

# First record of albinism in the Chinese fanray, *Platyrrhina sinensis* (Elasmobranchii: Myliobatiformes: Platyrrhinidae)

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## Research Article

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# Abstract

A female albino fanray was found in the eighth seafood market (Siming District, Xiamen City, Fujian Province, China), having been captured in the southern Taiwan Strait in April 2022. Based upon morphological measurements and DNA barcoding, it was identified as the Chinese fanray, *Platyrrhina sinensis* (Bloch&Schneider, 1801). Morphometrics are reported, and with no retainment of pigmentation in skin, while irises pigmentation is normal, the specimen is considered as a partial albinism (leucism). The specimen is an adult female, with normal shape, normal body length, normal body mass and normal external structure. As an offshore fish, the albinism individual has more difficulties to avoid predators to reach adult size, which is rare in nature. This represents the first reported case of albinism in the family Platyrrhinidae and one of a rare record of albinism within chondrichthyans, which provides new reference and basis for the physiological and ecological research of albino fish.

## Introduction

Albinism is a genetic condition due to the absence or defect of tyrosinase, which affect the production of melanin (King and Summers 1988; Wang et al. 2007), including the entirety (Complete or total albinism, (Bigman et al. 2016) and part (incomplete, or imperfect, or partial albinism, (Berdeen and Otis 2011) albinism of an organism. The main features of the former are a completely unpigmented body and red eyes, while in the latter, this mutation only affects a part of the body, and normal irises pigmentation can be observed (Mnasri et al. 2010; Lipej et al. 2011; Becerril-Garcia et al. 2017).

Individual albinism is widespread in the animal kingdom. At present, it has been reported about invertebrates (Jones 1897), fish (Muto et al. 2013), amphibians (Alejandro and Ghirardi 2011), reptiles (Bechtel and Bechtel 1981), birds (Seneca 1985) and mammals (Wright 1918).

Albinism in chondrichthyans is relatively rare. Bigman et al. (2016) have reviewed 58 cases of albinism in chondrichthyans, and in the past five years, published records about albino chondrichthyans include the blonde ray (*Raja brachyura* Lafont, 1873) (Quigley et al. 2018), the white shark (*Carcharodon carcharias* (Linnaeus, 1758)) (Kabasakal 2020), the lanternshark (*Etmopterus lucifer* Jordan & Snyder, 1902) (Finucci 2020), the sandbar shark (*Carcharhinus plumbeus* (Nardo, 1827)) (Erguden et al. 2020), the velvet belly lantern shark (*Etmopterus spinax* (Linnaeus, 1758)) (Carlos Arronte et al. 2022), the bull shark (*Carcharhinus leucas* (Valenciennes, 1839)) (Wakida-Kusunoki et al. 2022), the Angelshark (*Squatina squatina* (Linnaeus, 1758)) (Jimenez-Alvarado et al. 2023), the Atlantic nurse shark (*Ginglymostoma cirratum* (Bonnaterre, 1788)) (Shiple et al. 2023).

The Chinese fanray, *Platyrrhina sinensis* (Bloch&Schneider, 1801), is an ovoviviparous species of the family Platyrrhinidae (Iwatsuki et al. 2011), which is mainly distributed in the northwest Pacific Ocean. Chinese fanray is a warm-water demersal fish, which likes to inhabit sandy-muddy bottoms and swims slowly, with a maximum length of 64cm. Its staple food is small crustaceans and shellfish (Chen and Yang 2013). Up to now, there is no report about its albinism.

## Materials and methods

In April 2022, an albino fish was collected from the eighth seafood market in Siming District, Xiamen City, Fujian Province, China. Its appearance was similar to the family *Platyrrhinidae*, but the individual was albino. According to the fishermen, the fish was captured in the southern Taiwan Strait. At present, the specimen is kept in B1-209 Marine Fish Resources Protection Laboratory of Zhoulongquan Building in Xiang'an Campus of Xiamen University, China.

The specimen was identified by morphological measurements and the classification standard of Nelson et al. (2016) was used to define which type of albinism applied to this specimen. Total length, disc length, disc width, total body mass and pure body mass of this specimen and ten normal, mature (same age) specimens captured in the same place were measured.

To confirm the accuracy of morphological study, DNA barcoding technology was used to support the taxon of *Platyrrhina sinensis* at the genetic level, and the specific steps are as follows: First, got a piece of muscle tissue so as to use the TSINGKE animal DNA extraction kit for DNA extraction. Then, conducted PCR. The sequences of *ps*-COI-F and *ps*-COI-R primers used for *COI* gene amplification were 5'-ATCTTTGGTGCCTGAGCAGG-3' and 5'-GAAGGGTTGCTAGTCAACTAAAACT-3', and the synthesis of primers was entrusted to Allwegene Technologies Company. PCR was carried out in a 40  $\mu$ L reaction mix, which contains DNA template (1 $\mu$ L), forward primer (2 $\mu$ L), reverse primer (2 $\mu$ L) and 2 $\times$ T8 High-Fidelity Master Mix (35 $\mu$ L). The above amplification systems are amplified according to the following amplification procedures: an initial denaturation (98°C, 3min), 35 cycles consisting of denaturation (98°C, 10s), annealing (58°C, 20s) and extension (72°C, 10s), and a final extension (72°C, 5min). The amplified PCR product was subjected to agarose gel electrophoresis (2 $\mu$ l sample + 6 $\mu$ l bromophenol blue), and the identification gel map was obtained at 300V for 12 minutes. Finally, the prepared PCR products were sent to the Allwegene Technologies Company for first-generation sequencing.

## Results

The most significant characters distinguishing *Platyrrhina sinensis* from others are as follows: there are two longitudinal thorns in the middle of the back and tail (strongly hooked and gradually embedded into the origin of the first dorsal fin), and no thorns in the front of the scapula area; The thorns in the eye socket, neck back and scapula area are not surrounded by light yellow or white pigment; The back is covered with tiny dermal teeth of uniform size and shape, without obvious larger dermal teeth (smooth to the touch) (Iwatsuki et al. 2011). The albino specimen exhibits the aforementioned morphological characteristics and has no significant morphometric differences from other normal individuals. To sum up, this individual conforms to the morphological characteristics of Chinese fanray, *Platyrrhina sinensis* (Bloch & Schneider, 1801).

The specimen is female, retaining no pigmentation in skin, with normally pigmented irises, which represents partial albinism (leucism) (Fig. 1a and 1b). The skin color of the normal specimen is brown,

with black irises color (Fig. 1c and 1d). By measuring the morphological measurements of ten normal female Chinese fanrays with the same age captured in the same place, the specific data are shown in Table 1.

Compared with morphological identification, DNA barcoding is more accurate in biological classification, and this method has been widely used in biological identification classification in various fields (Witt 2006). In this study, the DNA fragment (680bp) of the albino specimen and the normal female Chinese fanray captured in the same place was effectively amplified, and the obtained fragments were compared in DNAMAN. The results showed that the similarity of the gene sequence between the albino specimen and the Chinese fanray was 98.83%. Based on the results of morphological and DNA barcoding, it is finally judged that the albino specimen is a Chinese fanray, *Platyrrhina sinensis* (Bloch & Schneider, 1801).

Table 1

Measurements from the albinism specimen and ten normal, mature specimens of same age of *Platyrrhina sinensis* caught in the southern Taiwan Strait. Averages are given with the range in parentheses.

	Total length(cm)	Disk length(cm)	Disk width (cm)	Total body mass(g)	Pure body mass (g)
Albinistic	35.9	16.1	20.3	351.2	310.0
Normal	39.7 (34.8–43.9)	17.2 (15.1–18.9)	21.3 (18.7–23.3)	462.0 (270.6–648.8)	403.6 (243.6–551.8)

## Discussion

Albinism in chondrichthyans is considered relatively rare, probably because their natural abundance in nature is relatively low (Bottaro et al. 2008). The specimen of *Platyrrhina sinensis* described here is the first case of partial albinism in the family Platyrrhinidae, and it is also one of the rare cases of albino recorded within elasmobranchs. Previous records about the complete albinism of Myliobatiformes include *Myliobatis californica* Gill, 1865 (de Jesus-Roldan 1990), *Gymnura micrura* (Bloch & Schneider, 1801) (Reis et al. 2013), *Rhinoptera bonasus* (Mitchill, 1815) (Fisher et al. 2014), *Dasyatis americana* (Hildebrand et Schroeder, 1928) (Wakida-Kusunoki 2015); records about leucism of Myliobatiformes include *Rhinoptera bonasus* (Mitchill, 1815) (F. Schwartz 1959), *Rhinoptera bonasus* (Mitchill, 1815) (Joseph 1961), *Dasyatis pastinaca* (Linnaeus, 1758) (Capapé 1975), *Dasyatis americana* (Hildebrand et Schroeder, 1928) (F. J. Schwartz 1977), *Mobula birostris* (Walbaum, 1792) (Marshall et al. 2009), *Zanobatus schoenleinii* (Müller & Henle, 1841) (Diatta et al. 2013), *Zanobatus schoenleinii* (Müller & Henle, 1841) (Capape et al. 2020).

The albino specimen reported in this study is mature female, whose total length, disc length, disc width, total body mass and pure body mass are within the normal specimens. We conclude that despite the lack of pigment, some individuals with albinism can still perform their biological functions normally. This

report only describes a single specimen, and the correlation between albinism and somatotype parameters, as well as whether there are differences between the indexes of various organs, growth index and survival rate of albino individuals and normal individuals still need further study. Previous studies have not found a clear relationship with the environment and pollution, and it is speculated that the cause of albinism is a genetic mutation.

Researchers have reported that the lack of pigmentation in deep sea species has no significant impact on individuals (Bottaro et al. 2008). However, for offshore fish such as the Chinese fanray, the lack of protective coloration makes it easy for predators to prey on, and the survival ability of albino individuals in the natural environment is significantly lower than that of normal individuals. We speculate that it may be the benthic habits of Chinese fanray that help some albino individuals not to be found by predators and reach adult size. This adult female individual is of great significance for the study of albino fish.

## Declarations

**Competing interests** The authors have no competing interests to declare that are relevant to the content of this article.

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### Authors' contribution

Y.Z. and ST.K. conceived and designed research. ST.K., MR.C., JM.X. conducted morphological species identification. Y.Z. and ST.K. made genetic analyses. MR.C. is the lead of the project and coordinate all works. All authors contributed to manuscript writing and read and approved the manuscript.

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**Ethics approval** No animal testing was performed during this study.

**Sampling and field studies** The study does not contain sampling material or data from field studies.

**Data availability** All data generated or analysed during this study are included in this published article

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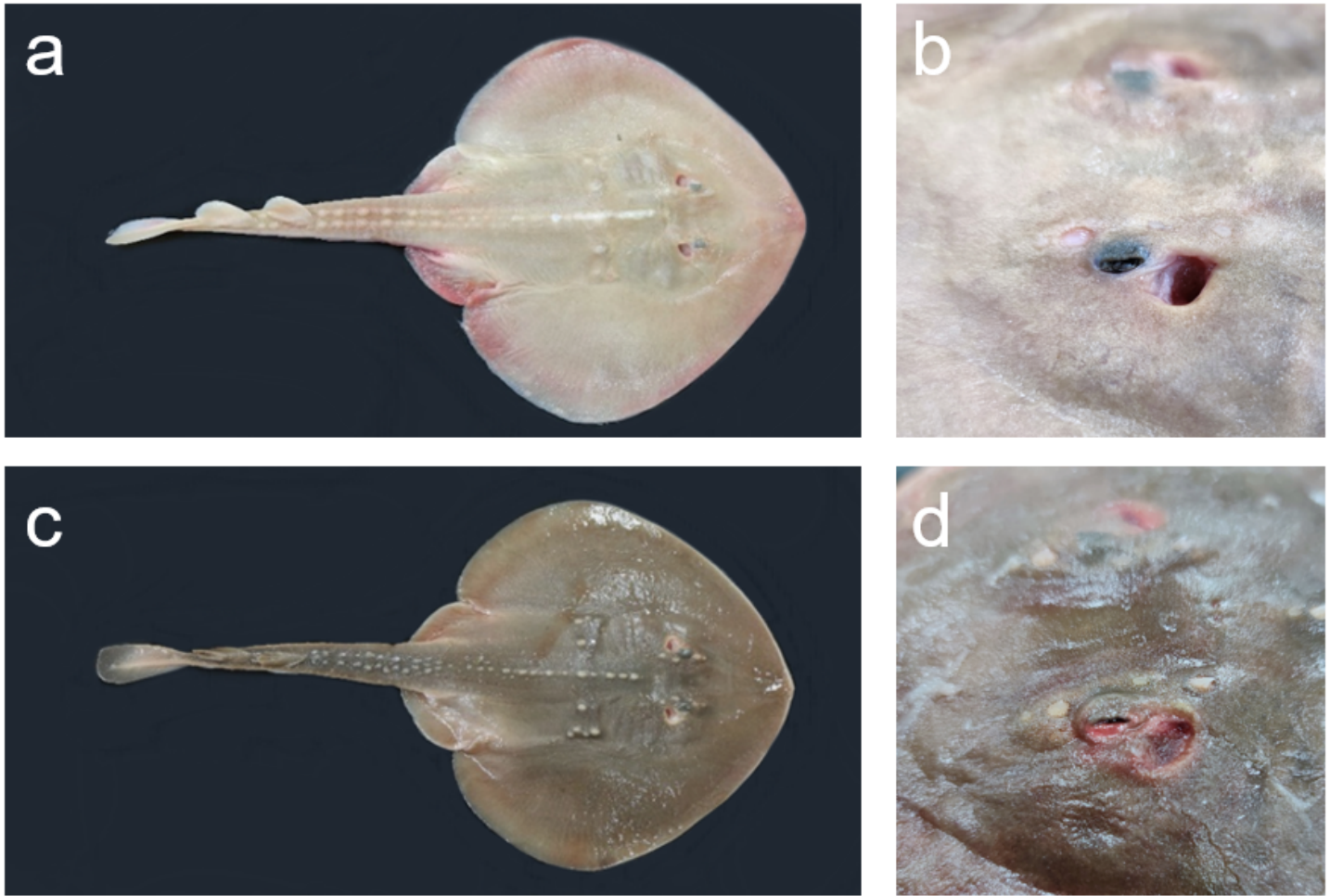
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## Figures





**Figure 1**

Albino *Platyrhina sinensis* caught in the Taiwan Strait (a, b), and example of specimen with normal pigmentation (c, d).