Jurnal Ilmu dan Teknologi Kelautan Tropis

p-ISSN: 2087-9423
e-ISSN: 2620-309X

Article Info:
Received 24 November 2025
Revised 23 February 2026
Accepted 07 April 2026

Corresponding Author:
Muhammad Browijoyo Santanumurti
Department of Aquaculture, Faculty of Fisheries and Marine Airlangga University
E-mail: m.browijoyo.s@fpk.unair.ac.id

First morphological and molecular report of needledscaled queenfish (*Scomberoides tol*) from Cilacap Waters, Penyu Bay, Indonesia

Muhammad Browijoyo Santanumurti[ab], Sugeng Hartono[c], I Gede Suweda Anggana Putera[c], Laksmi Sulmartiwi[d], Sapto Andriyono[d], Heru Pramono[d], Veryl Hasan[a], and Mohamed Abu El-Regal[e]

[a] Department of Aquaculture, Faculty of Fisheries and Marine, Airlangga University, Surabaya, 60115, Indonesia
[b] Fisheries Biotechnology Research Group, Faculty of Fisheries and Marine, Airlangga University, Surabaya, 60115, Indonesia
[c] Study Program of Aquatic Resources Management, Faculty of Fisheries and Marine Science, Jenderal Soedirman University, Dr Soeparno St., Purwokerto Utara District, Banyumas Regency, Central Java, 53122, Indonesia
[d] Department of Marine, Faculty of Fisheries and Marine, Airlangga University, Surabaya, 60115, Indonesia
[e] Department of Marine Biology, Faculty of Marine Sciences, King Abdulaziz University, Jeddah, 21589 Saudi Arabia

Abstract

Fish misidentification often occurs in family Carangidae in Indonesia, especially genus *Scomberoides*, in Cilacap Waters. The condition can affect the fisheries management in the study area, because the management must be assessed to species level. The study aims to determine the physical characteristics and molecular information of the fish. Fish morphology was studied, tabulated, and documented according to its shape, colour, and general properties. Physical properties were measured and counted for morphometry and meristics study. DNA test was conducted to identify the species molecularly. DNA amplification method was polymerase chain reaction (PCR). The target gene used was the Cytochrome C Oxidase Subunit I (COI) gene. The primers used were FISH F1 and FISH R1. DNA sequencing used the Sanger dideoxy method. The fish was identified as *Scomberoides tol* physically with insignificant differences. There was no scutes and caudal peduncle groove in the fish. Its bases of anal and dorsal fin were equal in length. Finlets existed and semi–detached at posterior area to dorsal and anal fin. The type of scales and mouth was needle like and terminal, respectively. The fish shares 100% similarity of DNA with *S. tol* from previous studies across regions.

Keywords: Carangidae, DNA, fish, intraspecific variation, morphology

1. Introduction

Carangidae is one of the largest fish families from the Carangiformes order. Thus-far, 140 species and 32 genera of fish have been reported to belong to the Carangidae family (Abdussamad et al., 2013). The fish can be found in both tropical and subtropical waters (Yaseen et al., 2024). One of the most widely known genera by the public is *Scomberoides*. In Indonesia, the *Scomberoides* species that have been reported are *Scomberoides commersonnianus, Scomberoides tol, Scomberoides tala*, and *Scomberoides lysan* (Arkham et al., 2021).

Most of the carangid fish have important economic and environmental value. The price is high due to their delicacy which produces high demand by the public (Feniola et al., 2024). Moreover, the fish also plays roles as both prey and predator in the food chain which enhance the sustainability of the aquatic ecosystem (Claeson et al., 2015).

Indonesian tends to overlook a species in genus *Scomberoides*, such as *S. commersonnianus*, and identify the fish as talang queenfish or talang in local name. Uniquely, *S. tol, S. tala*, and *S. lysan* fish are also known as talang fish (Arkham et al., 2021). The public does not know the differences between those species.

There are still difficulties in identifying talang fish by naked eyes to the species level, particularly on *S. tol, S. tala*, and *S. lysan*. The morphological characteristics of the fish are mostly similar, both in body shape and number of fins (Abdussamad et al., 2013). Although there are many identification keys reported and available, the differentiation of the fish is

hard to notice. Moreover, morphological identification itself is highly dependent on the subjectivity of the observer or researcher where the experience and skills are clearly very influential (Santanumurti et al., 2024). In fact, misidentification of species in fish often occurs due to the similarity of body shape, color, and organs (Luo et al., 2021).

The fish have been found and reported in various regions in Indonesia such as Java Island (East Java, West Java) to Papua (Merauke) (Alipin et al., 2021; Mote and Indrayani, 2022; Yaseen et al., 2024). Nevertheless, information related to physical and molecular identification of the fish has never been reported, even carried out in Penyu Bay, Cilacap Waters, Central Java, Indonesia (Tjahjo and Riswanto, 2013; Munir, 2016).

The misidentification of the fish can affect the fisheries management in Indonesia. Generally, the management emphasizes quota-based regulation and considers the vulnerability status of fish in accordance with prevailing policies (Nurlaela, 2023). The quotas and assessments are applied to species level to help control exploitation and ensure the sustainability of fish stocks, accurately. The analysis possibly produces many errors when the species is misidentified. One proposed solution is to carry out physical and molecular identification of *Scomberoides* fish in Indonesia.

Unfortunately, many publications related to *Scomberoides* fish from Indonesia did not use molecular identification methods such as DNA barcoding (Asni et al., 2022; Mote and Indrayani, 2022). Whereas the technology has high identification accuracy and efficiency without requiring whole fish samples (Santanumurti et al., 2024). Considering these challenges, related research is needed, especially to examine *Scomberoides* species found in Penyu Bay, Cilacap, Central Java. The study aims to determine the physical characteristics and molecular information of the fish. The results are valuable toward the biodiversity and richness of Indonesia's marine life. Furthermore, its findings are expected to support improved conservation efforts for fish species across the country.

2. Materials and Methods

2.1. Time and Place

Present study was conducted between 10th and 28th February 2025. It was started by collecting the samples and followed by studying the physical characteristics and DNA test. Samples collection was conducted once in Cilacap Waters (**Figure 1**). Meanwhile the rest of study were conducted simultaneously in Research and Community Service Laboratory of Faculty of Fisheries and Marine Sciences, Jenderal Soedirman University, and Bionesia Laboratory, Bali, Indonesia.

2.2. Samples and Data Collection

Samples were collected to the laboratory using cooler box to be measured, dissected, and analysed. The sample used in this study was one sample for morphological and molecular. Fish dimension was measured to collect length (cm) and weight (g) measurement board with 1 mm precision and digital scale with 0.1 g precision. Moreover, samples were observed to determine its physical characteristics according to fish morphology, morphometry, and meristic. Some tissues of fish organs were preserved in the container with ethanol 95% for molecular study (Santanumurti et al., 2024).

2.3. Morphological Characteristics Study

Fish morphology was studied, tabulated, and documented according to its shape, colour, and general properties. Furthermore, some part of physical properties was measured and counted for morphometry and meristic study (Yedier et al., 2023). The results were guided and confirmed by using fish identification book with title "The Living Marine Resources of the Western Central Pacific. FAO Species Identification Field Guide for Fishery Purposes," (Carpenter and Niem, 1999).

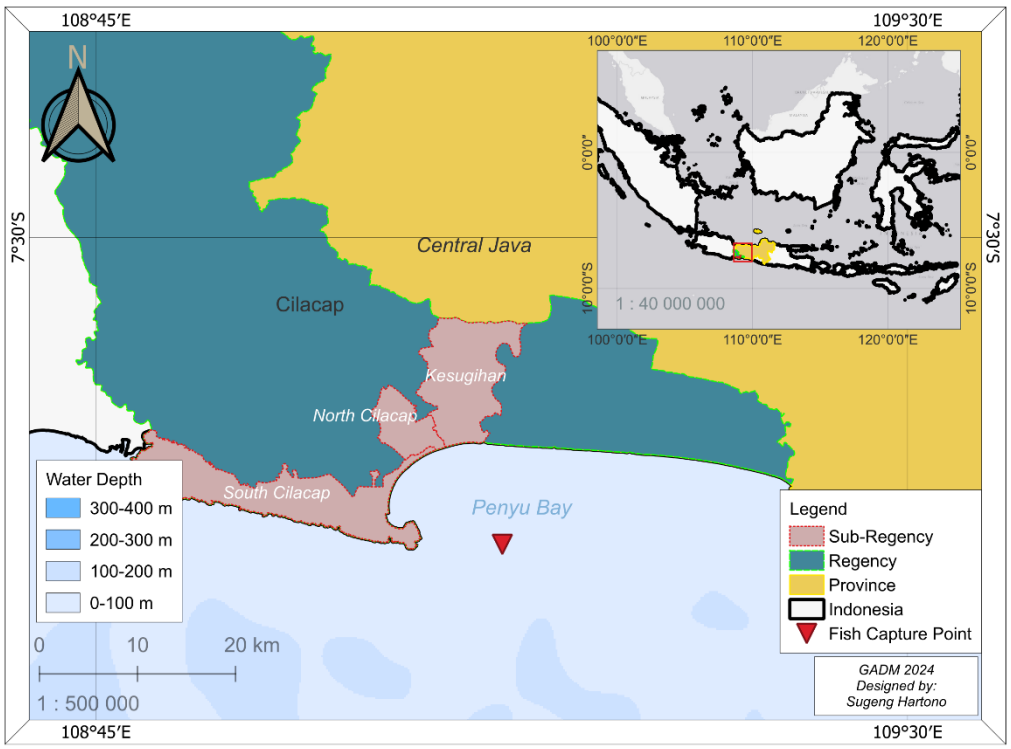

Figure 1. Map of Research Location in this study. The sample was collected from Penyu Bay, Cilacap Waters, Central Java, Indonesia.

2.4. Molecular Study

Tissue preservation was initiated as a preliminary step for molecular study (Yuan et al., 2014). The specimen was then sent to the BIONESIA Laboratory (Bali, Indonesia) for DNA testing. It was labelled with the specimen code BIOSUB312.001 and tested once.

DNA testing was conducted through several sequential steps, including (1) preparation of tissue samples, (2) DNA extraction using the 10% Chelex protocol, (3) DNA amplification using the Polymerase Chain Reaction (PCR) technique, (4) visualization of PCR results, and (5) DNA sequencing. Tissue sample preparation involved collecting approximately 10 grams of tissue from the fish specimen. The DNA extraction process was carried out to isolate the DNA, which involved preparing a 10% Chelex solution, adding the tissue sample into a microtube containing the Chelex solution, heating the mixture at 95°C for 45 minutes, mixing the solution and tissue, centrifuging the mixture to separate contents, and collecting the supernatant containing DNA for amplification (Yuanawati et al., 2022).

DNA amplification via PCR followed the BIONESIA laboratory protocol. The target gene used in the study was the Cytochrome C Oxidase Subunit I (COI) gene. The primers used were FISH F1 (5'-TCA ACC AAC CAC AAA GAC ATT GGC AC-3') and FISH R1 (5'-TAG ACT TCT GGG TGG CCA AAG AAT CA-3') as described by (Ward et al., 2005).

The total PCR reaction volume was 26 µL, consisting of 2 µL of extracted DNA template, 1.25 µL of each primer at a concentration of 10 mM, 9 µL of double-distilled water (ddH_2O), and 12.5 µL of ReadyMix. The PCR mixture was then amplified using an Applied Biosystems™ 2720 Thermal Cycler. The thermal profile used in the PCR protocol consisted of pre-denaturation at 94°C for 3 minutes, denaturation at 94°C for 30 seconds, annealing at 50°C for 30 seconds, and extension at 72°C for 60 seconds. The denaturation to extension cycle was repeated 38 times, followed by a final extension step at 72°C for 2 minutes. PCR product visualization was performed using 1% agarose gel electrophoresis stained with GelRed® Nucleic Acid Gel Stain. Positive samples showed visible DNA bands under UV light.

DNA sequencing was carried out using the Sanger dideoxy method at Genetika Science Company, Jakarta. The sequencing output was in the form of sequence files (Ab1 format),

which were further analysed computationally. The sequence data were edited and aligned using the ClustalW method in MEGA XI software. Each base arrangement was manually checked to ensure the quality of the data used (Megarani et al., 2020).

Further analysis was conducted by matching the sequences with genetic information available in the NCBI GenBank database using the Basic Local Alignment Search Tool (BLAST) on the NCBI website (https://blast.ncbi.nlm.nih.gov/Blast.cgi). The degree of similarity and data accuracy were recorded for each sequence.

Genetic data was analysed to produce phylogenetic tree. The aim was to review its genetic relationship with other samples and to confirm the BLAST identification results at the species level. A phylogenetic tree was constructed using the Neighbor-Joining (NJ) method with 1000 bootstrap replications in MEGA XI software.

3. Results and Discussion

3.1. Morphology of *S. tol* in Cilacap Waters

Fish samples from Cilacap Waters were identified as *S. tol* in family Carangidae. The observation results (*see* **Table 1**) showed that the fish matched the characteristics of the species morphologically. The genus was confirmed due to some existing characteristics according to (Smith-Vaniz, 1999). The fish had no scutes and caudal peduncle groove. Bases of anal and dorsal fin were equal in length. Moreover, finlets existed and semi-detached at posterior area to dorsal and anal fin. Meanwhile, the species level was confirmed due to the similarity on the type of scales and mouth.

Table 1. The results of morphology observation on fish samples of *S. tol* found in Cilacap Waters. The S. tol collected in Cilacap Waters has 6 vertically oval blackspots, no cutes developed along posterior part of lateral line; no caudal peduncle groove, fusiform body shape, body strongly compressed, large eyes, slighty concave dorsal head, terminal mouth, small scales, and forked caudal shaped.

Details	Observation results
Body characteristics	No scutes developed along posterior part of lateral line; no caudal peduncle groove; finlets existed and semi-detached at posterior area to dorsal and anal fin; black pigmented at outer dorsal fin; dorsally bluish, ventrally silver or white, with 6 vertically oval blackspots, the first 4 intersect the lateral line; bases of anal and second dorsal fin about equal in length; II detached spines in front of anal fin; pelvic fins shorter than pectoral fins in length; anal fin lobe immaculate and white.
Body shape lateral	Fusiform or normal.
Cross section	Body strongly compressed; dorsal and ventral profiles equally convex.
Type of eyes	Large, round, and positioned laterally.
Dorsal head and nape profile	Slightly concave.
Type of mouth/snout	Terminal and moderately pointed; upper jaw extends to posterior margin of pupil.
Position of mouth	Slightly oblique, located at the end of the snout, but angled slightly upward.
Type of scales	Very small, cycloid-type scales, needle-like, and difficult to see with the naked eye.
Caudal shape	Forked.

3.2. Morphometry and meristic of *S. tol* in Cilacap Waters

The present study measured approximately 32 external shapes of *S. tol* collected from Cilacap Waters to analyse its morphometry (*see* **Table 2**). Some parts of the fish were compared to previous studies to see the difference among samples from various regions. Total length of the fish from present study (37.73 cm) was longer than any fish from previous studies.

However, the snout length (24.32%) and the body depth (22%) were shorter by 4–5% and around 2% respectively than any others.

Table 2. The results of morphometry observation on fish samples of *S. tol* found in Cilacap Waters compared with previous studies. This study showed complete morphometric characteristics of *S. tol*, with lower snout length compared with others.

Characteristics	Present study (n=1)	Smith-Vaniz and Staiger (1973)♣ (n=148)	Guun (1990) (n=23)	Yokogawa and Takemori (2001) (n=1)	Kim et al. (2018) (n=2)	
					PKU52395	PKU60285
Weight (g)	261	-	-	-	-	-
Total length (cm)	37.73	-	8.7–27	16.38	12.45	9.9
Fork length (cm)	33.81	-	-	-	11.18	8.84
Standard length (cm)	31.93	2.0–46.8	-	13.58	10.7	8.5
Pre dorsal length (cm)	16.23	-	-	-	-	-
Pre pectoral length (cm)	6.27	-	-	-	-	-
Pre pelvic length (cm)	6.74	-	-	-	-	-
Pre anal length (cm)	15.88	-	-	-	-	-
Head length (cm)	6.25	-	-	-	-	-
Snout length (in % HL)	24.32	29.1–32.8	-	-	29.1	28.3
Head width (cm)	1.9	-	-	-	-	-
Head depth (cm)	3.22	-	-	-	-	-
Eye diameter (cm)	1.5	-	-	-	-	-
Distance between eyes (cm)	1.8	-	-	-	-	-
Body depth (in % FL)	22	20–24.7	22.1–24	-	24	24.6
Body width (cm)	2.3	-	-	-	-	-
Dorsal fin spine base length (cm)	3.33	-	-	-	-	-
Longest dorsal fin length (cm)	2.81	-	-	-	-	-
Dorsal finlets base length (cm)	11.52	-	-	-	-	-
Pectoral fin length (cm)	4.14	-	-	-	-	-
Pelvic fin base length (cm)	0.99	-	-	-	-	-
Longest pelvic fin length (cm)	3.56	-	-	-	-	-
Two detached spine base length (cm)	0.8	-	-	-	-	-
Two detached spine length (cm)	1.29	-	-	-	-	-
Anal fin base length (cm)	3.48	-	-	-	-	-
Longest anal fin length (cm)	1.91	-	-	-	-	-
Anal finlets base length (cm)	11.22	-	-	-	-	-
Caudal height (cm)	7.95	-	-	-	-	-
Caudal peduncle (cm)	1.57	-	-	-	-	-
Top caudal fin length (cm)	7.54	-	-	-	-	-
Middle caudal fin length (cm)	1.9	-	-	-	-	-
Bottom caudal fin length (cm)	7.17	-	-	-	-	-

Note: ♣–Includes holotype specimen.

The results of meristic observation on countable parts of fish fin are displayed on **Table 3**. Seven parts showed similar results from previous studies. A slight difference was only noticed on pectoral fin, where (Smith-Vaniz and Staiger, 1973) found one spine on the pectoral fin of *S. tol* collected from the Malay Archipelago and Indian Ocean. The spine was not found from any others, especially from samples at least the last decade.

Table 3. The results of meristic observation on fish samples of *S. tol* found in Cilacap Waters compared with previous studies. *S. tol* found in this study had almost the same meristic characteristics with Smith-Vaniz and Staiger (1973) and Guun (1990).

Characteristics	Present study (n=1)	Smith-Vaniz and Staiger (1973) (n=148)	Guun (1990) (n=23)	Yokogawa and Takemori (2001) (n=1)	Kim et al. (2018) (n=2)	
					PKU52395	PKU60285
Dorsal fin spines	VII+I	VI–VII+I	VI–VII+I	VI+I	VI+I	VII+I
Dorsal fin rays	19	19–21	19–21	19	21	21
Pectoral fin rays	15	I+15–18	-	18	18	18
Pelvic fin spines	I	-	-	I	I	I
Pelvic fin rays	6	-	-	5	5	5
Anal fin spines	II+I	II+I	II+I	II+I	II+I	II+I
Anal fin rays	18	18–20	17–20	17	19	19

3.3. Molecular Identification

The study was successfully amplified COI gene of *Scomberoides* from Cilacap Waters, Penyu Bay, Central Java, Indonesia. **Figure 2** showed the gel electrophoresis results where DNA fragments separated and visualized based on their molecule size (Cermakova et al., 2023). The results showed that the size of the samples taken was between the 600-700 bp marker and was in accordance with the size of the COI gene. Sajjad et al. (2023) stated that the COI gene is a genetic marker to identify living things with a size of 650 bp. Thus, the gene successfully obtained in the study is the COI gene.

The results of the molecular analysis showed that the fish in the study were *S. tol*. It was confirmed by the similarity reaching 100% with *S. tol* with accession numbers DQ885123.1 and KU535574 (*see* **Table 4**) (Jaafar, 2014; Kim et al., 2018). The results of current study are the first report of molecular data of *S. tol* from Cilacap Waters, Central Java, Indonesia.

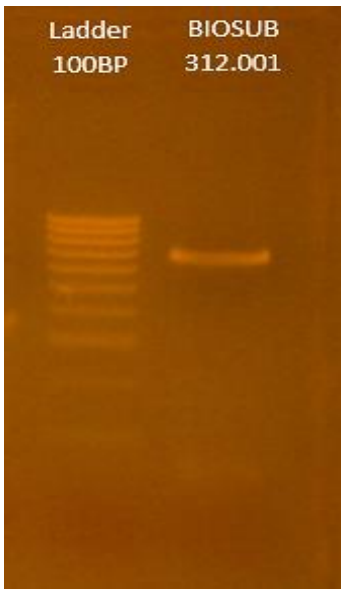

Figure 2. The electrophoresis of COI gene from *Scomberoides* in the present study. The DNA fragment was separated and visualized clearly with the size molecule of the COI gene (600-700 bp).

There are only six records of *S. tol* in Indonesia itself that have been entered into NCBI: HM392323.1 (West Java), JN312861.1 (West Nusa Tenggara), MN257526.1 (Aceh), GU673882.1 (Bali), GU674249.1 (East Java), and West Papua (ON888875.1). The results of the study contribute to the data of *S. tol* from various provinces of Indonesia.

Table 4. Similarity results of *Scomberoides* from this study compared with NCBI. *Scomberoides* collected in this study had 100% similarity with *Scomberoides tol* with accession number of DQ885123.1 and KU535574.

Sample	Query Cover (%)	Similarity (%)	Accession Number
Scomberoides tol	100	100	DQ885123.1
Scomberoides tol	100	100	KU535574
Scomberoides commersonnianus	100	94.5	KJ013058.1
Scomberoides commersonnianus	100	94.35	OQ386602.1
Scomberoides commersonnianus	100	93.87	PP090605.1
Scomberoides tala	100	92.37	OQ386069.1
Scomberoides tala	100	92.37	OQ387737.1
Scomberoides lysan	100	92.21	OQ385640.1
Scomberoides lysan	100	91.76	OQ386295.1

3.4. Phylogenetic Tree

Phylogenetic tree is a branching diagram used to describe the evolutionary relationships between species, populations, or genes based on the similarities and differences in their genetic or morphological characteristics (Dornburg and Near, 2021). The results of current study indicated that the sample certainly included the fish sample in Clade 1 of phylogenetic tree meaning the results of current study identified the fish as *S. tol* (*see* **Figure 3**).

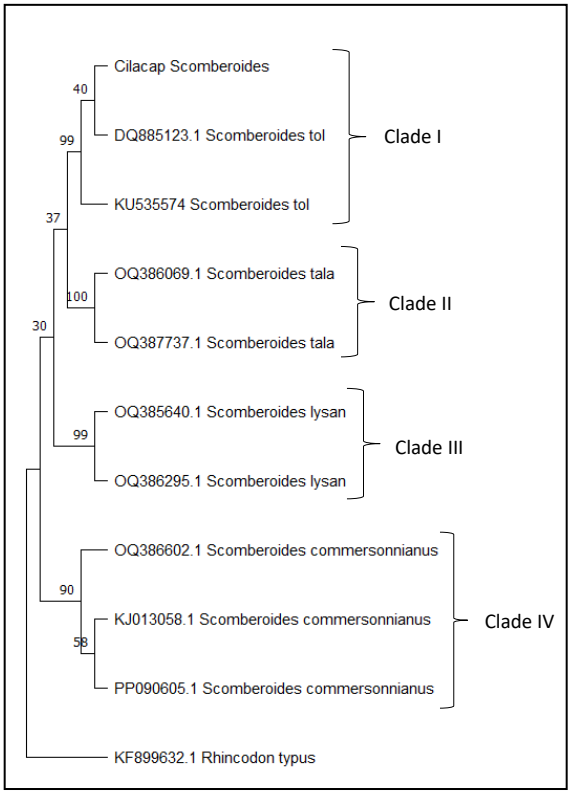

Figure 3. Phylogenetic tree of *S. tol* from current study and its relationship with other *Scomberoides* using Neighbor-Joining (NJ) method with 1000 bootstrap replications in MEGA XI software. S. tol found in this study had evolutionary relatives with *S. tol* since they were from the same ancestral branch (clade I).

3.5. Discussion

Morphologically, *S. tol* has a round black blotches while *S. tala* has vertically elongated stripe of black bloteches (Abdussamad et al., 2022). Compared to *S. lysan*, *S. tol* has a black body mark that is more round and visible (Abdussamad et al., 2022). In terms of body characteristics, *S. tol* has a oblong elongate and compressed body shape, while *S. commersonnianus* and *S. pelagicus* has a deeper and more robust body shape (Abdussamad et al., 2022). According to this comparison, morphologically, the *Scomberoides* sample obtained from Cilacap in this study was *S. tol*. The comparison of Scomberoides found in this study with others showed in **Figure 4**.

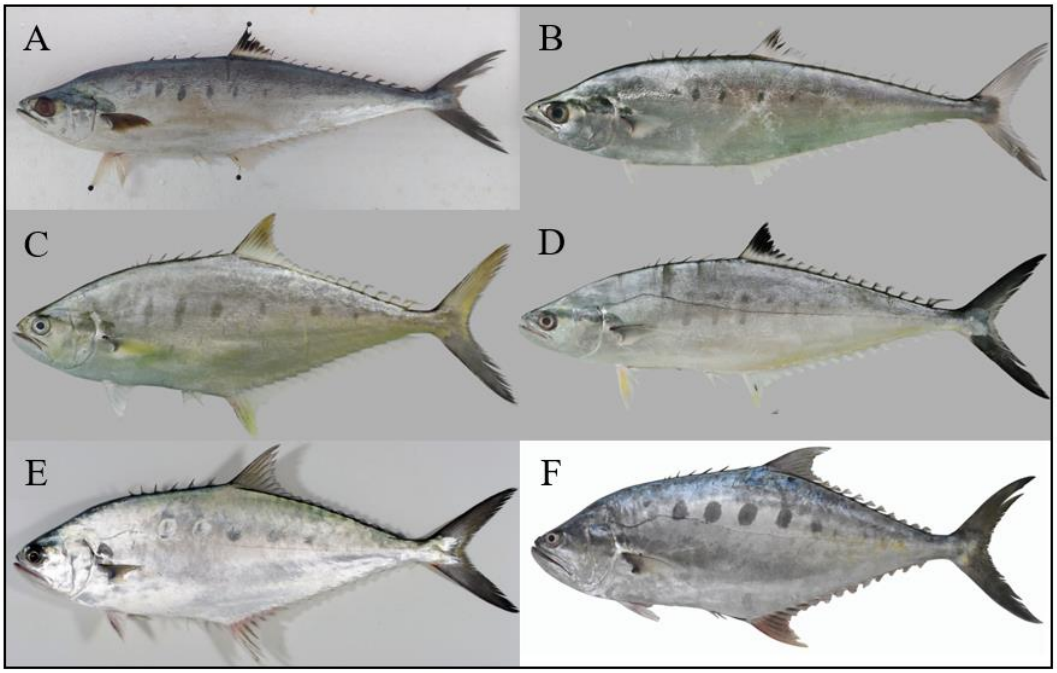

Figure 4. The morphology comparison of *Scomberoides*. (A) *S. tol* from this study; (B) *S. tol*; (C) *S. tala*; (D) *S. lysan*; (E) *S. commersonnianus*; (F) *S. pelagicus* (Matsunuma et al., 2019; Abdussamad et al., 2022; Su et al., 2025).

The species *S. to*l is widely distributed in the surface waters of coastal regions across many countries (Smith-Vaniz, 1999). It has been reported from the South China Sea (Kyushin et al., 1982), the Red Sea (Dor, 1984), Australian Waters (Allen and Swainston, 1988), and throughouttrathe Indo-Pacific region (Kimura et al., 1998).

Several authors have conducted morphological studies on *S. tol* from various localities, and their findings are consistent with those of the present study. The earliest known work was by (Cuvier and Valenciennes, 1832), who described the species as *Chorinemus tol* from Malabar, India. Subsequent studies include Smith-Vaniz and Staiger (1973) in the Malay Archipelago and Indian Ocean, (Gunn, 1990) in Australia, Carpenter et al. (1997) in Kuwait, Lin and Shao (1999) in Taiwan, Yokogawa and Takemori (2001) in Japan, Nakabo (2002) also in Japan, Psomadakis et al., (2015) in Pakistan, Kim et al. (2018) in South Korea, and Low and Jaafar (2021) in Singapore.

The finding from Kim et al. (2018) claimed that the species has caudal peduncle groove. The claim obviously created a contradiction in the diagnosis of *S. tol* morphology. Only some closely related species in Carangidae (*S. lysan*, *S. tala*, and *S. commersonnianus*) have caudal peduncle groove (Smith-Vaniz, 1999; Abdussamad et al., 2013).

Environmental factors may have influenced the development of the caudal peduncle groove observed in the study by (Kim et al., 2018). The groove is a key adaptation that enhances swimming efficiency and speed in Carangidae, supporting their predatory lifestyle (Burhanuddin and Erviani, 2016). Therefore, it is probable that factors related to swimming and predation—such as water currents and feeding competition in South Korean Waters—contributed to the development of the feature in *S. tol*. Alternatively, the presence of the

groove could also be attributed to ontogenetic variation, a concept in fish taxonomy where morphological features change as a fish matures from juvenile to adult (Hilton and David, 2007).

The slight differences in morphometry of *S. tol* in Cilacap Waters can be explained by its relationship to growth rate. According to Von Bertalanffy, (1957); Kinne, 1960; Brett (1979), the rate depends on many factors such as abiotic and biotic factors separately or in mixed manner, which affect fish metabolism and growth. Generally, the value decreases greatly at the onset of maturity. There are fish that grow quickly at a young age and reach maturity earlier eventually being outgrown by slower–growing individuals, indicating that early growth advantages do not always continue throughout the fish's lifespan. The total length of the fish clearly showed the fish was older compared to fish from previous studies. Hence, the value of the snout length and body depth were lower insignificantly than other comparative samples.

The existence of a fin pectoral spine found in Smith-Vaniz and Staiger's samples (1973) made the diverse results to current study. The difference was called as intraspecific differences or intraspecific variation, which is normally found in many animals. It occurs due to genetic variation within a population or different ecological pressures that cause populations to specialize in different ways (Gregory, 2011). In fish, the case can be found in some species from Aegean Sea (Koutsidi et al., 2024) or Nile River and Lake Nasser (Jawad et al., 2021).

The sample of needlescaled queenfish from Cilacap Waters was still confirmed as *S. tol* according to its morphometric and meristic traits. Even though there were slight differences with other samples from previous studies. The present study found no significant difference on measurable and countable parts of the fish. However, it is recommended that the stakeholders of fisheries in Indonesia to maintain the environmental quality of the waters, as the pollution and overfishing may lead to mutations and affect the physical development of the fish.

Molecular data accurately identify the species which is essential for conservation efforts and biodiversity assessments. The information also helps resolving taxonomic ambiguities and supporting the discovery of new species. Since there are many challenges in identifying *S. tol* in Indonesia, the results of current study facilitated to distinguish the species among genus *Scomberoides* which existed in the region.

The record was registered with NCBI with accession number PV563873.1. As NCBI is the Global Molecular Data Centre, it allows scientists around the world to access and utilise the data (Sayers et al., 2025). Scientists and the public can find, compare, and analyse biological data from around the world, including *S. tol* from Cilacap Waters (Central Java, Indonesia). NCBI has standard formats and validation so that the molecular data entered has high accuracy and consistency (Sayers et al., 2025).

The phylogenetic tree also shows groups of closely related species (Rice et al., 2022). If the DNA sequence of the target fish is grouped (clade) with a known species, it is certain that the specimen belongs to that species. In the case of genus *Scomberoides*, it currently has five reported species, *S. tol*, *S. tala*, *S. lysan*, *S. commersonnianus*, and *S. pelagicus* (Abdussamad et al., 2022). However, the phylogenetic tree data presented in current study did not display *S. pelagicus* as its own clade. It is because the fish was only reported in a publication from India in 2021 and the molecular data has not been recorded in NCBI, yet (Abdussamad et al., 2022).

Unfortunately, the number of fish samples is the limitation in this study. Only one sample was identified morphologically and molecularly. This was due to the difficulty in obtaining *S. tol* sampel. On the island of Java, especially Central Java, the presence of *S. commersonnianus* is more frequently reported (Dwi et al., 2019). Furthermore, small pelagic fish like *Scomberoides* were already fully exploited according to Ministerial Decree No. 19 of 2022 (Nurlaela, 2023). Furthermore, data from the Cilacap Ocean Fisheries Port (2024) indicates that needlescaled queenfish (*S. tol*) were not landed in Cilacap waters (Cilacap Ocean Fisheries Port, 2024). This may be the reason why *S. tol* was difficult to find during fish collection activities in Cilacap Waters, Penyu Bay, and was the first discovery in this study. Further research needs to be conducted by adding more samples so that the data will be more detailed.

4. Conclusions

The study concluded the identification of a fish sample collected from Cilacap Waters, Central Java, Indonesia which was confirmed as *S. tol* according to its physical traits and molecular information. The morphology was aligned with the relevant identification guidebook, while the morphometric and meristic traits were not significantly different compared to previous studies from various waters. On the other hand, DNA test proved that the fish sample from study area shares 100% similarity of DNA with the samples from previous studies across regions. As the first record of *S. tol* in Cilacap Waters, the finding can be used to analyse the fish population and stock accurately in the future while maintaining the quality of its habitat. Thus, the sustainability and biodiversity of aquatic life can be achieved in the area.

Conflicts of Interest

There are no conflicts to declare.

Acknowledgements

The authors would like to express their sincere gratitude to all individuals and organizations who supported this study. We thank Faculty of Fisheries and Marine, Airlangga University and Faculty of Fisheries and Marine Science, Jenderal Soedirman University for providing the facilities. This article is supported by Program Bantuan Publikasi pada Jurnal Bereputasi No. 0488/C/DT.06.01/2025 from Direktorat Jenderal Riset dan Pengembangan, Kementerian Pendidikan Tinggi, Sains, dan Teknologi.

AI Writing Statement

The authors did not employ any artificial intelligence-assisted technology during the writing process.

References

Abdussamad, E.M., Gopalakrishnan, A., Mini, K.G., Sukumaran, S., Divya, P.R., Retheesh, T.B., Muhammed, A.A., Dipti, N.V., Akhil, A.R., Thomas, T., & Jacob, K.D. (2022). Description of a new species of queenfish, *Scomberoides pelagicus* from Indian seas. *Journal Environmental Biology*, *43*(1), 105-114. https://doi.org/10.22438/jeb/43/1/MRN-1975

Abdussamad, E.M., Rohit, P., Koya, K.P.S., Mohamed, O.M.M.J.H., & Jeyabalan, K. (2013). Carangids (Family: Carangidae) in the seas around Indian subcontinent with description of macro-taxonomic characters for the field identification of genera and species. *Indian Journal of Fish*, *60*, 21-36. https://eprints.cmfri.org.in/9506/1/3_EM_Abdussamad.pdf

Alipin, K., Ratningsih, N., & Dianty, R.S. (2021). Identification of fish catched by fishermen on the east coast of Pananjung Pangandaran. *Biotropika: Journal of Tropical Biology*, *9*(2), 131-135. https://doi.org/10.21776/ub.biotropika.2021.009.02.05

Allen, G.R., & Swainston, R. (1988). *The marine fishes of North-Western Australia. a field guide for anglers and divers*. Perth, Australia: Western Australian Mus.

Arkham, M.N., Tiku, M., Ramli, A, & Trihandoyo, A. (2021). Identification off fish catched by North Coast Fishers (Pantura) in East Java Province. *Journal of Aceh Aquatic Science*, *5*(1), 46-55. http://dx.doi.org/10.35308/jaas.v6i1.6080

Asni, A., Kasmawati, & Sugianto, H.T. (2022). Study of the level of enviromental friendliness of purse seine fishing gear in PPI Pontap Palopo City. *Journal of Indonesian Tropical Fisheries (JOINT-FISH): Jurnal Akuakultur, Teknologi Dan Manajemen Perikanan Tangkap Dan Ilmu Kelautan*, *5*(2), 228-240. https://doi.org/10.33096/joint-fish.v5i2.147

Brett, J.R. (1979). *Environmental Factors and Growth (Vol. 8)*. New York, United States of America: Academic press.

Burhanuddin, A.I., & Erviani, A.E. (2016). Trevally of The Spermonde Archipelago, South Sulawesi. *Jurnal Ilmu Kelautan SPERMONDE*, *2*(2), 13-20. https://journal.unhas.ac.id/index.php/jiks/article/view/1303

Carpenter K.E., Krupp F., Jones, D.A., & Zajonz, U. (1997). *The Living marine resources of Kuwait, Eastern Saudi Arabia, Bahrain, Qatar and the United Arab Emirates.* Rome, Italy: FAO.

Carpenter, K.E., & Niem, V.H. (1997). *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volume 6.* Rome, Italy: FAO.

Cermakova, E., Lencova, S., Mukherjee, S., Horka, P., Vobruba, S., Demnerova, K., & Zdenkova, K. 2023. Identification of fish species and targeted genetic modifications based on DNA analysis: state of the art. *Foods, 12*(1), 228. https://doi.org/10.3390/foods12010228

Cilacap Ocean Fishing Port. (2024). *Statistics Report: Fisheries Statistics 2024.* https://ppid.kkp.go.id/upt/pelabuhan-perikanan-samudera-cilacap/informasi-publik/berkala/

Claeson, K.M., Sarr, R., Hill, R.V, Sow, E.H., Malou, R., & O'Leary, M.A. (2015). *Proceedings of The Academy of Natural Sciences of Philadelphia, 164,* 133-147.

Cuvier, G & Valenciennes, A. (1832). *Histoire naturelle des Poissons*. Tome huitième, Livre neuvième. Paris, France: F.G. Levrault.

Dor, M. (1984). *Checklist of the fishes of the Red Sea*. Jerusalem, Israel: Jerusalem Israel Academy of Sciences and Humanities.

Dornburg, A., & Near, T.J. (2021). The emerging phylogenetic perspective on the evolution of actinopterygian fishes*. Annual Review of Ecology, Evolution, and Systematics*, *52*(1), 427-452. https://doi.org/10.1146/annurev-ecolsys-122120-122554

Dwi, N.D.A., Purnama, F.A.D., & Dian, W. (2019). A technical study of modified gillnet in Kendal Regency waters. *Russian Journal of Agricultural and Socio-Economic Sciences*, 92(8), 187-196. https://doi.org/10.18551/rjoas.2019-08.20

Feniola, L., Pratiwi, F.D., & Muftiadi, M.R. (2024). Diversity and conservation status of fish caught in gillnet fishing gear remain at Sungailiat Fisheries Port. *Akuatik: Jurnal Sumberdaya Perairan, 18*(1), 35-46.

Gregory, T.R. (2011). *The evolution of the genome*. Elsevier Academic Press.

Gunn, J.S. (1990). *A Revision of Selected Genera of the Family Carangidae (Pisces) From Australian Waters*. Australian Museum.

Hilton, E.J., & David, J.G. (2007). *When two equals three: developmental osteology and homology of the caudal skeleton in carangid fishes (Perciformes: Carangidae)*. *Evolution & Development, 9*(2), 178-189. https://doi.org/10.1111/j.1525-142x.2007.00148.x

Jaafar, T.N.A.M. (2014). *DNA barcoding and population genetic structure of Malaysian marine fishes*. Bangor University.

Jawad, L.A., Farrag, M.M.S., & Park, J.M. (2021). Interspecific and intraspecific differences in pectoral-fins spine morphology in Nile River and Lake Nasser catfishes, Siluriformes. *Proceedings of the Zoological Institute of the Russian Academy of Sciences*, *325*(3), 308-322. https://doi.org/10.31610/trudyzin/2021.325.3.308

Kim, K.M., Choi, S., & Kim, J.K. (2018). First reliable record of the needle-scaled queenfish, *Scomberoides tol* (Perciformes: Carangidae), from Korea. *Korean Journal of Fisheries and Aquatic Sciences*, *51*(4), 444-449. https://doi.org/10.5657/KFAS.2018.0444

Kimura, S., Iwatsuki, Y., & Kojima, J.I. (1998). Descriptive morphology of the juvenile stages of two Indo-Pacific carangids, *Scomberoides lysan* and *Scomberoides* tol (Pisces: Perciformes). *Copeia*, *1998*(2), 510-515. https://doi.org/10.2307/1447453

Kinne, O. (1960). Growth, food intake, and food conversion in a euryplastic fish exposed to different temperatures and salinities. *Physiological Zoology*, *33*(4), 288-317. https://doi.org/10.1086/physzool.33.4.30152673

Koutsidi, M., Lazaris, A., Peristeraki, P., Tserpes, G., & Tzanatos, E. (2024). Quantification of intraspecific and interspecific competition in fish species of the Aegean Sea. *ICES Journal of Marine Science*, *81*(2), 334-347. https://doi.org/10.1093/icesjms/fsad201

Kyushin, K., Amaoka, K., Nakaya, K., Ida, H., Tanino, Y., & Senta, T. (1982). *Fishes of the South China Sea*. Tokyo, Japan: Japan Marine Fishery Resource Research Center.

Lin, P.L., & Shao, K.T. (1999). A review of the Carangid fishes (family Carangidae) from Taiwan with descriptions of four new records. *Zoological Studies, 38*(1), 33-68. https://zoolstud.sinica.edu.tw/Journals/38.1/33.pdf

Low, J.K.Y., & Jaafar, Z. (2021). Biodiversity record: recent record of the queenfish, *Scomberoides tol*, in Singapore. *Nature in Singapore, 14*: e2021036. https://doi.org/10.26107/NIS-2021-0036

Luo, M., Lu, G., Yin, H., Wang, L., Atuganile, M., & Dong, Z. (2021). Fish pigmentation and coloration: Molecular mechanisms and aquaculture perspectives. *Reviews in Aquaculture. 13*(4), 2395-2412. https://doi.org/10.1111/raq.12583

Matsunuma, M., Uchida, Y., & Fumihito Tashiro. (2019). First record of *Scomberoides commersonnianus* (Perciformes: Carangidae) from Yamaguchi Prefecture, Japan and a checklist of carangid fishes from Wakasa Bay and adjacent waters, Japan. *Japanese Journal of Ichthyology, 66*(2): 253-260. https://doi.org/10.11369/jji.19-015

Megarani, D.V., Nugroho, H.A., Andarini, Z.P., Surbakti, Y.D.R.B.R., & Widayanti, R. (2020). Genetic characterization and phylogenetic study of Indonesian indigenous catfish based on mitochondrial cytochrome B gene. *Veterinary World*, *13*(1), 96-103. https://doi.org/10.14202/vetworld.2020.96-103

Mote, N., & Indrayani, E. (2022). Diversity of pelagic fish caught by gill nets in Arafura sea, Waan district, Merauke regency, Papua. *Tropical Bioscience: Journal of Biological Science*, *2*(2), 41-50. https://www.academia.edu/download/98068557/3925.pdf

Munir, M. (2016). Genetic interpretation of isozyme banding patterns in several tissues of milkfish (*Chanos chanos* Forskal) from ponds in Cilacap, Coastal Waters. *Marine Journal (MARJAN)*, *2*(1), 1-9.

Nakabo, T. (2002). *Fishes of Japan with pictorial keys to the species*, *3rd*. Tokyo, Japan: Tokai University Press.

Nurlaela, E. (2023). Measured fishing: challenges and applications. In K. Amri, H. Latuconsina, & R. Triyanti (Ed.), *Pengelolaan sumber daya perikanan laut berkelanjutan* (pp. 267-314). BRIN Publishing. https://doi.org/10.55981/brin.908.c759

Psomadakis, P.N., Osmany, H.B, & Moazzam, M. (2015). *Field identification guide to the living marine resources of Pakistan. FAO species identification guide for fishery purpose.* Rome, Italy: FAO.

Rice, A.N., Farina, S.C., Makowski, A.J., Kaatz, I.M., Lobel, P.S., Bemis, W.E., & Bass, A.H. (2022). Evolutionary patterns in sound production across fishes. *Ichthyology & Herpetology*, *110*(1), 1-12. https://doi.org/10.1643/i2020172

Sajjad, A., Jabeen, F., Ali, M., & Zafar, S. (2023). DNA barcoding and phylogenetics of Wallago attu using mitochondrial COI gene from the River Indus. *Journal of King Saud University - Science*, *35*(6), 102725. https://doi.org/10.1016/j.jksus.2023.102725

Santanumurti, M.B., Suciyono, S., Syaifurrisal, A., Adiputra, Y.T., & El-Regal, M.A.A. (2024). Morphological and molecular comparison of areolate grouper (*Epinephelus areolatus*) from Saudi Arabia and Indonesia. *Jurnal Ilmu dan Teknologi Kelautan Tropis*, *16*(2), 193–209. https://doi.org/10.29244/jitkt.v16i2.57410

Sayers, E.W., Beck, J., Bolton, E.E., Brister, J.R., Chan, J., Connor, R., Feldgarden, M., Fine, A.M., Funk, K., Hoffman, J., Kannan, S., Kelly, C., Klimke, W., Kim, S., Lathrop, S., Marchler-Bauer, A., Murphy, T.D., O'Sullivan, C., Schmieder, E., Skripchenko, Y., Stine, A., Thibaud-Nissen, F., Wang, J., Ye, J., Zellers, E., Schneider, V.A., & Pruitt, K.D. (2025). Database resources of the National Center for Biotechnology Information in 2025. *Nucleic Acids Research, 53*(D1), D20-D29. https://doi.org/10.1093/nar/gkae979

Smith-Vaniz, W.F. (1999). Carangidae the living marine resources of the Western Central Pacific. In K.E. Carpenter & V. H. Niem (Eds.), *The living marine resources of the Western Central Pacific* (4th ed.). Rome, Italy: FAO.

Smith-Vaniz, W.F., & Staiger, J.C. (1973). Comparative revision of Scomberoides, Oligoplites, Parona and Hypocanthus with comments on the phylogenetic position of Campagramma (Pisces: Carangidae). *Proceedings of The California Academy of Sciences Fourth Series*. *39*(4), 185-256. https://www.biodiversitylibrary.org/page/15773833#page/195/mode/1up

Su, Y., Hsu, Y.C., & Lin, T.Y. (2025). New records of *Scomberoides tala* (Cuvier, 1832), barred queenfish (Actinopterygii, Carangiformes, Carangidae), from Southwestern Taiwan. *Check List, 21*(1), 72-80. https://doi.org/10.15560/21.1.72

Tjahjo, D.W.H., & Riswanto. (2013). Current status and alternative management of fish resources in Segaraanakan Lagoon, Cilacap. *Jurnal Kebijakan Perikanan Indonesia*, *5*(1), 9-16. https://doi.org/10.15578/jkpi.5.1.2013.9-16

Von Bertalanffy, L. (1957). Quantitative laws in metabolism and growth. *The Quarterly Review of Biology, 32*(3), 217-231. https://doi.org/10.1086/401873

Ward, R.D., Zemlak, T.S., Innes, B.H., Last, P.R., & Hebert, P.D.N. (2005). DNA barcoding Australia's fish species. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *360*(1462), 1847-1857. https://doi.org/10.1098/rstb.2005.1716

Yaseen, F., Ali, W., Muhammad, A., Faisal, M., & Liang, Y. (2024). A comprehensive review of length-weight relationships and fishery dynamics in the family Carangidae across different regions worldwide. *Pakistan Journal of Marine Sciences*, *33*(2), 672-687.

Yedier, S., Bostanci, D., & Türker, D. (2023). Morphological and morphometric features of the abnormal and normal saccular otoliths in flatfishes. *Anatomical Record*, *306*(3), 672-687. https://doi.org/10.1002/ar.25106

Yokogawa, K., & Takemori, H. (2001). First record of needlescaled queenfish *Scomberoides tol* from the Seto Inland Sea, Japan. *IOP Diving News, 12*, 2-3. https://www.researchgate.net/publication/263254945_First_record_of_needlescaled_queenfish_Scomberoides_tol_from_the_Seto_Inland_Sea_Japan

Yuan, X., Li, H., Wang, C., & Hong, B. (2014). DNA Extraction from Formalin Fixed *Coilia macrognathos* Fin Tissues. *Agricultural Sciences*, *5*(12), 1097-1099. https://doi.org/10.4236/as.2014.512119

Yuanawati, D., Farizky, H.S., Santanumurti, M.B., Jamal, M.T., Sani, L.M.I., Madduppa, H., & Sari, P.D.W. (2022). The newest COI molecular detection of Asian redtail catfish *Hemibagrus nemurus* (Valenciennes, 1840) in Progo River, Magelang, Central Java, Indonesia. *Journal of Advanced Veterinary and Animal Research*, *9*(4), 591-600. https://doi.org/10.5455/JAVAR.2022.I628