various environmental variables, including food and nutrient availability, which can impact fish growth and result in size variation (Seah et al 2009). Furthermore, it is important to note that high fishing activity in Kendari Bay waters can have a significant impact on the size of fish caught. This is due to the fact that high exploitation rates tend to result in the capture of smaller fish.

Sex ratio. The sex ratio, or the ratio of male to female fish, is used to estimate population stability. It can have an impact on ecological conditions (Fryxell et al 2015). Rinandha et al (2020) emphasized the importance of knowing the sex ratio as it is useful for maintaining the stability of fish populations in nature. Gaps in the sex ratio can lead to biological, physiological, and behavioral changes in fish that can interfere with reproductive success (Maskill et al 2017). Weir et al (2011) found that the ratio of male and female fish in nature can be affected by factors such as competition, behavior, mate selection, and aggression.

During the study, the sex ratio of *L. berbis* in Takalar waters was unbalanced, with 1.49 males for every female. Specifically, there were 539 male fish and 361 female fish observed. Table 2 illustrates the uneven distribution of male and female fish, with males

consistently outnumbering females at every sampling time, except in September 2023. In Takalar waters, immature male fish (gonad maturity scale I and II) outnumber females, with 94.81% versus 83.10%, respectively. However, the number of mature female fish (gonad maturity scale III and IV) is higher at 16.90% compared to only 5.19% of males (Table 3). The low number of mature fish is attributed to the study being conducted outside of the spawning season for *L. berbis*. Currently, there is no available information regarding the spawning season of this species in Takalar or any Indonesian waters. The peak spawning season of *L. equula* in the waters of Mayangan, Subang, occurs in August (Novitriana et al 2004), while in Palabuhanratu, West Java, it takes place in September-October and January-February (Sitindaon 2023). The splendid ponyfish (*E. splendens*) spawns in May in Labuan Bay (Saadah 2000) and in July in Sunda Strait (Ramadhan 2019). According to Sharif et al (2018), the spawning peak of *G. minuta* in Palabuhanratu takes place in July. Meanwhile, the spawning season of *L. berbis* caught in Takalar waters is believed to occur in September, as the average body weight reaches its maximum value at that time (Table 1). The increase in body weight is thought to be due to the increase in gonad weight before spawning. To determine the exact spawning season of this species, it is necessary to rely on reproductive biology data, including gonad maturity stage and gonad somatic index. The spawning process is more likely to occur when the sex ratio of male and female fish is 1:1 or when there are more female fish than male fish. However, during the study, more male fish were obtained than female fish, which could threaten the sustainability of the *L. berbis* if this condition persists for a long time. Saadah (2000), in her study of *E. splendens* in Labuan, found a higher proportion of male fish than female fish. Similarly, Fadillah (2015), Ramadhan (2019), and Septyowati (2019) obtained comparable results in Sunda Strait. Novitriana et al (2004) reported that the common ponyfish (*L. equula*) caught in Mayangan waters had a higher number of male fish. Simanjuntak (2010) observed the same trend in Palabuhanratu and Labuan, and Pratiwi (2011) in Jakarta Bay. Prihatiningsih et al (2014) reported a higher number of female *E. splendens* caught than males in Banten. Similarly, *L. equula* has been reported in Sunda Strait by Permatachani et al (2016), in Blanakan by Simanjuntak (2010), in Kendal by Permatasari et al (2022), and in Palabuhanratu by Haerunnisa (2023). Publications on sex ratios of several Leiognathidae species are listed in Table 4. In nature, the estimated ratio of male to female fish is close to 1:1, indicating a relatively equal number of males and females caught. However, deviations in the number of either sex can occur due to factors such as behavioral patterns, mortality rates, growth patterns, size, age, and onset of gonadal maturity. Differences in growth rates between males and females may result in imbalances in population proportions. Sulistiono et al (2009) reported that the sex ratio of males and females in a fish population is ideally 1:1. However, based on catch data, more male fish were caught than female fish in the entire sample. This may be due to differences in habitat, migration, or behavior between the sexes, making male fish more vulnerable to capture than female fish (Jega et al 2017). The sex with a faster growth rate will grow larger, reducing predation, while the opposite is true for the sex that grows slowly and becomes prey for predators (Omar et al 2011; Trisyani et al 2019; Wakiah et al 2019). Fishing gear selectivity, exploitation rates, and ecological factors such as temperature can also cause deviations from the 1:1 sex ratio (Rawat et al 2019). Pavlov et al (2014) suggested that sex ratio differences may be caused by environmental factors and fishing pressure rates. Additionally, genetic factors (Wedekind 2017) and differences in habitat conditions (Fryxell et al 2015) may also play a role.

Size at first maturity. Determining the size at first maturity is crucial in identifying the minimum size of fish that can be caught sustainably. Estimating this size is also a useful tool in assessing the population's development in a given body of water. Overfishing can lead to a decline in fish populations if immature fish are caught before they have a chance to spawn. To ensure the sustainable utilization of fish resources and guarantee their long-term viability, one precaution that can be taken is the use of selective fishing gear. For instance, adjusting the mesh size to the type of target fish can be effective.

Table 4

Sex ratio of Leiognathidae species from various locations

Species	*Location*	*Number of fish (ind)*		*Sex ratio*	*References*
		Male	*Female*		
Deveximentum insidiator	Puducherry, India	709	744	0.95:1.00	Vassanda (2009)
Eubleekeria splendens	Porto Novo, India (1976-1977)	506	437	1.16:1.00	Jayabalan (1986)
	Porto Novo, India (1977-1978)	368	334	1.10:1.00	
	Labuan, Banten, Indonesia	539	208	2.59:1.00	Saadah (2000)
	Sunda Strait, West Java, Indonesia	316	230	1.37:1.00	Fadillah (2015)
	Banten, Indonesia	62	121	0.51:1.00	Prihatiningsih et al (2014)
	Ratnagiri, India	154	206	0.75:1.00	Acharya & Naik (2015)
	Myeik, Myanmar	380	425	0.89:1.00	Maung et al (2019)
	Sunda Strait, West Java, Indonesia	285	184	1.55:1.00	Ramadhan (2019)
	Sunda Strait, West Java, Indonesia	284	184	1.55:1.00	Septyowati (2019)
Gazza minuta	Palabuhanratu, West Java, Indonesia	574	471	1.16:1.00	Sharif et al (2018)
Karalla dussumieri	Gulf of Mannar, India	105	213	0.49:1.00	James & Badrudeen (1981)
	Puducherry, India	761	684	1.11:1.00	Vassanda (2009)
Leiognathus brevirostris	Puttalam, Sri Lanka	281	647	0.43:1.00	Jayawardane & Dayaratne (1998)
Leiognathus equula	Mayangan, West Java, Indonesia	528	362	1.45:1.00	Novitriana et al (2004)
	Taiwan	458	500	0.92:1.00	Lee et al (2005)
	Sunda Strait, West Java, Indonesia	874	1021	0.86:1.00	Permatachani et al (2016)
	Blanakan, West Java, Indonesia	52	73	0.71:1.00	
	Labuan, Banten, Indonesia	51	32	1.59:1.00	Simanjuntak (2010)
	Palabuhanratu, West Java, Indonesia	63	31	2.03:1.00	
	Jakarta Bay, Indonesia	243	131	1.85:1.00	Pratiwi (2011)
	Sunda Strait, West Java, Indonesia	501	434	1.15:1.00	Ramadhani (2016)
	Sunda Strait, West Java, Indonesia	502	437	1.14:1.00	Shidqi (2016)
	Palabuhanratu, West Java, Indonesia	241	218	1.11:1.00	Octaviani (2022)
	Kendal, Central Java, Indonesia	36	184	0.20:1.00	Permatasari et al (2022)
	Palabuhanratu, West Java, Indonesia	109	210	0.52:1.00	Haerunnisa (2023)
Nuchequula nuchalis	Gwangyang Bay, Korea	209	379	0.55:1.00	Lee & Huh (2000)
Photopectoralis bindus	Kakinada, India	288	252	1.14:1.00	Murty (1983)
	Karnataka, India	288	202	1.43:1.00	Rawat et al (2019)

Based on the data from Figure 2, it can be inferred that female *L. berbis* reach sexual maturity at a smaller size (107.9 mm) compared to males (124.8 mm). This is consistent with the general trend observed in fish species, where females tend to mature earlier than males (Craig et al 2004). Fadillah (2015) and Septyowati (2019) reported that male fish populations mature gonads for the first time at a greater length than female fish of *E. splendens* populations caught in Sunda Strait. Permatachani et al (2016), Ramadhani (2016), and Shidqi (2016) found that female *L. equula* matured earlier than males in the Sunda Strait, while Sitindaon (2023) found the same in *L. equula* caught in Palabuhanratu. However, Novitriana et al (2004) reported that male *L. equula* in Mayangan waters matured earlier than females. The size and age at which fish reach gonadal maturity varies between species and can even differ within the same species depending on environmental conditions and geographical location. Table 5 presents the average size at which several Leiognathidae species reach gonadal maturity. Fish use differences in size at first gonad maturity as a reproductive strategy to restore population balance in response to changes in conditions, abiotic factors, and overfishing (Moresco & Bemvenuti 2006). In order to achieve sustainable management of fish stocks in a water body, it is important to have knowledge of the size of the first mature gonad, which is a key biological variable in fish reproduction. Regular observations of the size of these fish can serve as an indicator of the pressure on fish populations (Nur et al 2022). Overfishing can cause fish populations to mature gonads at smaller sizes, which can lead to concerns about future depletion. The size at which gonads first mature can be influenced by factors, such as sex, season, age, gonad development, food availability (Tesfahun 2018), fish species, size, and adaptability (Lagler et al 1977). Habitat, growth, and reproductive strategies are believed to be additional factors that influence these conditions (Rinandha et al 2020).

Table 5

Size at first maturity of Leiognathidae species from various locations

Species	*Location*	*Size at first maturity (mm)*		*References*
		Male	*Female*	
Gazza minuta	Porto Novo, India (1976-1977)	99	101	Jayabalan (1988)
	Porto Novo, India (1977-1978)	99	102	
Leiognathus brevirostris	Gulf of Mannar, India	68	63	James & Badrudeen (1975)
	Puttalam, Sri Lanka	79.8	81	Jayawardane & Dayaratne (1998)
Leiognathus equula	Mayangan, West Java, Indonesia	68	95	Novitriana et al (2004)
	Sunda Strait, West Java, Indonesia	178.6	130.0	Ramadhani (2016)
	Sunda Strait, West Java, Indonesia	150	146	Shidqi (2016)
	Sunda Strait, West Java, Indonesia	146.16	116.54	Permatachani et al (2016)
	Palabuhanratu, West Java, Indonesia	163	139	Sitindaon (2023)
Eubleekeria splendens	Porto Novo, India (1976-77)	89.0	94.0	Jayabalan (1986)
	Porto Novo, India (1977-78)	90.0	89.5	
	Sunda Strait, Indonesia	156.90	119.50	Fadillah (2015)
	Sunda Strait, Indonesia	175.52	160.86	Septyowati (2019)
	Myeik, Myanmar	90	84	Maung et al (2019)
	Ratnagiri, India	100.5	100.5	Acharya & Naik (2015)
Photopectoralis bindus	Karnataka, India	93	95	Rawat et al (2019)

Conclusions. The research conducted in Takalar waters provides the first information related to the reproduction of *L. berbis* in Indonesia, specifically regarding sex ratio and size at first gonad maturity. The study found an imbalance in sex ratio, with males dominating over females. Additionally, female fish were found to mature earlier than males. These results can serve as a baseline for further research on the reproductive biology of this species.

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Conflict of interest. The authors declare that they have no conflicts of interest.

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