

# ALIEN FISH IN MARINE CAVES OF THE AEGEAN SEA, GREECE

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## Abstract

An underwater visual survey protocol for recording motile species was applied in 12 marine caves of the Aegean Sea (eastern Mediterranean) aiming to unveil the distribution pattern of alien fishes in this protected habitat. Species richness and abundance of motile fauna were recorded within 3-minutes at each of the three ecological cave zones (entrance, semi-dark and dark zone) while SCUBA diving. Eight alien and crypto-expanding fishes were found out of 32 recorded species, comprising up to 46% of the population. Alien fish distribution patterns seem to fit well with their known distribution from other marine habitats across the Aegean Sea.

## Introduction

The distribution patterns of non-indigenous fish are widely studied in the Mediterranean Sea. However, little is known about their presence in dark habitats such as marine caves. Herein we aim to investigate the establishment of alien species in marine caves of the Aegean Sea (eastern Mediterranean).

## Methods

Twelve submerged and semi-submerged sea caves, distributed in nine Greek islands of the Aegean Sea were surveyed. During summer 2020, two scientific divers recorded species richness and abundance of motile taxa within a 3-min visual survey at the entrance, semi-dark and dark zone of the caves.

## Results

- 32 fish species were recorded in the studied sea caves among which 8 were alien or crypto-expanding.
- Alien fish comprised 25% of all fish species and 10% of the total fish abundance.
- The highest ratio of alien/native species abundance was 46% at the southeasternmost studied cave (Fig. 1 & 2).

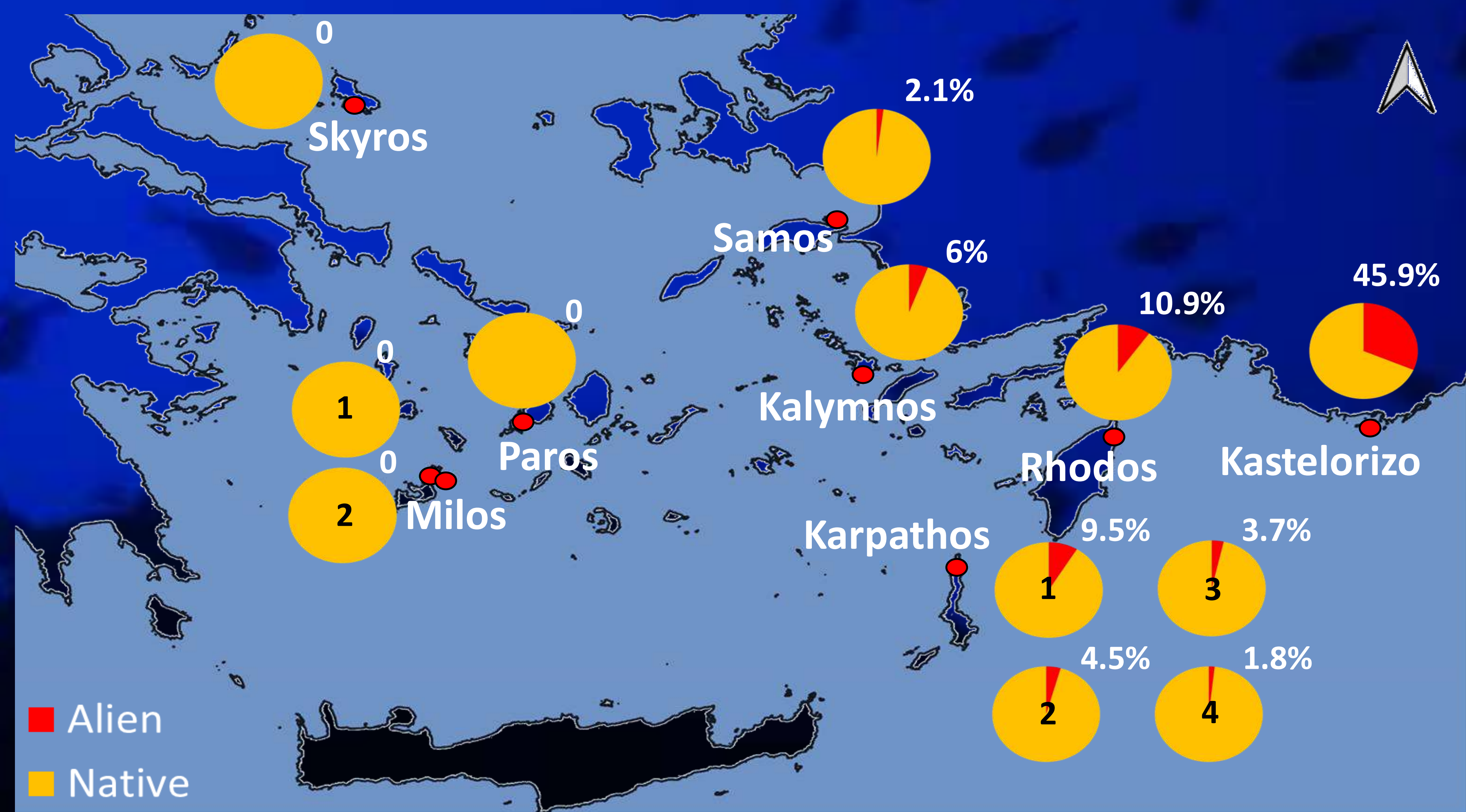


Fig. 1: Map with the location of the studied marine caves in the Aegean Sea and the Alien / Native abundance ratio of fish species.

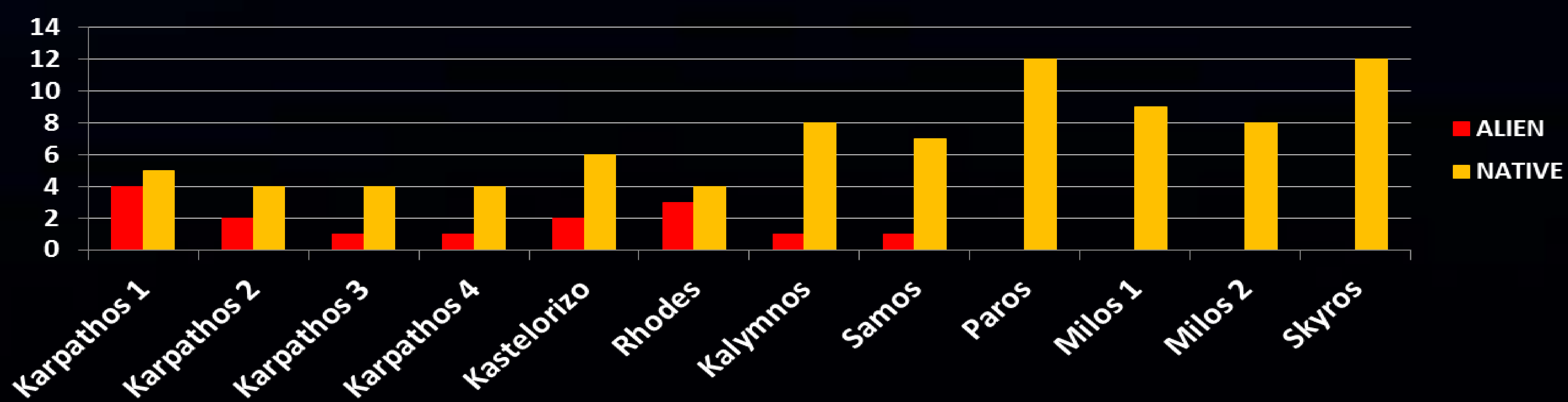


Fig. 2: Number of Alien and Native fish species recorded in transect at all studied caves.

- *Pempheris rhomboidea* exhibited the highest abundance, with more than 200 adult individuals at the dark interior and more than 200 juveniles at the cave entrance of the southeasternmost studied cave in Kastelorizo Island.
- The lionfish *Pterois miles* was recorded at all cave zones.
- *Torquigener flavimaculosus*, *Siganus luridus* and *Siganus rivulatus* were exclusively recorded at the entrance zone of the caves.
- *Sargocentron rubrum* and *Parupeneus forsskali* were observed at the semi-dark and dark cave parts.
- The crypto-expanding fish *Enchelycore anatina* was recorded at the semi-dark zone of two caves.

## Discussion & Conclusions

This study showed that alien fish have successfully been established in the marine cave environment of the eastern Mediterranean Sea, especially at the entrance and semi-dark cave zones. Their higher species richness and abundance at the southeasternmost studied caves seem to fit well with their known distribution in other marine habitats of the Aegean Sea. Further analysis of the collected data and additional samplings are expected to provide better estimates of alien species' impact on marine cave ecosystems.



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