Evaluation of the efficiency of bottom traps and trammel net in capturing cuttlefish *Sepia officinalis* in Abruzzi waters (Adriatic Sea)

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A research project aiming at evaluating the population consistency of the cuttlefish *Sepia officinalis* was carried out in 2008 along the coasts of the Abruzzi (Italy), in the Adriatic Sea. In this area, at the end of winter (March-April) cuttlefish migrate from cold, deep waters toward warmer coastal waters, where they reproduce. Small-scale cuttlefish fishery is permitted in this area from 15 March to 30 September. During this period, two different sampling gears, bottom traps and trammel nets, were used in five stations to test their efficiency in capturing cuttlefish. The caught specimens were counted, measured and weighed, and their sex and sexual stage determined. The results showed that bottom traps were always more efficient than trammel nets. During the first months of migration (March-April) a higher percentage of large males was recorded, followed by catches of females and smaller males in later periods. Bottom traps also proved to be a valid sampling method for the octopus *Octopus vulgaris*, which was found during the entire study period and represented the second most abundant species.

1. Introduction

The cuttlefish *Sepia officinalis* is a demersal species widely distributed throughout the Mediterranean and eastern Atlantic, and is very common in the coastal zone on sandy and muddy bottoms.

In the Mediterranean large individuals, with males preceding females, leave deeper waters early in spring to migrate to shallower water, where they reproduce.

This group is followed by a succession of smaller animals throughout the summer. In the autumn, a gradual descent to deeper water begins. Spawning usually peaks at water temperatures between 13 ° and 15°C. The life cycle covers 12 to 24 months, depending on environmental conditions.

The growth rate is rapid: young hatched in early summer from the spring brood usually spawn in the autumn of the following year, while those from the autumn brood spawn in the spring of their second year of life.

In Abruzzi waters (Adriatic Sea), cuttlefish are an important resource exploited by small-scale fisheries from March, during the reproductive period. A study on the efficiency of sampling gears (bottom traps and trammel nets) in catching cuttlefish was carried out as part of research into the relationships between cuttlefish migration and sea water temperature, carried out in 2008 along the Abruzzi coasts. Cuttlefish size by month was also analysed.

Figure 1. Cuttlefish

2. Material and methods

2.1 Sampling

Sampling was carried out from February to September 2008 in 5 stations along the coast of Abruzzi (Martinsicuro, Giulianova, Montesilvano, Francavilla, Ortona) by local small-scale fishermen using two different gear types: bottom traps and trammel net.

Figure 2. The sampling stations along the Abruzzi coast

Figure 3. Bottom traps

Two kinds of bottom trap were used, in line with local fishermen's habits. In the first four stations, typical parallelepiped-shaped cages with a metal frame and a net covering one entrance were used. In the Ortona station, fyke nets consisting of cone-shaped bags mounted on rigid structures and completely covered by netting were used.

The trammel net was 500 m long and 2 m high, and consisted of three panels made of polyamide monofilament with stretched mesh size of 40 mm. It was lowered at dusk and hauled in after two days.

At each station, 40 bottom traps and 1 trammel net were used, equivalent to the working time spent in fishery operations, 11 samplings were carried out at each station.
Cuttlefish were counted, weighed and the mantle length measured. 30 specimens from those caught by bottom traps were dissected and sexed for each sampling date and station, in order to detect differences in the arrival time of each sex.
Other organisms caught by the bottom traps were classified by species and counted to evaluate the sampling efficiency of this gear for other species.

Figure 4. Trammel net

2.2 Statistical analysis

To verify the statistical difference between bottom trap and trammel net efficiency, both the number of specimens caught and their biomass were compared using the non-parametric Mann-Whitney test.

The association between sampling date and specimen length was investigated separately for males and females using linear regression analysis.

3. Results

Overall, 992 cuttlefish were caught, with a total weight of 230.23 kg. Of these, 720 (143.03 kg) were collected by bottom trap and 272 (87.20 kg) by trammel net.

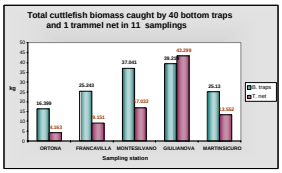

Figure 5. Total cuttlefish biomass per sampling point

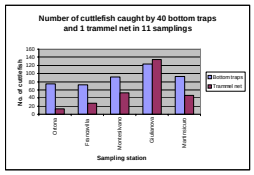

Figure 6. Number of cuttlefish per sampling point

3.1 Comparison of bottom traps and trammel net

The Mann-Whitney test identified a statistically significant difference between bottom trap and trammel net efficiency for both the number of specimens (U=2048, p<0.01) and the biomass (U=1979.5, p<0.01). The number of specimens caught and their biomass were significantly higher in the bottom traps (Figures 7-8).

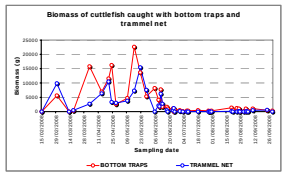

Figure 7. Biomass of cuttlefish caught with bottom traps and trammel net

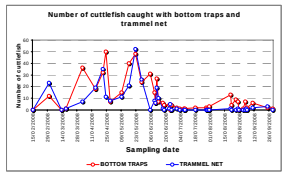

Figure 8. Number of cuttlefish caught with bottom traps and trammel net

3.2 Association between sampling date and specimen length

The linear regression identified a significant negative correlation between sampling date and specimen length for both males and females (Figures 9-10, Table 1) with a significantly negative angular coefficient (more evidently negative in the males). This result shows that the length of the caught specimens decreased from March to September, in line with literature reports.

Table 1. Regression analysis

GROUP	Parameters	B	Standard error	t	Sig.	95% Confidence Interval for B	
						Lower bound	Upper bound
FEMALE	Constant	16.248	0.637	25.523	<0.0001	14.992	17.505
	Time (months)	-0.504	0.114	-4.436	<0.0001	-0.729	-0.28
MALE	Constant	18.805	0.558	33.712	<0.0001	17.705	19.905
	Time (months)	-1.142	0.11	-10.371	<0.0001	-1.359	-0.925

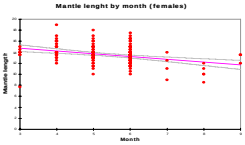

Figure 9. Regression between mantle length and sampling date (females)

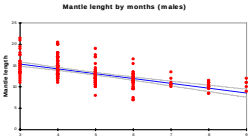

Figure 10. Regression between mantle length and sampling date (males)

3.3 Evaluation of additional species caught with the bottom traps

The additional species caught using bottom traps are shown in the bar chart of Figure 11.
During the entire study period, in addition to the high number of cuttlefish the bottom traps also captured 472 specimens of the common octopus (Octopus vulgaris), which, as confirmed by local fishermen, is not usually captured by trammel net or by other fishing methods in the study area. Bottom traps thus proved to be a valid method for sampling both cephalopod species. However, limited numbers of other species were caught by the bottom traps, confirming their high selectivity.

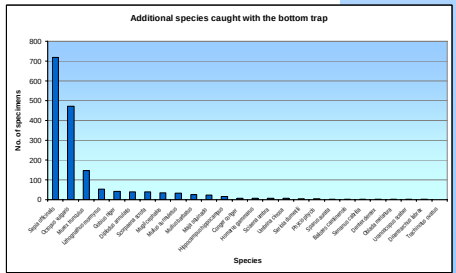

Figure 11. Number of species caught using bottom traps

4. Discussion

This study, carried out along the Adriatic coast of the Abruzzi, showed that:

- bottom traps are considerably more efficient than the trammel net for the capture of cuttlefish;
- the first specimens of cuttlefish of both sexes to arrive inshore are the largest, with size decreasing over time;
- the use of bottom traps also enables the capture of other valuable species.

Literature

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