

Field report of a megamouth shark (*Megachasma pelagios* Taylor, Compagno & Struhsaker) in the Zhubi Dao, South China Sea

Han Tian^{1,2}  | Jun Zhang^{1,3,4}  | Zuozhi Chen^{1,3,4} | Jiangyuan Chen⁵

¹South China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Guangzhou, China

²School of Marine Science, Sun Yat-sen University, Zhuhai, China

³Key Laboratory for Sustainable Utilization of Open-sea Fishery, Ministry of Agriculture and Rural Affairs, Guangzhou, China

⁴Key Laboratory of Big Data for South China Sea Fishery Resources and Environment, Chinese Academy of Fishery Sciences, Guangzhou, China

⁵College of Fisheries, Ocean University of China, Qingdao, China

Correspondence

Jun Zhang and Zuozhi Chen, South China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Guangzhou 510301, China.

Email: zhangjun@scsfri.ac.cn and zzchen2000@163.com

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Abstract

A live female megamouth shark (*Megachasma pelagios* Taylor, Compagno & Struhsaker) was accidentally captured during a scientific survey conducted in the southwestern waters near Zhubi Dao in the South China Sea, using a midwater trawl. Based on its distinctive morphological characteristics, the shark was promptly identified as *M. pelagios*. The estimated total length of the shark was about 5.0 m. Clear photographs and video recordings were taken of the individual, which was ultimately released back into the ocean. This observation represents a rare live sighting and valuable visual documentation in the South China Sea region. Recorded on 18 September 2018, it is the earliest-known field record of a megamouth shark in the South China Sea with clear scientific survey documentation, as well as a successful release case.

KEYWORDS

audiovisual materials, fishery by-catch, sex-geographic distribution, shark release, western Pacific

The megamouth shark (*Megachasma pelagios* Taylor et al., 1983) is a large filter-feeding species that has been observed to exhibit vertical migratory behaviour (Clerkin et al., 2024; Taylor et al., 1983). As the sole species within its family, the megamouth shark is classified under the order Lamniformes, family Megachasmidae, which was first observed on 15 November 1976, and was formally described and named in 1983 by Taylor et al. This species is distinctly characterized

by a tadpole-like body bauplan, including a disproportionately large head, a signature oversized mouth and an exaggeratedly elongated upper lobe of the heterocercal caudal fin. The megamouth shark is considered a possible panmictic population based on the absence of significant genetic structure, indicating that individuals across the globe possess strong migratory capabilities (Liu et al., 2018). In 2019, the megamouth shark was listed as 'least concern' by the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (Kyne et al., 2019).

Han Tian and Jiangyuan Chen have contributed equally to this work.

Till now, approximately 270 records of the megamouth shark have been reported across the Pacific, Indian and Atlantic oceans, all within latitudes of 45° , although some of these records include unpublished sightings and data that require further evidence for validation (Beuningen et al., 2023; Liu et al., 2018; Nakaya, 2010; Skelton et al., 2023; Xavier et al., 2025; Yu et al., 2021). There have been no publicly available scientific sighting reports of the megamouth shark in the South China Sea (SCS), especially a lack of publicly accessible visual documentation, which has left the public extremely unfamiliar with the distribution of the megamouth shark in the SCS. For example, fish databases from mainland China lack descriptions of its distribution in the SCS (Wu & Zhong, 2021). In our research, we have compiled a capture and release record of the megamouth shark from 2018, sourced from recently declassified documents, marking the first sighting of a megamouth shark in the SCS with clear images, gender and other details recorded.

On 18 September 2018, a megamouth shark was accidentally captured by a midwater trawl in the southwestern waters near the Zhubi Dao in the SCS (Figure 1). This survey was conducted as part of a long-term monitoring study on the mesopelagic fish community and their diel vertical migration behaviour in the southwestern waters near the Zhubi Dao. The fisheries resource and environmental science survey vessel *Nanfeng* (1537 t GT, 66.7 m in length, 12.4 m in width and 5.0 m in draft) conducted the survey from 19:55 to 20:55, maintaining a drifting state at a speed of 1.95 m/s

and a depth of 75 m. The starting co-ordinates were 114.04117° E, 10.76733° N, and the ending co-ordinates were 113.97667° E, 10.77688° N. The water depth in this area was 3050 m. The mid-water trawl, featuring a straightened mouth perimeter of 136.1 m, a head tube length of 30.0 m and four panels, had codend mesh stretched to 10 mm^2 , extending 20 m from the codend, with the forward section measuring 40 mm.

Several audiovisual materials were recorded using a handheld mobile phone, including a total of 10 clear photographs and 5 segmented video recordings, totalling 80 s in MOV format. The videos were manually viewed using Windows Media Player, and representative still images were extracted. These images were then combined and stitched using basic editing in Photoshop (2024). The length of the individual was roughly estimated using the survey vessel's length and the height of the crew as references.

At approximately 21:15, a giant shark was towed onto the aft deck by the midwater trawl and released from the net (Figure 2a–g). It was quickly identified on site by the research team as the megamouth shark (*M. pelagios* Taylor, Compagno & Struhsaker). The megamouth shark exhibited the characteristic features of the species: a large head with a blunt snout and a hemispherical shape when viewed from above; a wide mouth with the posterior edge extending beyond the eyes and small teeth inside the mouth; two dorsal fins, relatively low in height; elongated and broad pectoral fins, with twisted bases; a heterocercal caudal fin with an exaggeratedly

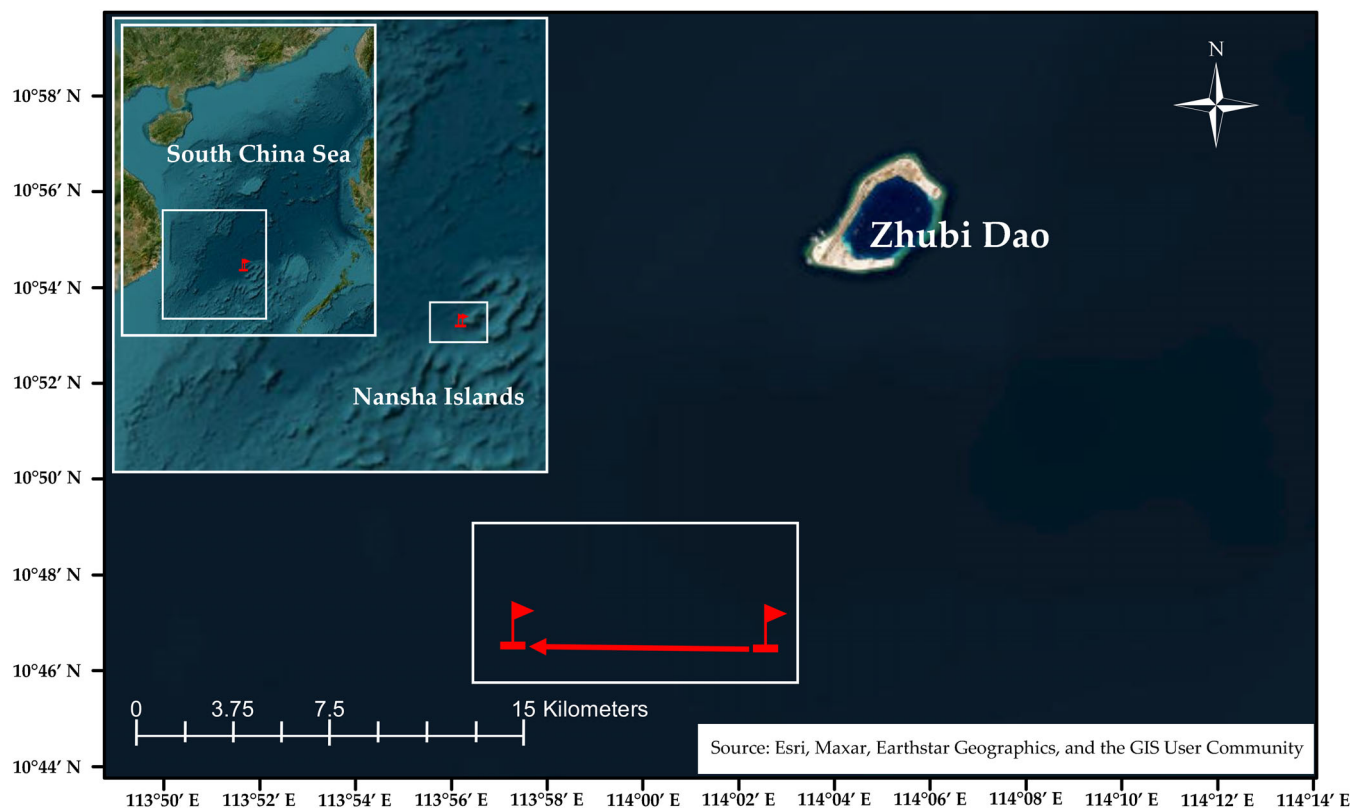


FIGURE 1 Study area near the Zhubi Dao, the South China Sea. The white box indicates approximate capture location. The red markers indicate the starting and ending points of the survey route.



FIGURE 2 *Megachasma pelagios* capture observed on 18 September 2018, South China Sea: (a) shark captured using a midwater trawl; (b) shark released back into the sea; (c) tail; (d) frontal version; (e) side version (female); (f) gill and pectoral fin; (g) mouth and snout.

elongated upper lobe and no lateral projections on the tail stalk (Clerkin et al., 2024; Taylor et al., 1983; Yun & Watanabe, 2023). Based on the on-site identification, it was confirmed that the individual was a female megamouth shark. The megamouth shark showed no apparent cutting wounds, parasitic infestations or signs of bleeding; however, the individual was clearly under severe stress, as evidenced by the pronounced redness on the underside of the body, which was likely caused by net abrasion. The image and video electronic Supporting Information provided in this study showcase additional diagnostic features and external details of the megamouth shark. Due to the potential dangers posed by unknown live individual, the researchers were unable to conduct a detailed assessment of its biological parameters. By comparing with the vessel and the crew member (whose height is 1.8 m, as shown in the image provided as electronic Supporting Information in this study), the shark's length was roughly estimated to be at least 5.0 m. A more detailed verification of the shark's total length was conducted using additional reference objects. A key reference was the width of the wooden deck planks, which, including the spacing between them, measured approximately 11 cm on average. To improve the accuracy of the estimation, a set of fishing gear was placed at approximately the same location, and its length was measured to be 5.25 m (as shown in the image provided as electronic Supporting Information in this study). Based on these references, the shark's total length was estimated to be between 5.0 and 5.5 m. Based on the crane operator's work experience, this individual's weight was roughly estimated to be at least 1000 kg. By referencing the body weight–total length relationship for female megamouth sharks summarized by Yu et al. (2021), the weight of this individual is conservatively estimated to be 1000 kg. To ensure animal welfare, we

implemented mitigation measures and released the shark back into the sea using the ship's onboard hoisting equipment.

The midwater trawl operation was affected by the megamouth shark, resulting in an abnormal catch consisting mainly of a small number of mesopelagic zone species, including *Ceratoscopelus warmingii*, *Diaphus garmani*, *Oplophorus typus*, *Symbolophorus evermanni*, *Lateolabrax japonicus*, *Diaphus fragilis*, *Diaphus malayanus*, *Bolinichthys longipes*, *Octopoteuthis* sp. and *Oplophorus* sp. Because the average depth of the surveyed sea area ranges between 2000 and 3050 m, and the diel vertical migration of mesopelagic organisms in this region is prominent, we speculate that the accidental capture of the megamouth shark may be related to its diel vertical migration behaviour for predation purposes. Studies by Nelson et al. (1997), Yu et al. (2021) and Clerkin et al. (2024) have all indicated that megamouth sharks ascend to shallower waters (approximately less than 100 m) from dusk to night to forage. Another possible explanation is that the presence of the megamouth shark in this area might have been influenced by Typhoon Mangkhut.

Yu et al. (2021) reported the only two records of megamouth sharks in the SCS, one being a small male and the other an individual of unidentified sex. However, these records were solely based on fishery by-catch data, lacking publicly available or verifiable scientific reports, as well as credible video and photographic evidence. Therefore, to date, the distribution of megamouth sharks in the SCS has not been widely accepted in fishery database records (Wu & Zhong, 2021; FishBase, 2025; The Fish Database of Taiwan, 2025). Yu et al. (2021) suggested that the distribution of megamouth sharks may be related to sex, with larger female individuals (total length greater than 5 m) being more common in the western Pacific region. In December 2023, the first evidence supporting ovoviviparity in

megamouth sharks was reported, when the carcass of a female and seven pups – presumed to have been expelled postmortem – was discovered along the coast of the Philippines (Smith, 2023). Based on historical sex-specific records, the western Pacific region is considered a potential nursery ground for this species. Our study provides rare and the most direct evidence confirming the presence of large female megamouth sharks in the SCS, marking the first clear documentation of the species' images and sex identification in this region. Moreover, the findings offer valuable insights for future efforts to more effectively mitigate the threat of midwater trawling on megamouth sharks. For example, in future studies, midwater trawl nets could be deployed only after using omnidirectional scanning sonar to confirm the absence of acoustic echoes from large organisms in the water column, thereby effectively minimizing the by-catch and harm of deep-sea sharks.

In recent years, with increased exploration of the SCS, some large shark species have been reported and identified based on photographic and video evidence (Tian et al., 2024). Tian et al. (2024) suggested that the Pacific sleeper sharks (*Somniosus pacificus*) discovered in the deep sea of the SCS were all female based on the sex characteristics observed in photographs. Similar to our study, this provides valuable insights into the sex-geographic distribution of large sharks. Several emerging algorithms for reconstructing tagged individuals in midwaters offer numerous novel and promising avenues for future research on species with deep-sea habits (Arostegui et al., 2024). Deep-sea imaging and publicly accessible valid records serve as direct evidence of species distribution and should be made publicly available and systematically organized to enhance the understanding of the geographic distribution and ecological habits of marine animals.

AUTHOR CONTRIBUTIONS

Han Tian wrote the manuscript. Jun Zhang and Zuozhi Chen conducted the field operations and made observations. Jun Zhang and Zuozhi Chen obtained project funding. Jianguan Chen assisted Han Tian in conducting background research and confirming information.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article. The data presented in this study are available on request from the corresponding author. The video and additional images can be accessed as the electronic supplementary material.

ORCID

Han Tian  <https://orcid.org/0000-0002-0683-196X>

Jun Zhang  <https://orcid.org/0000-0002-4683-4735>

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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