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Case Studies in the Ligurian and northern Tyrrhenian Sea, Italy

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RESEARCH & INNOVATION

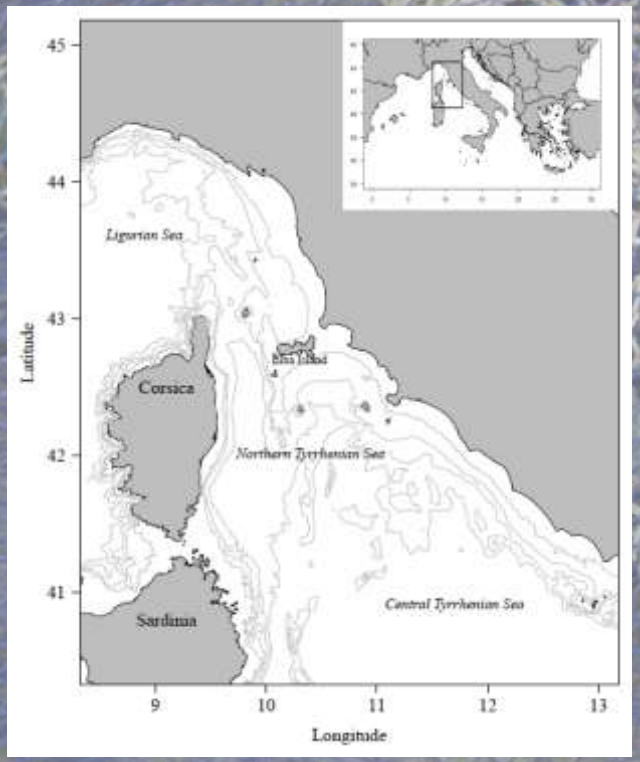
WP2 - **Technological and social solutions**

Task 2.6 – Modifying existing fishing practices

- Many trawl fishermen in Tuscany are using lights on nets in shrimp fisheries. Those lights seem to be efficient in increasing the catch of shrimps; currently, there is no scientific evidence in support of this anecdotal believe.

- The aim of the study is to evaluate whether those lights are efficient in increasing the catch of target species, and, at the same time, in decreasing by-catch and discards.

Case Study 1.8
"Testing the use of lights in trawl fisheries targeting shrimps in Northern Tyrrhenian Sea: assessing possible effects on target species and by-catch"



First experimental survey carried out in August 2016.

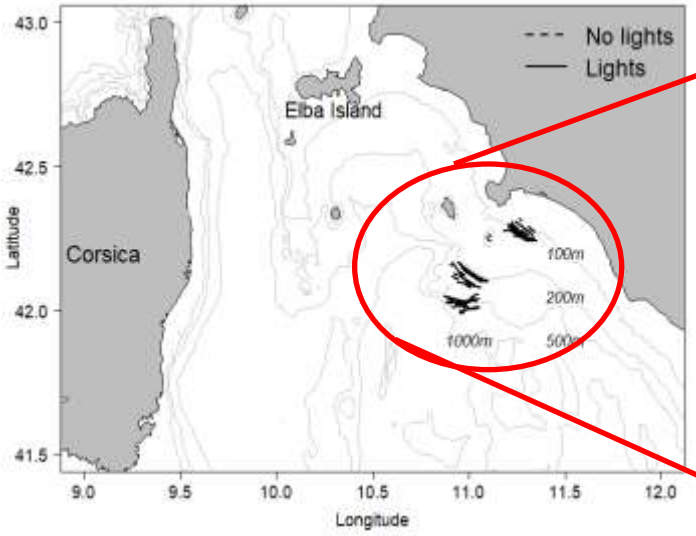
Second experimental survey carried out in December 2016.

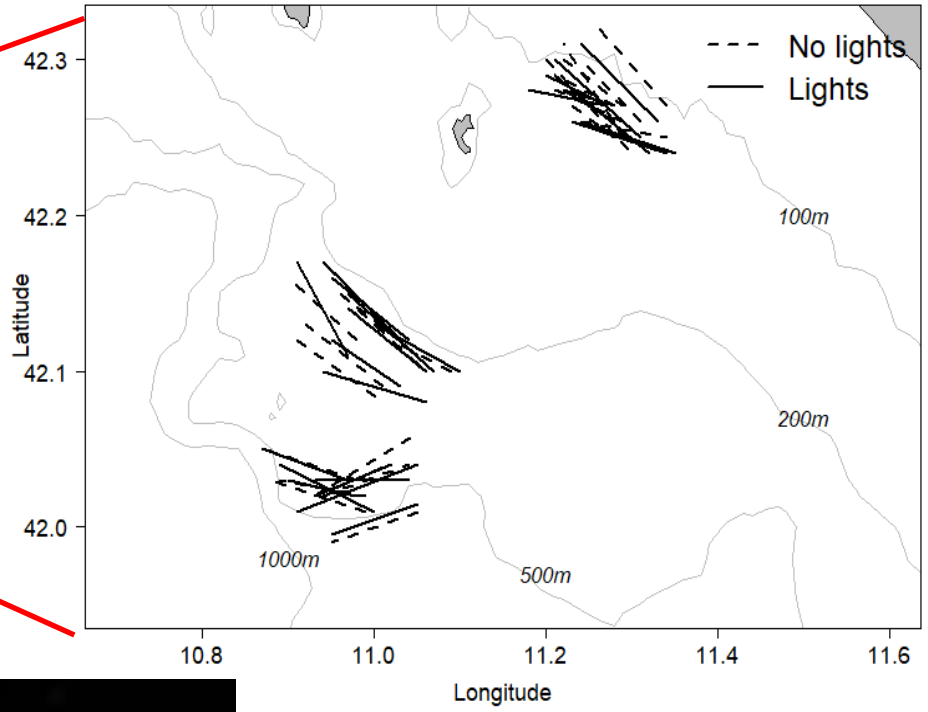
Third survey performed in May 2017.

Solutions explored:

- Green, blue, and white lights around head rope, and on the upper panel of net body

The sampling design consisted in paired hauls using a local commercial fishing vessel (FV Angela Madre, 22.7 m LOA and 210 kW), alternating the control bottom trawl net with the one equipped with lights on the headline. The field trials consisted of a total of 52 hauls (26 with lights, 26 without lights). Trawling was performed at 3.1-3.4 knots.





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In each haul, the trawl net was equipped with SIMRAD sensors to monitor the geometry of the net during the towing.

In addition, a TD probe (DST centi Star:Oddi) was placed on the net to record bottom temperature.

Sorting was performed by fishermen to avoid any bias in discarding.

Commercial fraction was divided by species, and total weight by species and commercial category recorded.

Sub-samples by species and category was performed, and measures (total length for fish, mantle length for cephalopods and carapace length for crustaceans) recorded.

Total weight of discards was recorded, and sub-samples brought to the lab for sorting and identification at the lowest taxonomic level possible (i.e., species). For each taxon, n. of individuals and total weight were recorded.

For each haul and for each taxon identified (both in the commercial and discarded fraction), biomass and density indices (kg/km^2 and N/km^2) were calculated (*swept area method*, Sparre et al. 1989).

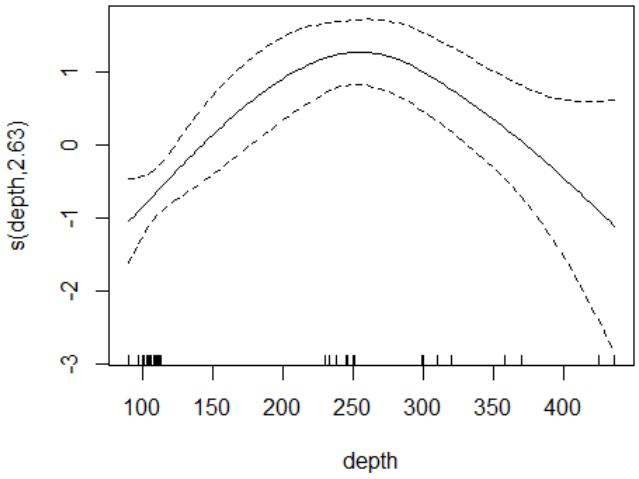
A total of **184 species** was caught during the two surveys, including fish, crustaceans, cephalopods, and benthic taxa (i.e., echinoderms, cnidarians, etc.).

55 species were landed; **166 species** discarded. Only **18 species** were totally landed, while **129** totally discarded.

11 species with MCRS (Minimum Conservation Reference Size, Annex III Reg. EC n. 1967/2006): Deep-water rose shrimp, Norway lobster, European hake, red mullet, striped red mullet, mackerel, horse mackerel, common pandora, blackspot sea bream, sardine, anchovy.

Only striped red mullet and blackspot sea bream did not show any discard.

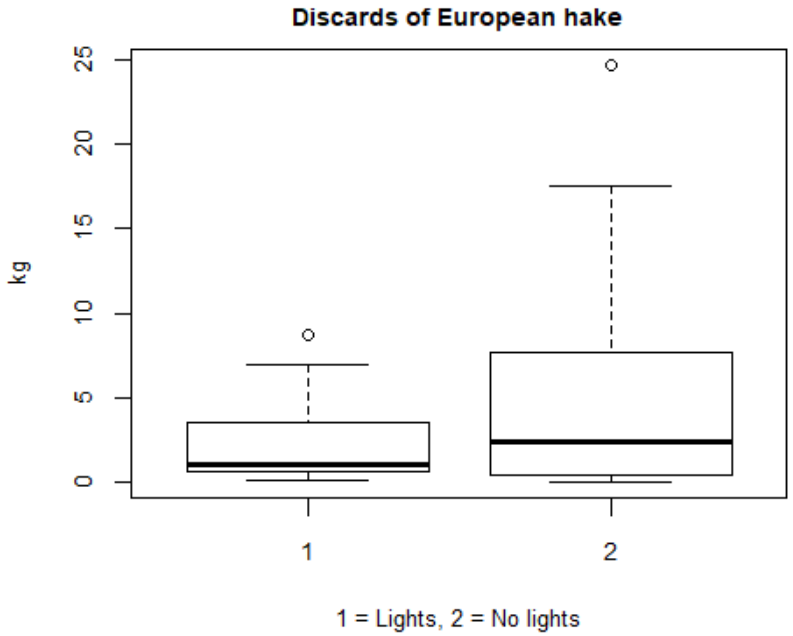
To assess the effects of lights on catches (both commercial and discards), catches in weight were modeled along with explanatory variables such as depth, bottom temperature, swept area, lights and season (these last two variables were treated as 2-levels factors) by means of **Generalized Additive Mixed Models (GAMM)** which employ non-linear and non-parametric techniques for regression modeling (Hastie & Tibshirani, 1990; Miller et al., 2013).



Plot showing the smoothing function describing the effect of Depth on the discard rates of European hake.

Benthic invertebrates were NOT included in the analysis.

The results show that the use of lights affect the discards of species with MCRS (mostly fish), and in particular European hake.
The results of GAMM show that discards of European hake are significantly higher in the hauls performed without lights.
The use of lights did not affect the catch rates of commercial catches, like those of the deep-water rose shrimp, *P. longirostris*.



Box-and-whisker plot showing the discard rates of European hake with lights (1) and without lights (2).

Conclusions

- **The use of artificial lights on the headline of the trawl net seems to be effective in reducing the capture of European hake under MCRS in the fishery targeting deep-water pink shrimp.**

- **The use of artificial lights placed on the trawl net can be a simple and economical solution to reduce unwanted catches of European hake without loss of the commercial fraction.**

- **This is the first study aimed at investigating the effects of artificial lights on the catches of trawl nets. The results, although indicating a promising scenario, need to be confirmed by further investigations, both in time and in space.**

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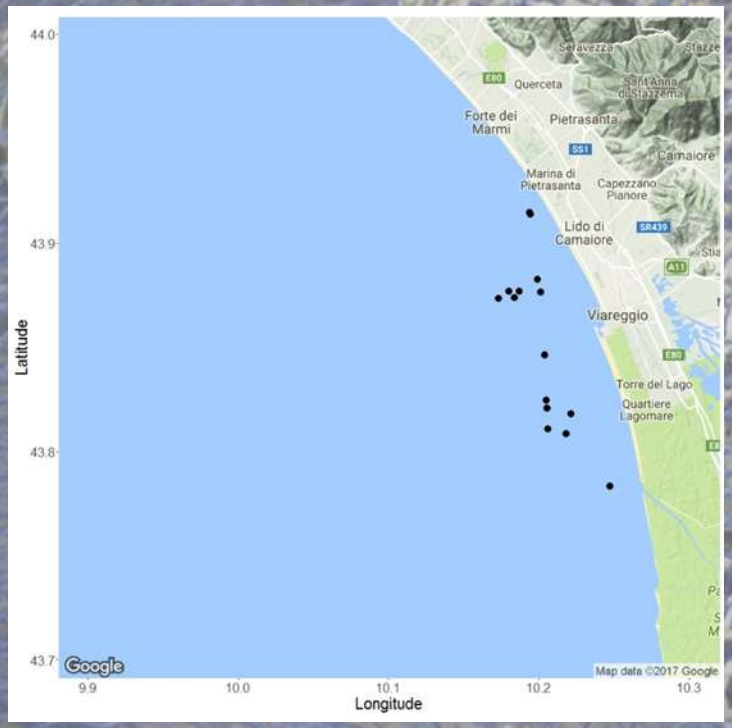
Case study 3.5 “Technological solution (guarding net) to limit the unwanted catches in the caramote prawn (*Penaeus kerathurus*) set net fisheries in the Ligurian Sea (W Mediterranean)”

- The caramote prawn fishery is important for some small-scale fishing fleets in Tuscany. Unfortunately, catch of target species is associated with large amounts of unwanted catches (mainly benthic invertebrates); this generates discards and damages to the nets, with consequent environmental impacts and associated costs for fishermen.
- Some fishermen are using a “guarding net” to reduce unwanted catches.

CS was aimed at carrying out an experimental study to test the effects of a “guarding net ” device placed in a trammel net to reduce the unwanted catches



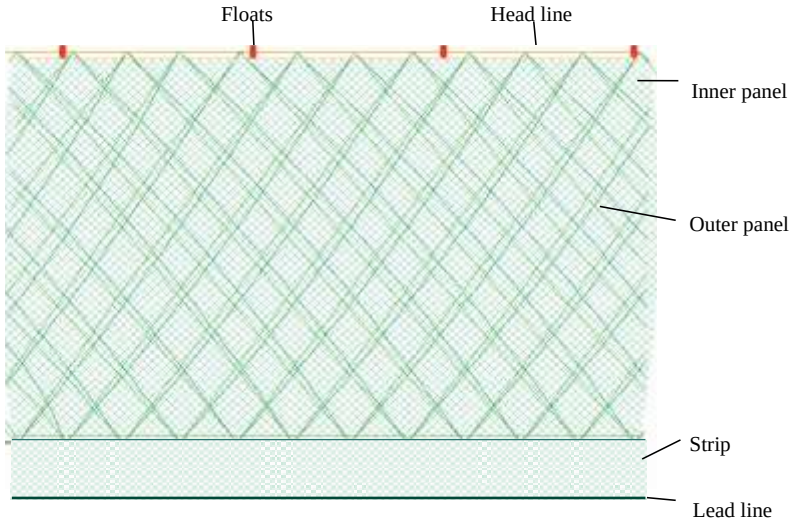
- From July 2015 to May 2016 a preparatory work was carried out. Meetings with fishermen and other stakeholders were held to present the objectives and work plan of the case study. Fishermen suggestions provided useful technical indications for constructing the experimental nets:
- From June to July 2016, 15 experimental fishing trials were carried out .

Solutions explored:

- two trammel nets provided with two types of “guarding” net, placed at the bottom of the standard trammel net, just above the lead line: 20 cm (SE20) and 30 cm (SE30)

Nets used:
- a professional standard trammel net used to exploit caramote prawn (STN);
- two experimental trammel nets provided with two types of “guarding” net: 20 cm (SE20) and 30 cm (SE30) height, respectively.

15 experimental fishing trials were performed, with a professional vessel involved in the caramote prawn fishery.
In each experimental trial, four net sheets of 100 m of each type of trammel net (STN, SE20, SE30) were used.



Scheme of a trammel net equipped with a guarding net (or “Greca” strip).

All the catches with the three different nets were characterized from both a qualitative (species identification) and a quantitative (biomass and number of individuals) point of view.

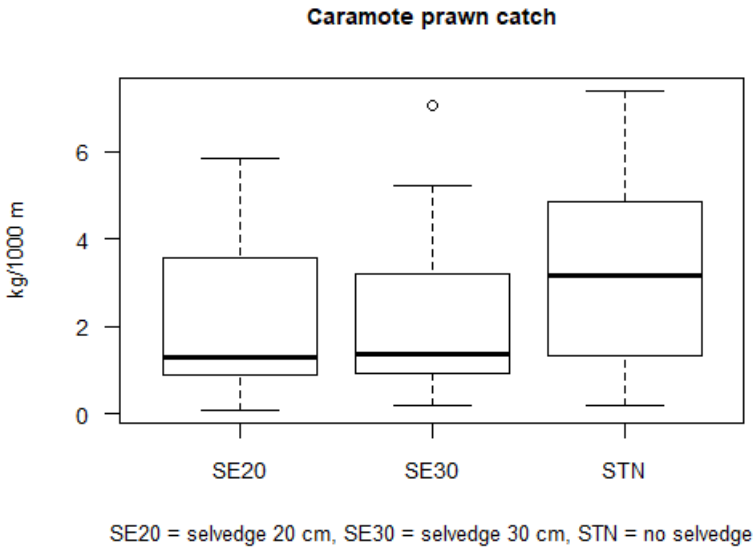
For the main target species, the demographic structure (individual size) was recorded.

Generalized Additive Models (GAM) (Hastie and Tibshirani, 1990) were used to test the effects of the different types of net on the catchability of targeted species and discards.

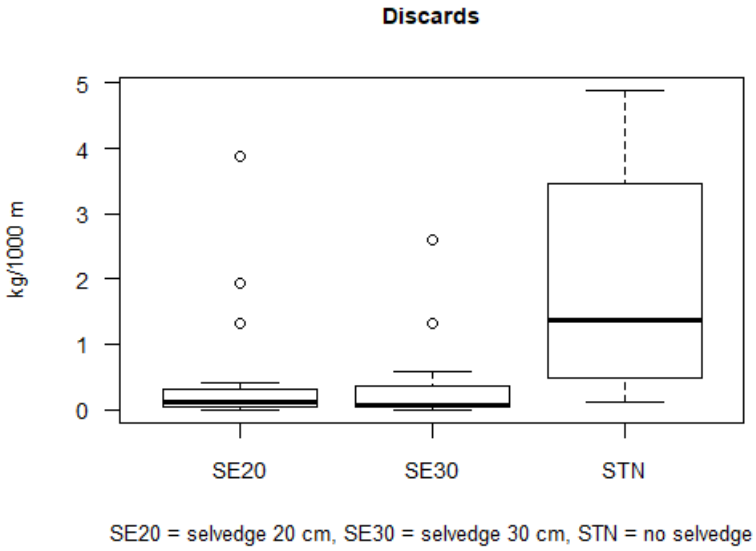
A cost-benefit evaluation of the usability of these trammel nets in a professional fisheries context was also performed.

Interviews with the local fishermen were performed to collect socio-economic information, in order to characterise the performance of this fishery and to evaluate the effects of the introduction of the selvedge technical device.

The results revealed that the use of a modified trammel net can significantly reduce the amount of discards (mostly represented by benthic species, such as crabs, gastropods, etc.) in the trammel net fishery targeting caramote prawn.



Box-and-whisker plot of the catches of the target species, caramote prawn, with the three different types of net.



Box-and-whisker plot of the discards with the three different types of net.

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Conclusions

- **Our experiments showed that the addition of ‘selvedge’ net to traditional trammel nets can reduce bycatch significantly.**
- **Selvedge fitted to trammel nets proved to be an effective solution to decrease discards and unwanted catches.**
- **The economic loss due to the slightly reduced catch of commercial species is offset by decreased sorting time and labour costs.**

Beneficiaries:

Linked parties:

Thank you ;)

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