

Diving Impact: Frequentation, Diver Behavior and Consequences on the Mediterranean Fish Community

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Introduction

Due to its favorable climate, clear waters and remarkable biodiversity, Mediterranean French coast and particularly Corsica Island, harbour several diving hot spots. In order to implement the European Marine Strategy Framework Directive, this study aims to quantify and qualify diving activities in order to reduce impacts on marine environment while strengthening coexistence of different users, for a better regional scale management.

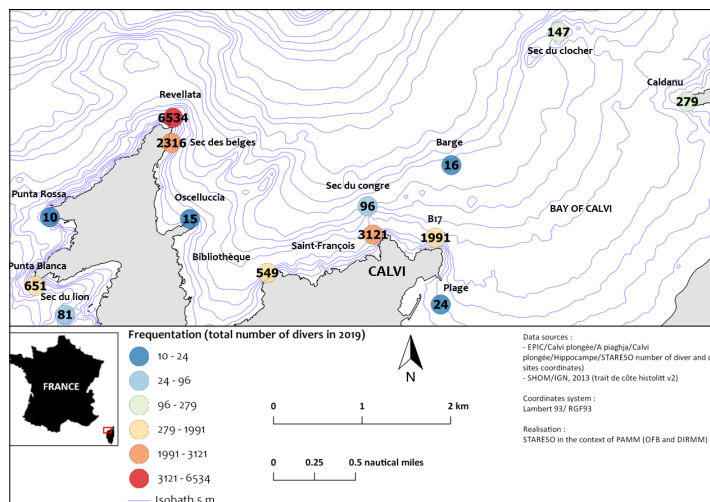


Fig. 2 : Map of the dive sites in the bay of Calvi showing their corresponding frequentation in 2019.

Quantification of frequentation

Based on 24,638 photographs (Fig.1) and the 1785 dive groups registers from 6 diving structures present in Calvi Bay.



Fig. 1 : The Revellata dive site, August 13, 2019.

Between Avril and October 2019 : 21445 divers on all dive sites of the bay and 6534 divers on Revellata dive site (Fig. 2).

Characterization of divers behaviors

Anonymous underwater diver behaviour observation, in 10-minute-increments, to count frequency of contact with environment, type of contact (voluntary / involuntary) and the part of body or instruments concerned.

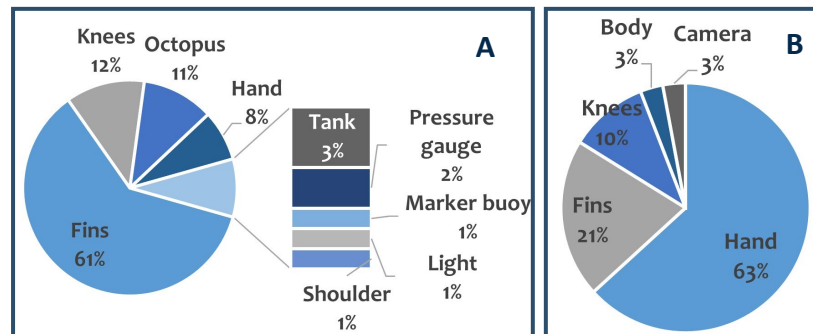


Fig. 3 : Portions of involuntary (A) and voluntary (B) diver contacts with substrate.

Divers' awareness of the impacts of diving is relatively low and more than 80 % of them made contact with the environment during the diving session, with an average of 7 contacts per 10 min. The majority of involuntary contacts involve fins, and hands for voluntary contacts (Fig. 3). Additionally, divers holding a camera are more likely to make intentional contact with the substrate. Divers' experience is also a major factor (buoyancy control).

Identification of fish disturbance

Fish counts (by UVC) carried out before divers arrive on site, counts repeated after the passage of divers. Particular attention was paid to Dusky groupers (*Epinephelus marginatus*) whose behaviour, in front of divers, was noted according to 5 behavioral typologies (Fig.4).

Fish populations respond differently depending on the species involved. Brown meagre (*Sciaena umbra*) and Dusky groupers (*Epinephelus marginatus*) biomasses decrease significantly following diving sessions.

Large groupers (> 70 cm) are more wary of divers, by observing them, preparing for an escape or even fleeing more than 10 m away. On the contrary, smaller groupers (50 - 70cm) are less fearful. And small individuals (<50 cm) are curious and more likely to show an attraction to diver.

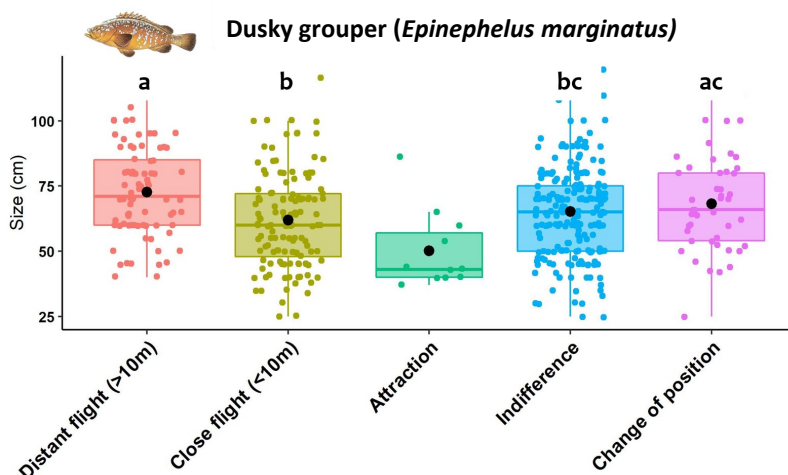


Fig. 4: Boxplots of sizes (in cm) of Dusky groupers observed according to their behavior with respect to divers.