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## Rare records of the exotic Reef Stonefish (*Synanceia verrucosa* Bloch and Schneider, 1801) in the Mediterranean waters of the Gaza Strip, Palestine

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### Abstract

The geographical location of the Gaza Strip (365 km<sup>2</sup>) of Palestine in the eastern Mediterranean region makes it a first and important stop for discovering new arrivals of exotic marine creatures or Lessepsian immigrants coming from the Red Sea through the Suez Canal, with the Reef Stonefish is of particular concern. The current study aims to shed light on the rare records of the Reef Stonefish (*Synanceia verrucosa* Bloch and Schneider, 1801) in the marine ecosystem of the Gaza Strip and its expected risks to Gazans. The current study relied heavily on visits to and contacts with the General Directorate of Fisheries at the Ministry of Agriculture and on social media reports. The Reef Stonefish was recorded as a result of being caught or accidentally caught in the coastal waters of the Gaza Strip for at least five times. In most of the events, the specimens, which ranged from 30 to 40 cm in length, were photographed and some of them were displayed in posts on social media pages. The first record of a single specimen of stonefish was in 2008, although the specimen was not photographed at that time. This is the first record of the Reef Stonefish in the eastern Mediterranean, although some Mediterranean countries recorded specimens of the same fish in their coastal waters after 2010. Other single specimens of the Reef Stonefish were recorded in 2010, 2015, 2018 and 2023 in the Gaza Strip. In fact, it is not surprising that the Gaza Strip preceded the countries of the eastern Mediterranean in recording the first occurrence of the Reef Stonefish, as it is closest to the mouth of the Suez Canal in the Mediterranean. The Reef Stonefish has warty, scaleless skin that is brown or gray, with possible spots of various colors. The Reef Stonefish is known for its highly toxic sting and would pose a potential threat to human health if given the chance to establish a successful breeding population in the eastern Mediterranean. Despite this, no one reported that any of the Gazans or fishermen was exposed to its toxicity.

**Keywords:** Reef Stonefish, *Synanceia verrucosa*, Lessepsian immigrants, Suez canal, Eastern Mediterranean, Gaza Strip, Palestine

### 1. Introduction

The geographical location of the Gaza Strip (365 km<sup>2</sup>) of Palestine in the eastern Mediterranean region makes it an interesting place to spot new arrivals of exotic, alien, non-native or non-indigenous marine organisms from the Indian and Pacific Oceans and the Red Sea through the Suez Canal, which connects the Red Sea and the Mediterranean Sea together (Abd Rabou *et al.*, 2007; Abd Rabou, 2013 and Bariche *et al.*, 2019) [7, 1, 11]. Such a migration that takes place from the Red Sea to the Mediterranean via the Suez Canal is called the "Lessepsian migration" (Bariche, 2012) [9]. According to Abu Amra (2018) [5], a considerable percentage of the nearly 130 bony fishes (Osteichthyes) species recorded in the Gaza Strip were exotic. The Reef Stonefish (*Synanceia verrucosa* Bloch and Schneider, 1801), which belongs to the Synanceiidae family (commonly known as stonefishes) and Scorpaeniformes order of the Actinopterygians has been recorded several times and rarely in the marine ecosystem of the Gaza Strip. This family has a great ability to camouflage themselves like stones and rocks on seabeds, hence the name. The fishes of this family are classified as the most venomous fishes in the world due to the powerful neurotoxins they possess, which have caused deaths worldwide (Castro and Huber, 2007) [14]. The Reef Stonefish is widespread in the coastal bottoms of the Indian and Pacific Oceans as well as the Red Sea, which has the

most beautiful coral reefs in the world. The fish seems to live on sand and rubble or among rocks and seaweed in such marine environments including the Mediterranean Sea which was said to harbor individuals of this Lessepsian immigrant (Edelist *et al.*, 2011) [18].

There seems to be a lack of studies on the Reef Stonefish in the Gaza Strip except for the lonely study of Bariche *et al.* (2019) [11] who described the occurrence of two exotic fish species; namely the Reef Stonefish (*Synanceia verrucosa*) and Sohal Surgeonfish (*Acanthurus sohal*) in the Mediterranean waters of the Gaza Strip. On the other hand, specimens of the Reef Stonefish were recorded on the coasts of several countries bordering the Mediterranean Sea at different times. Edelist *et al.* (2011) [18] demonstrated the occurrence of Reef Stonefish in the Mediterranean Sea, and they recorded its occurrence in coastal waters located south of Tel Aviv. Bilecenoğlu (2012) [13] reported on the first sighting of the Reef Stonefish in the marine waters of Turkey. Ibrahim *et al.* (2019) [18] dealt with the first record of the Reef Stonefish in the Syrian coast and described it as the fourth record in the Mediterranean Sea environment. Akbora *et al.* (2021) [7] reported the first record of the Reef Stonefish in the coastal waters of Cyprus. In light of the scarcity of information about the recording or occurrence of the fish on the coasts of the Mediterranean, as indicated by the aforementioned studies, the current study aims to shed light on the rare records of the exotic Reef Stonefish (*Synanceia verrucosa* Bloch and Schneider, 1801) in the Mediterranean waters of the Gaza Strip, Palestine and its expected risks to fishermen or Gazans.

## 2. Methodology

The current study relied mainly on what was reported by Facebook pages and other social media. To investigate further, the researchers used to communicate with or hold visits to specialized authorities such as the General Directorate of Fish Resources, the Marine Police and some fishermen in order to document the data.

## 3. Results

### 3.1. Incidents of Reef Stonefish Documentation in the Gaza Strip

Numerous meetings and discussions conducted by the researchers with the staff of the General Directorate of Fisheries at the Palestinian Ministry of Agriculture and some fishermen in the Gaza Strip indicated that the occurrence of the Reef Stonefish is very rare, and five specimens of the fish in question were recorded during the past 15 years, starting from 2008 and ending with 2023, as follows::

1. In 2008, the first specimen of the Reef Stonefish caught in the bottom nets used by bottom trawlers was recorded in the Gaza City, Gaza Strip. Unfortunately, that specimen was not documented by photo or video, as stated by the General Directorate of Fisheries at the Palestinian Ministry of Agriculture. Of course, this is the first specimen of the Reef Stonefish ever detected in the Gaza Strip.
2. On October 20, 2010, a second specimen of the Reef Stonefish was caught in the coastal waters of the Gaza City, Gaza Strip. The specimen was submitted at that time to the laboratory of the General Directorate of Fisheries at the Palestinian Ministry of Agriculture for imaging only without preservation in formalin (Figure 1).



**Fig 1:** The second specimen of the Reef Stonefish (*Synanceia verrucosa*) caught on October 20, 2010 in the coastal waters of Gaza City and submitted to the laboratory of the General Directorate of Fisheries for photography

In 2015, a third specimen of the Reef Stonefish was caught in bottom trawls during offshore fishing operations. The General Directorate of Fisheries at the Palestinian Ministry of Agriculture kept that specimen and then preserved it in formalin inside its museum. The measurements made by the researchers showed that the specimen was 35 cm long, and the preserved specimen is still in the museum to this day (Figure 2).



**Fig 2:** A 35 cm long specimen of the Reef Stonefish (*Synanceia verrucosa*) preserved in formalin has been in the Museum of the General Directorate of Fisheries since 2015

On December 4, 2018, a Gazan fisherman caught a fourth specimen of the Reef Stonefish using a trammel net from the coastal waters of the Mediterranean Sea in Gaza City, Gaza Strip, dozens of meters away from the shore (Figure 3). The specimen was not preserved at the time, but photos of it have been shared on Facebook. The entire scene of this event has been published scientifically by Bariche *et al.* (2019) [9].



**Fig 3:** The fourth specimen of the Reef Stonefish (*Synanceia verrucosa*) caught from the coastal waters of Gaza City on December 4, 2018 [Source: Bariche *et al.* 2019] [11]





**Fig 4:** Gazan fisherman show a specimen of the Reef Stonefish (*Synanceia verrucosa*) caught from the marine ecosystem of the Gaza Strip, Palestine

In the early days of June 2023, a fifth specimen of the Reef Stonefish was caught off the coast of the Gaza Strip. Many photos and short videos spread on social media, especially Facebook, of the specimen while it was in the hands of some Gazan fishermen (Figure 4). It is clear from the posts and comments that the fishermen and the general public were amazed at the shape and danger of the fish. Most of them said that this is the first time they catch such a strange and rare fish. The posts indicated that the specimen accidentally fell into the fishing nets at a depth of tens of meters from the shore. The fate of the fish was not known and it was not preserved.

## 2.2. Description of the Reef Stonefish specimens

The caught and preserved specimens, as shown in Figures 1, 2, 3 and 4, have a stocky body with a broad, dorsally flattened head. The eyes are slightly raised and behind each eye there is a shallow hole. The mouth is semicircular and opens dorsally. On the back of the fish there are about thirteen dorsal spines of approximately equal length and covered with skin. The pectoral fin is very broad while the caudal fin is rounded. Since the Reef Stonefish is so well camouflaged, it is usually found motionless on the sea floor, and resembles a stone or piece of coral. Its warty, scaleless skin is brown or grey, possibly with spots of different colors (Figure 1) and is sometimes covered with algae. The preserved specimen of 2015 shown in Figure 3 was 35 cm long, while the recent specimen of 2023 shown in Figure 4 was 37 cm long.

## 3.3. Envenomation of the Reef Stonefish in the Gaza Strip

The Reef Stonefish is the most venomous fish in the world. It has 12 - 14 stout spines in the dorsal fin which can inject highly toxic venom. Discussions conducted with the General Directorate of Fisheries at the Ministry of Agriculture and some fishermen showed that they are fully aware of the toxicity of the Reef Stonefish and that they hear about such toxicities and fatalities from various media, despite its rare occurrence in the eastern Mediterranean environment. However, no one mentioned that any of the Gazans or fishermen was exposed to its venom.

## 4. Discussion

The current study investigates the recording of five single specimens of the Reef Stonefish (*Synanceia verrucosa* Bloch and Schneider, 1801) in the coastal waters of the Gaza Strip, Palestine, starting from 2008 to 2023. The extreme scarcity of

this species prevented it from being included in some previous studies of fish species found in the marine ecosystem in the Gaza Strip (MEaA, 2001; Abu Aouda *et al.*, 2008; Shaheen, 2016; Abu Amra, 2018; Abd Rabou, 2020 and Hussein *et al.*, 2022) [36, 6, 45, 5, 3]. This may be due to the fact that Reef Stonefishes are rarely caught during fishing operations, as well as not being an economical fish locally. Even the brochures published by the General Directorate of Fisheries at the Ministry of Agriculture did not address the Reef Stonefish among the local fisheries (Salah and Abutair, 2012) [43]. Most Gazans believe that the Reef Stonefish is a Lessepsian immigrant that came to the Mediterranean through the Suez Canal as the case of other alien or exotic fish species (Golani, 2010 and 2021; Golani and Bogorodsky, 2010; Edelist, 2013 and Golani and Fricke, 2018) [24, 23, 24, 17, 25] including the most dangerous Silver-cheeked Toadfish (*Lagocephalus sceleratus* Gmelin, 1789) (Abu Amra, 2018 and Abd Rabou, 2019) [5, 2] and the Nomad Jellyfish (*Rhopilema nomadica* Galil, 1990) [39], which is believed to have arrived in the Mediterranean in the 1970s (Abd Rabou *et al.*, 2007 and Abd Rabou, 2013) [4, 2].

It has become closer to reality that the Reef Stonefishes have reached the Mediterranean Sea, especially its eastern basin, through the Suez Canal, which is considered an artificial waterway with double passage in Egypt, and this explains the recording of many specimens of the species in eastern Mediterranean countries such as Turkey, Syria, Israel, Cyprus (Edelist *et al.*, 2011; Bilecenoğlu, 2012; Ibrahim *et al.*, 2019 and Akbora *et al.*, 2021) [18, 13, 18, 7] as previously mentioned and currently in the Gaza Strip (Bariche *et al.*, 2019) [11]. In fact, it is not surprising that the Gaza Strip preceded the countries of the eastern Mediterranean in recording the first occurrence of the Reef Stonefish in 2008, as it is closest to the mouth of the Suez Canal in the Mediterranean. The political and scientific nature of the Gaza Strip made it late to document the occurrence of the species, as the Gaza Strip lacks the financial, technical and scientific capabilities to record many fish species, whether indigenous or non-indigenous. The Reef Stonefish appears to be a natural component of biodiversity in the Red Sea environment, as revealed by several studies (Galal, 1999; Golani and Bogorodsky, 2010; Edelist *et al.*, 2011; Bilecenoğlu, 2012; Bariche, 2012; Edelist, 2013; Eid and Al-Tawaha, 2016; Khalil *et al.*, 2018 and Saggiomo *et al.*, 2021) [20, 24, 18, 13, 9, 7, 19, 31, 41]. Edelist *et al.* (2011) [18] attributed the arrival and recording of the fish in question to the eastern Mediterranean to the spread of pelagic larvae and their possible migration to the Mediterranean through the Suez Canal, as adults and larger individuals are mostly inactive and rarely move. The likelihood of Reef Stonefish escaping from the aquaria, in which they are raised, as is common in some countries, is very low since the species is not common in the ornamental fish trade of the region.

The eastern Mediterranean is an area full of biological invasions, especially by poisonous species of bony fish coming from the Red Sea as Lessepsian immigrants (Katsanevakis *et al.*, 2009; Rilov and Galil, 2009; Salameh *et al.*, 2011; Bariche *et al.*, 2013; Iglésias and Frotté, 2015 and Abu Amra, 2018) [30, 39, 44, 10, 29, 5]. One of these bioinvaders is the Silver-cheeked Toadfish (*Lagocephalus sceleratus* Gmelin, 1789) which seemed to invade the marine environment of the Gaza Strip since 2006 (Abd Rabou, 2019) [2]. Dozens of poisonings occurred due to ingestion of the Silver-cheeked Toadfish as revealed by Abd Rabou (2019) [2].

During the past three years, two deaths were recorded for a woman and a girl in the Gaza Strip, as a result of eating the Silver-cheeked Toadfish (Personal Communications). As for the Reef Stonefish, its occurrence is very rare and no injuries or fatalities were reported from it in the Gaza Strip. However, the fish is equipped with 13 venomous spines on its dorsal fin, which it can use to defend itself against predators or stun and kill its prey. The poison is so strong that it can cause severe pain, paralysis and even death to humans. Many of the studies reviewed showed the fish's seriousness and toxicity to public health, including fatalities (Lehmann and Hardy, 1993; Breton *et al.*, 2002; Lee *et al.*, 2004; Atkinson *et al.*, 2006; Dall *et al.*, 2006; Tang *et al.*, 2006; Rishpon *et al.*, 2008; Ngo *et al.*, 2009; Diaz, 2015; Ghanem *et al.*, 2019; Maillaud *et al.*, 2020; Poon *et al.*, 2020; Harris *et al.*, 2021)<sup>[34, 12, 33, 8, 15, 46, 40, 37, 16, 21, 35, 38, 26]</sup>. It is worth mentioning that the Reef Stonefish would pose a potential threat to human health if given the chance to establish a successful breeding population in the eastern Mediterranean.

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