

ADAPTATION OF SEA CUCUMBER *Holothuria tubulosa* TO THE ENVIRONMENTAL CONDITIONS UNDER AND NEAR THE FISH FARM IN THE ADRIATIC SEA

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INTRODUCTION

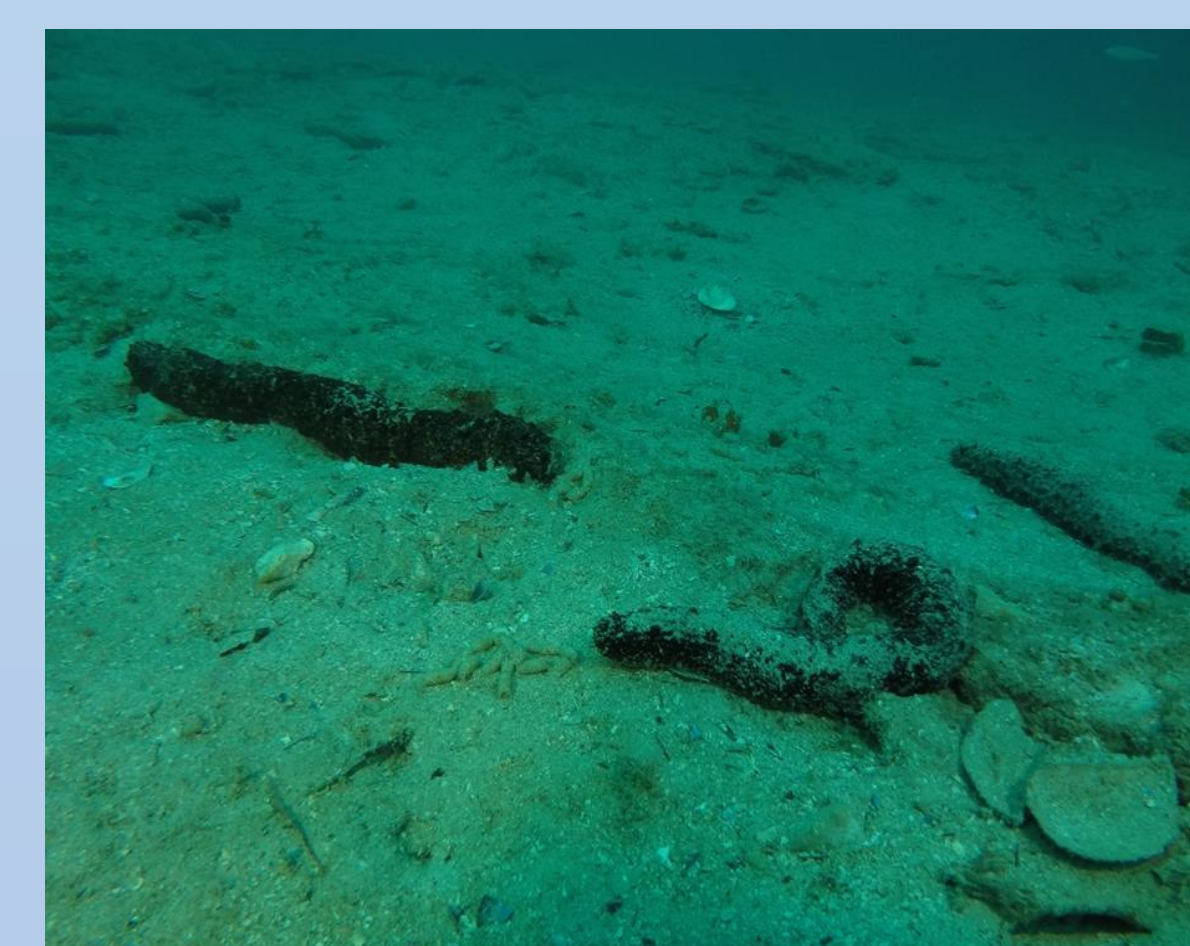
- Sea cucumbers play an important role in the marine ecosystems due to their ability to process organic-enriched sediments, stabilizing the bacterial community and to improve sediment quality.
- Also, they have an increasing economic value, and therefore are considered as a potential candidate for introduction into IMTA.
- This research focused on the adaptations of *Holothuria tubulosa* (Gmelin 1791) to the environmental conditions under the influence of intensive aquaculture.



Location of the research – fish farm in the central part of the Eastern Adriatic Sea

MATERIALS AND MEHODS

- Location: sea bass, sea bream, meagre and amberjack farm in Lamjana bay on the island of Ugljan (Middle part of the Eastern Adriatic).
- First site was directly under the farm (L1), while the second was 100m away from the edge of the cages (L2), and the reference site was chosen in area unaffected with aquaculture (1.200m away) (REF).
- Sampling periods: July (A), before the intensive feeding of the fish, and November (B), after the major feeding season.



Sea cucumber population structure at the edge of the farm (L2)



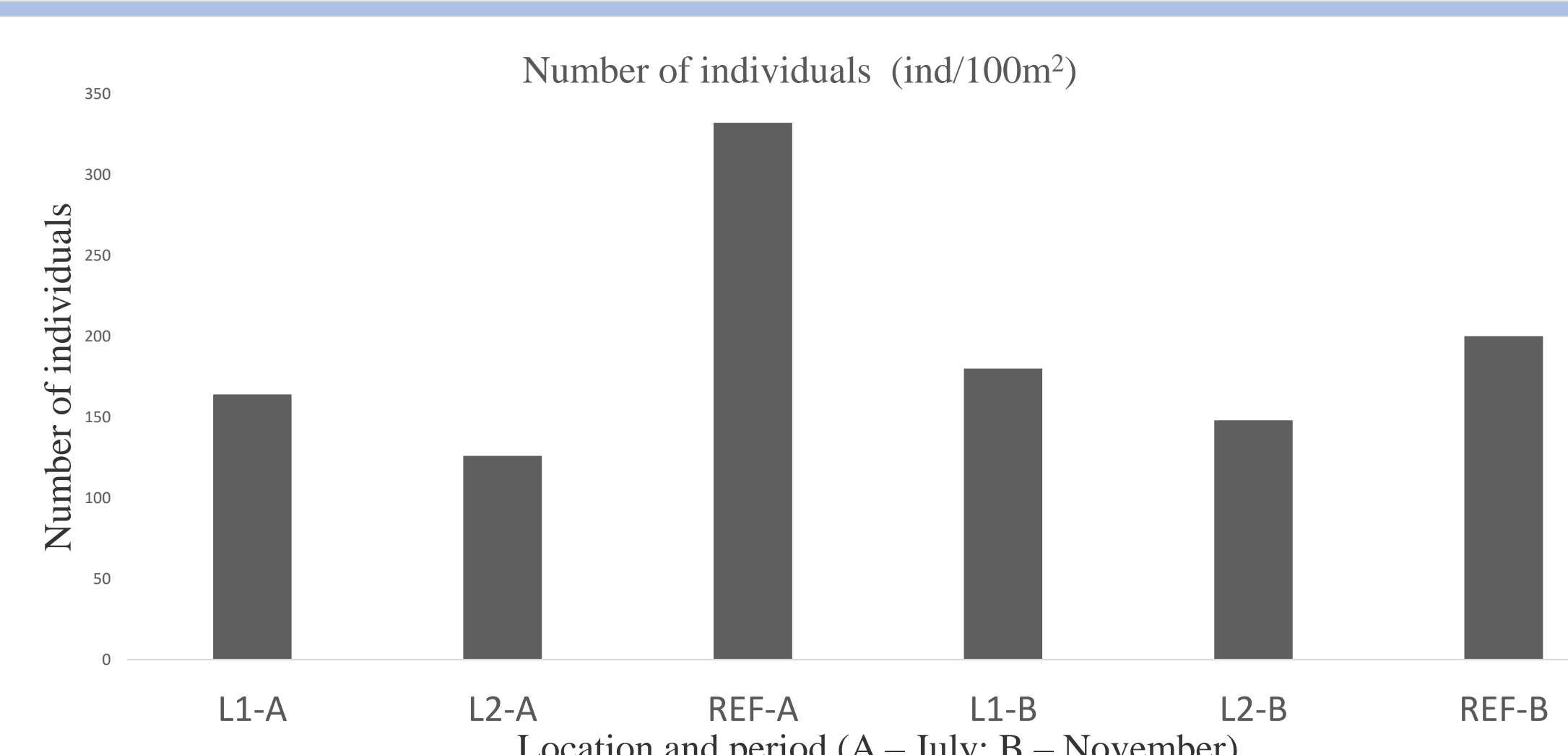
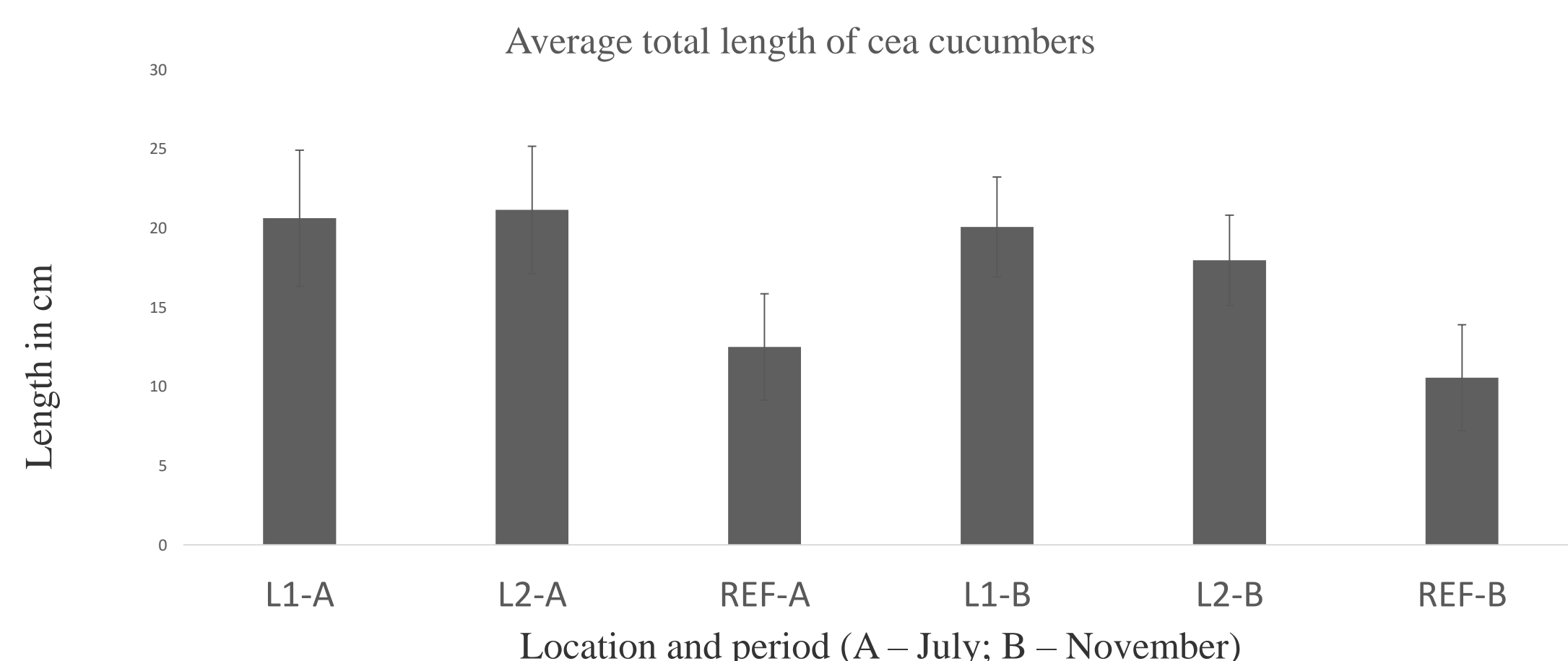
Sea cucumber population structure at the reference site (REF)

Results

- Population density was significantly higher at the reference point compared to locations below and next to the cage in both periods.
- However, the average size of the sea cucumbers under and next to the cage was 38 – 45% larger than at the reference point, indicating that the population density is inversely proportional to the length of individuals.
- In July, the stable isotopes signal ($\delta^{15}N$) in the tissue (meat) were significantly higher under and near the cages compared to the reference site (7.08 ‰, 6.78 ‰ and 5.37 ‰, respectively).
- Similar values were obtained in November, after the summer maximum feed uptake on the farm (6.93 ‰, 7.13 ‰, and 5.67 ‰, respectively).

| Location and period | Stable isotopes $\delta^{15}N$ | Stand. Dev. |
|---------------------|--------------------------------|-------------|
| L1-A | 7,08 ‰ | ±0,01 |
| L2-A | 6,78 ‰ | ±0,07 |
| REF-A | 5,37 ‰ | ± 0,03 |
| L1-B | 6,93 ‰ | ±0,04 |
| L2-B | 7,13 ‰ | ±0,01 |
| REF-B | 5,67 ‰ | ±0,01 |

Results of stable nitrogen isotopes ($\delta^{15}N_{org}$ (‰)) in the sea cucumbers meat



Conclusions

- Fish cage farming has a severe impact on the sediment composition
- The average size of the individuals, the population density and the composition of the cucumber meat and the composition of the sediment under the cage indicate that there is potential for cultivation in integrated aquaculture
- The values of stable nitrogen isotope composition $\delta^{15}N$ are higher at L1 and L2 in both surveys compared to REF due to increased input of organic matter.
- Future research:**
 - The need to carry out additional research on the life cycle of cucumbers and the impact of aquaculture in order to enable the potential introduction as a new commercially interesting species into cultivation in the future
 - Examine the potential for reducing the impact of intensive fish farming effects on the seabed
 - Examine the appropriate technology of growing cucumbers