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PRELIMINARY EVALUATION OF *SEPIA OFFICINALIS* (LINNAEUS, 1758) SPAWNING ON OCTOPUS TRAPS IN SARDINIA

VALUTAZIONE PRELIMINARE SULLA DEPOSIZIONE DI SEPIA OFFICINALIS *(LINNAEUS, 1758) IN NASSE PER POLPI*

Abstract - *This study monitored 150 octopus traps between February and July 2023 in south-western Sardinia to assess the presence, development, and hatching success of Sepia officinalis eggs. Egg clutches attached to traps were placed in stainless steel cages at sea to protect and monitor their development. Eggs were found from February to May, peaking in March and April. About 95% of firmly attached eggs successfully developed and hatched after 28–82 days, while detached eggs failed to complete development. Egg and paralarvae sizes (0.82 ± 0.15 cm and 1.22 ± 0.10 cm) matched previous reports. The findings confirm that octopus traps serve as effective spawning substrates but also highlight the risk of egg loss due to fishing and cleaning practices. No formal protection measures exist in Sardinia, where egg conservation depends on fishers' voluntary actions. The study emphasizes the need for targeted conservation to support fisheries and protect marine biodiversity.*

Keywords: Sepia officinalis*, cuttlefish eggs, octopus traps, embryonic development, small-scale fisheries*

Introduction - The common cuttlefish *Sepia officinalis* Linneaus, 1758 like most cephalopods, species has a short life cycle (1-2 years) and dies after spawning (e.g. Guerra *et al.,* 2015). A single cuttlefish can lay about 150-550 eggs preferably during the day and typically anchored on macroalgae and seagrasses with filaments that allow them to float but prevent them from detaching (Mangold, 1989). It is frequently that in the absence of natural substrates, cuttlefish could lay their eggs on artificial materials present on the seabed such as ropes, frayed materials, pieces of metal, nets and/or fishing gear, mainly traps (Sykes *et al.,* 2014). In Sardinia, cuttlefish egg masses are frequently found in octopus traps, creating issues for fishers due to reduced octopus catchability and the need for daily cleaning; in the Calasetta area (South West Sardinia), there is a particularly high level of awareness and sensitivity towards this phenomenon. Exposure of equipment to sunlight and routine cleaning operations cause eggs to detach and be lost, resulting in failure to complete their development and thus with potentially affecting the recruitment and thus the future biomass. To better understand the interaction between fishing practices and cuttlefish reproduction, observations were conducted to document the presence of cuttlefish eggs on octopus traps used by a small-scale fishery operating in south-western Sardinia. The main objectives of the study were to collect the eggs *in situ*, monitor their embryonic development and hatching, and ensure the subsequent release of the paralarvae back into their natural environment.

Materials and methods – The presence of cuttlefish eggs on octopus traps was monitored and quantified by inspecting 150 traps used during octopus fishing activities conducted by the vessel *Lara Minnie*, part of a small-scale fishery operating in south-western Sardinia. The monitoring took place between February and July 2023, the period of highets octopus fishing activity in the area.The traps were deployed daily at a depth of 20 meters on mixed sandy seabeds.

attached to the traps (Fig. 1a) were measured with a calliper before the coded traps were placed inside two stainless steel 'nursery' cages (1.5 × 1.5 m) suspended in the water column (Fig. 1b) for *in situ* monitoring. No more than four traps were placed in each cage at the same time, with the traps rotated over the study period as the clutches were found at different times. Some eggs that had accidentally detached from the traps were also placed freely inside the cages for observation.
Egg development was monitored every five days by lifting the cages and inspecting the clutches from above through a dedicated opening. During each inspection egg condition, color, and size were recorded with an action camera, and embryonic development duration was quantified Following hatching, the paralarvae were released into the sea.

Results - Cuttlefish egg deposition on octopus traps was observed from February to May, indicating an extended spawning period involving different individuals. Each trap typically hosted a single cuttlefish together with its own egg clutch. The highest frequency of egg clutches was recorded in April (5.3%), which can be considered the peak of the reproductive season, while lower frequencies were observed in March (4%) and in both February and May (1.3%). No egg clutches were recorded in June or July despite the continued use of traps (Tab. 1).

Tab. 1 – Monthly monitoring of cuttlefish egg deposition on octopus traps used by the vessel "Lara Minnie". *Monitoraggio mensile della deposizione di uova di seppia sulle nasse per polpi impiegate dall'imbarcazione "Lara Minnie".*

Month (fishing days)	**Traps with cuttlefish eggs**	**% of traps with eggs (out of 150)**	**Mean development time (days)**
February (3)	4	1.3 %	75
March (9)	18	4 %	55
April (10)	24	5.3 %	30
May (10)	4	1.3 %	28
June (10)	0	-	-
July (10)	0	-	-

The number of cuttlefish eggs found per trap showed considerable variation, ranging from a minimum of 21 to a maximum of 205 eggs. These eggs were characterized by their distinct black pigmentation and flask-like shape, with a gelatinous consistency. On average, the eggs measured 0.82 ± 0.15 cm in size.
During the monitoring period, it was observed that approximately 95% of the eggs firmly attached to the traps successfully developed over a timespan of 28 to 82 days. A notable change in coloration occurred towards the end of the embryonic development phase, with the eggs turning a light brown color shortly before hatching. Upon hatching, the paralarvae had an average length of 1.22± 0.10 cm.

In contrast, eggs that became detached from their original supports and were freely placed inside the observation cages failed to complete their development.

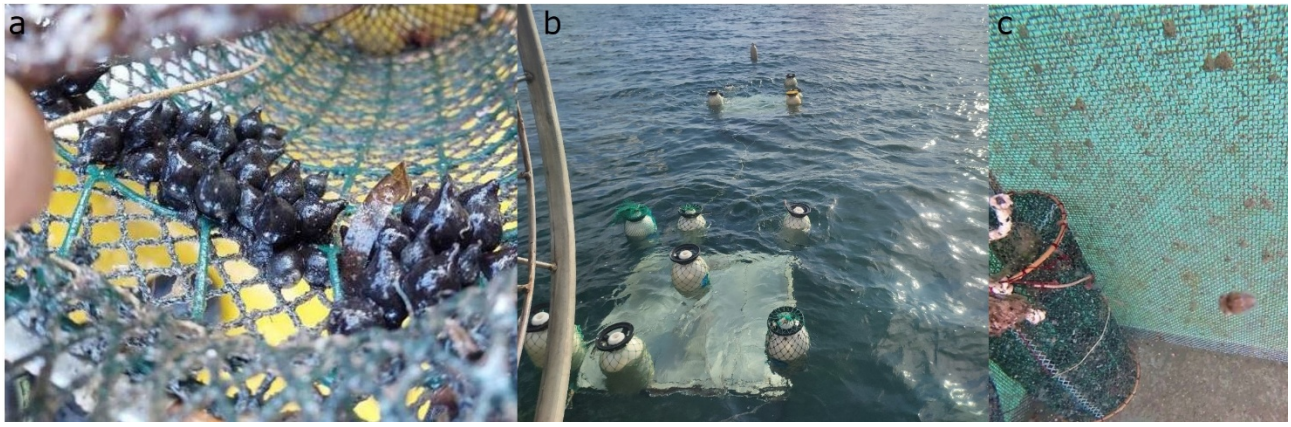

Fig. 1 - (a) cuttlefish eggs on an octopus trap; (b) stainless steel "nursery" cages; (c) an octopus trap inside the cage and paralarvae after hatching.
(a) Uova di seppia su una nassa per polpi; (b) gabbie "nursery" in acciaio inox; (c) nassa all'interno della gabbia e paralarvae dopo la schiusa.

Conclusions - The study highlights the significant interaction between octopus fishing and the reproductive cycle of the common cuttlefish, *Sepia officinalis*, in south-western Sardinia. The presence of cuttlefish eggs on octopus traps was confirmed primarily during the spring months during the peak spawning activity. Accordingly to other studies the variation in egg numbers per trap and the observed embryonic development times reflect natural biological variability influenced by environmental factors (e.g. Sykes *et al*., 2014).
Similar cases of egg deposition on fishing gear and limited restocking efforts have been reported in the Adriatic Sea (Progetto PO FEAMP, 2021). The successful development and hatching of approximately 95% of eggs firmly attached to traps demonstrate that these artificial substrates can effectively serve as spawning grounds, supporting the early life stages of cuttlefish. Conversely, the failure of detached eggs to complete development underscores the critical importance of eggs remaining anchored to stable supports. This result is consistent with restocking experiences carried out in the Adriatic Sea (Progetto PO FEAMP, 2021), where eggs removed from fishing gear are always fixed to artificial supports (e.g. grids or frames) before being transferred to nursery structures. Our observations therefore confirm that egg anchorage to a stable substrate represents a *conditio sine qua non* for the successful embryonic development of *Sepia officinalis*.
These findings emphasize the urgent need for effective and formal management measures to support artisanal fisheries, conserve cuttlefish stocks, and protect marine biodiversity. Such measures would align with local stakeholders' demands for targeted management and embody co-management principles increasingly advocated by researchers and policymakers (Linke & Bruckmeier, 2015; Sonderblohm *et al.,* 2017; Mereu *et al.,* 2018).
Overall, this study offers useful insights into the reproductive behavior of *Sepia officinalis* in Sardinian waters and supports the need for conservation measures integrated with sustainable fishing practices, particularly to reduce egg loss during peak spawning periods.

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