Recent experiences in reducing bycatch of Endangered, Threatened and Protected (ETP) in the Mediterranean: insights from three EU-LIFE projects

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EU-Life Conservation Actions

Conservation Actions must aim to directly improve (or reverse the decline of) the conservation status of the species, habitats, ecosystems or ecosystem services targeted. Their impact must be measurable and must be monitored and evaluated during the project.

TartaLife

LIFE12 NAT/IT/000937

2013-2019

Reducing the bycatch of sea turtles (mostly *Caretta caretta*)

LOWERING FISHING INTERACTIONS

Life DELFI

LIFE18 NAT/IT/000942

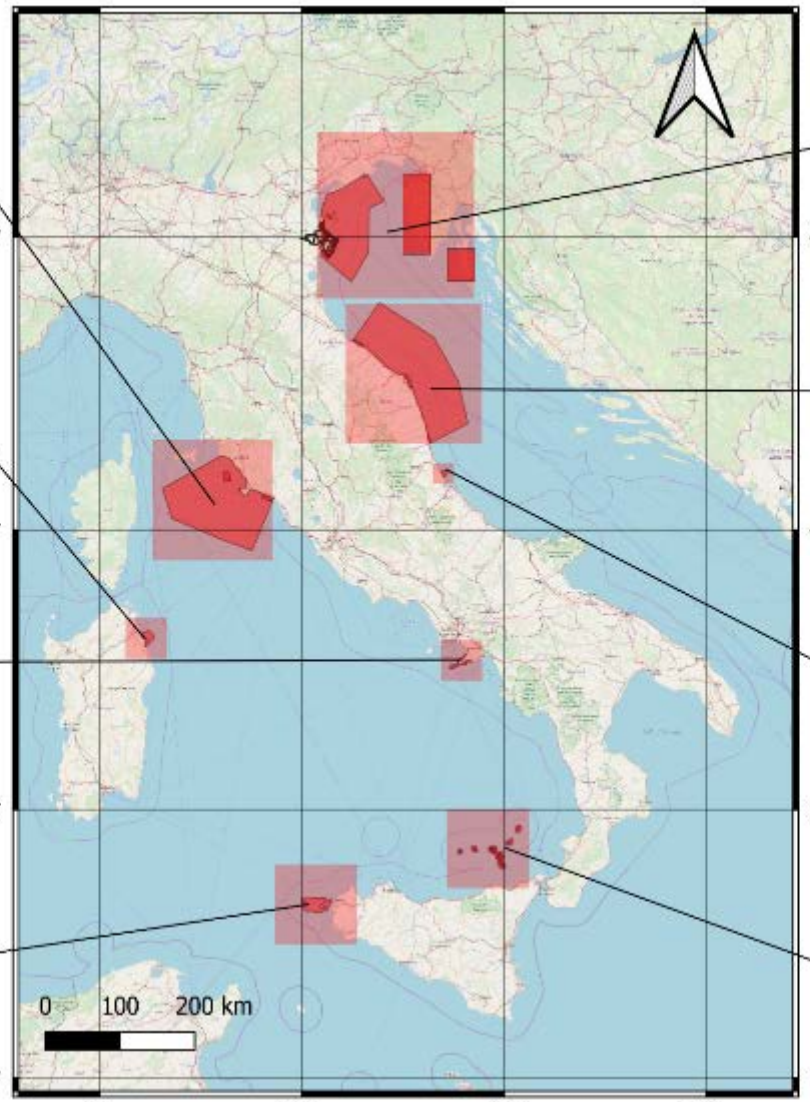
2020 - ongoing

Reducing the fisheries interaction with dolphins (mostly *Tursiops truncatus*)

Study areas

TartaLife

LOWERING FISHING INTERACTIONS life DELFI

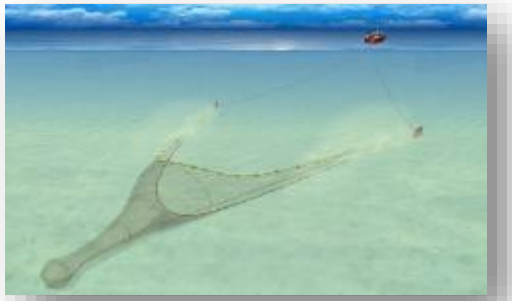


Bycatch Reduction Devices (BRDs)

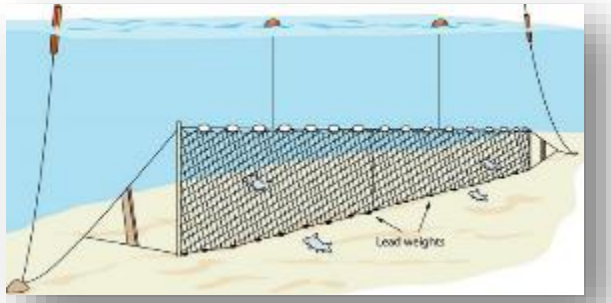
BRDs are generally defined as devices developed to exclude the endangered species like sea turtles, marine mammals or sea birds, and to reduce the non-targeted species in different gear systems.

TartaLife

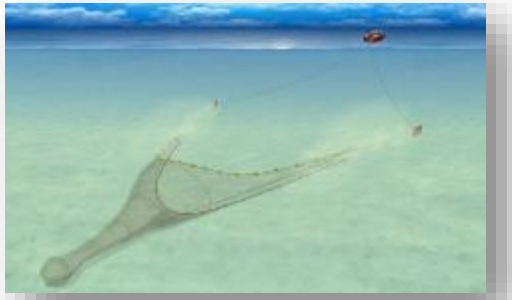
LOWERING FISHING INTERACTIONS life DELFI



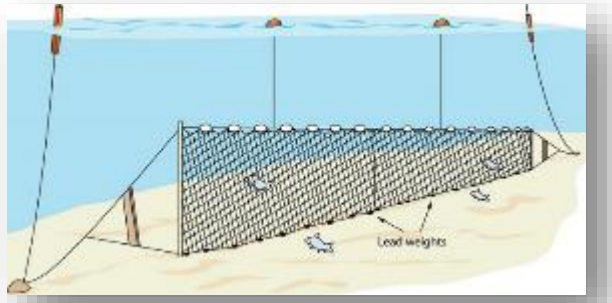
Bottom trawl



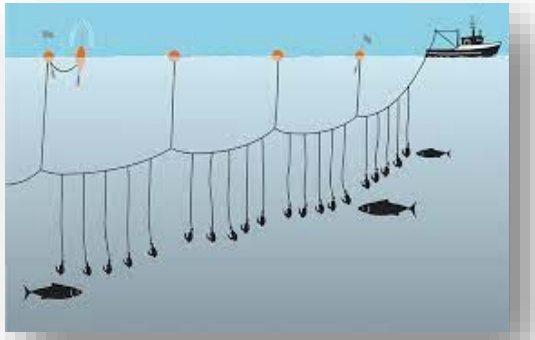
Gillnet



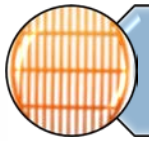
Bottom trawl



Gillnet & Trammel net

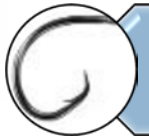


Drifting longline

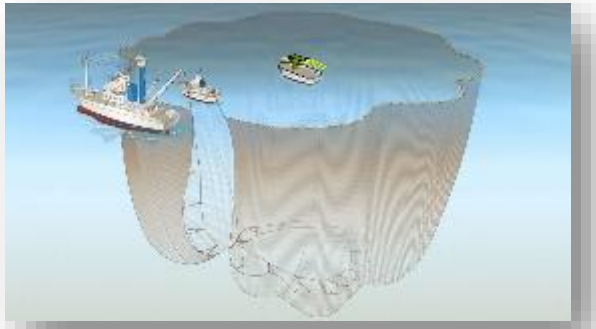


Turtle Excluder Devices

UV LED Lights



Circle Hooks



Purse seine

Interactive Pingers

Green LED Lights

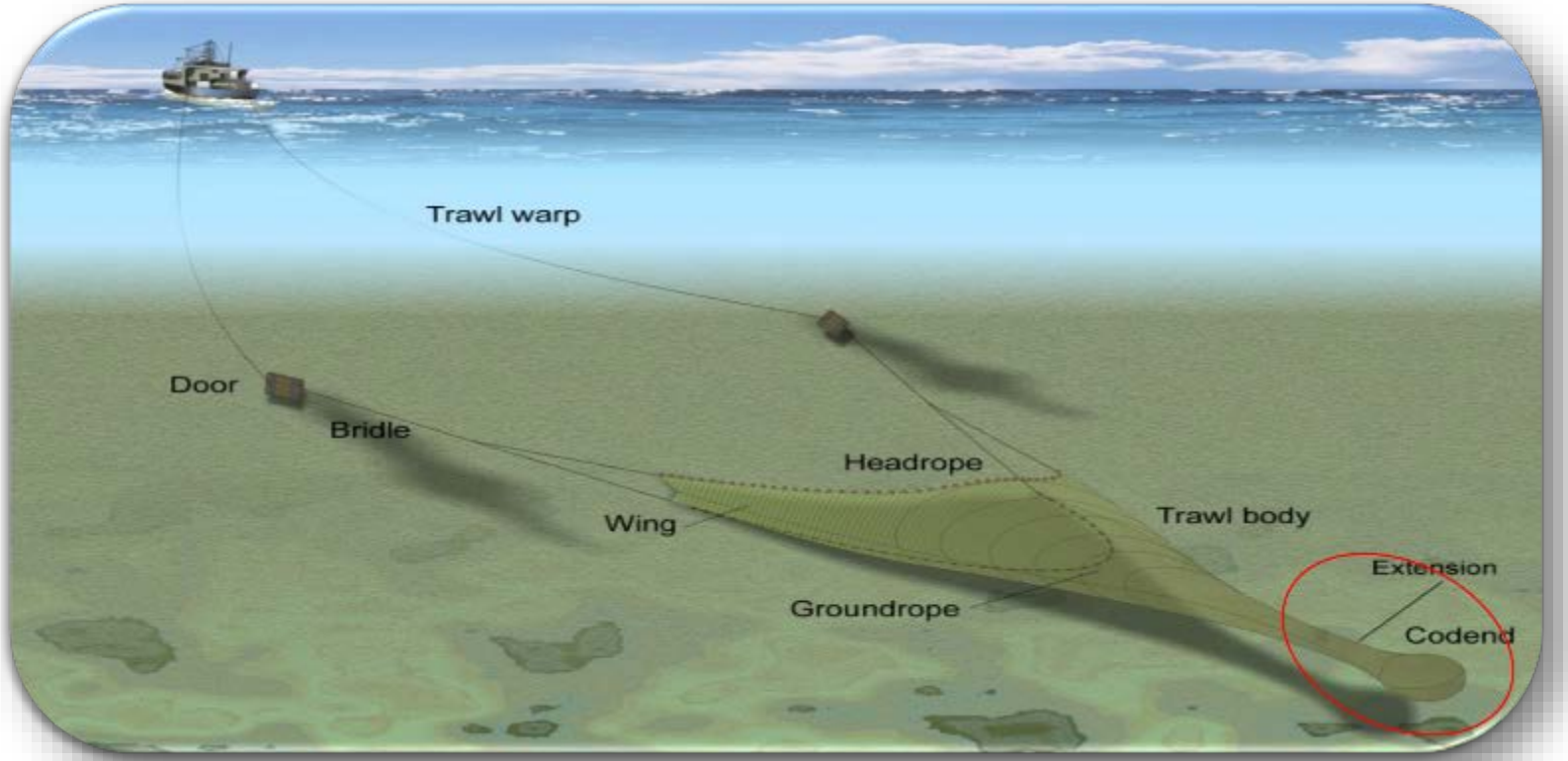
2013 - 2019

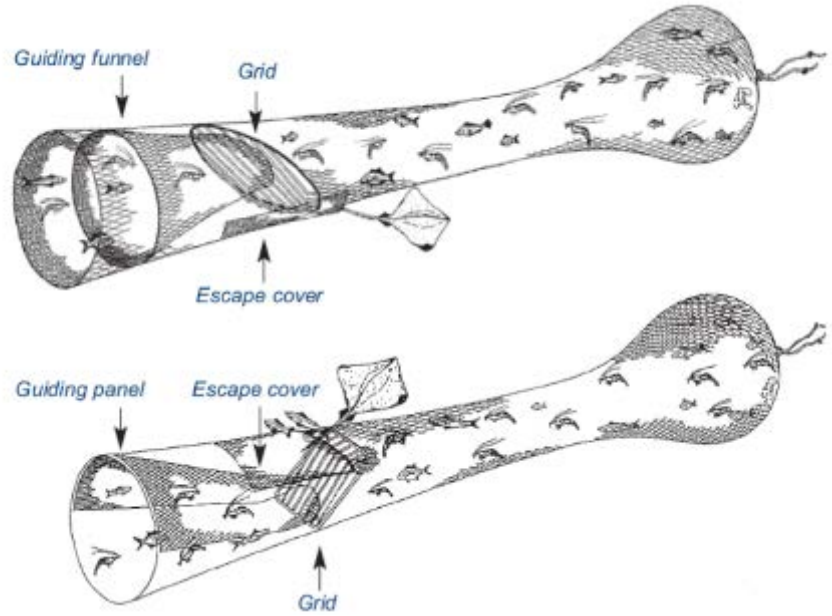
WHAT HAS BEEN DONE

TartaLife

Turtle Excluder Devices (TEDs)

TEDs are grids inserted before the codend of a trawl net that allow large objects such as sea turtles to escape from the net, while fish and other commercial species are diverted into the codend.





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Turtle Excluder Devices (TEDs)

The TED selected for sea trials was the "FLEXGRID". It is a very light grid made of high-strength plastic material, which ensures a remarkable elasticity and ability to resume its natural shape when the mechanical stresses are finished. These features allow the grid to maintain a stiff configuration during trawling but at the same time to bend it on the net winch as the net is hauled onboard.

Four models of FLEXGRID were tested

110 x 85 cm	142 x 96 cm	110 x 85 cm	110 x 85 cm
6-7 vertical bars	8 vertical bars	2 lateral holes	14 vertical bars




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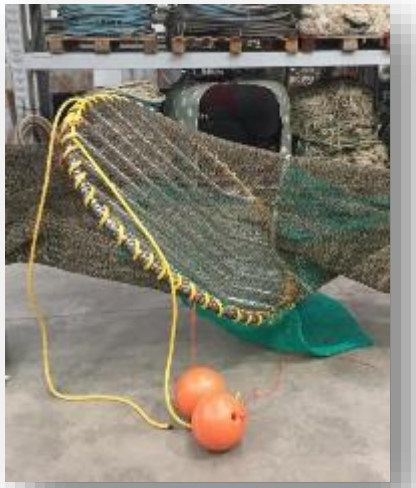
Turtle Excluder Devices (TEDs)

The performance of FLEXGRID was compared with that of a classic aluminum Supershooter grid, commonly used in shrimp fisheries in several countries.

SUPERSHOOTER



FLEXGRID

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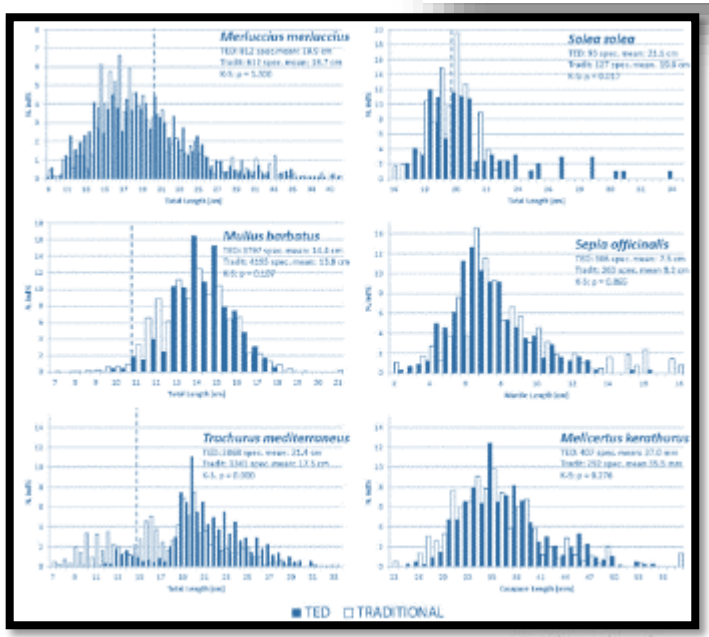
Turtle Excluder Devices (TEDs)

No loss of commercial catch was observed while using the FLEXGRID.



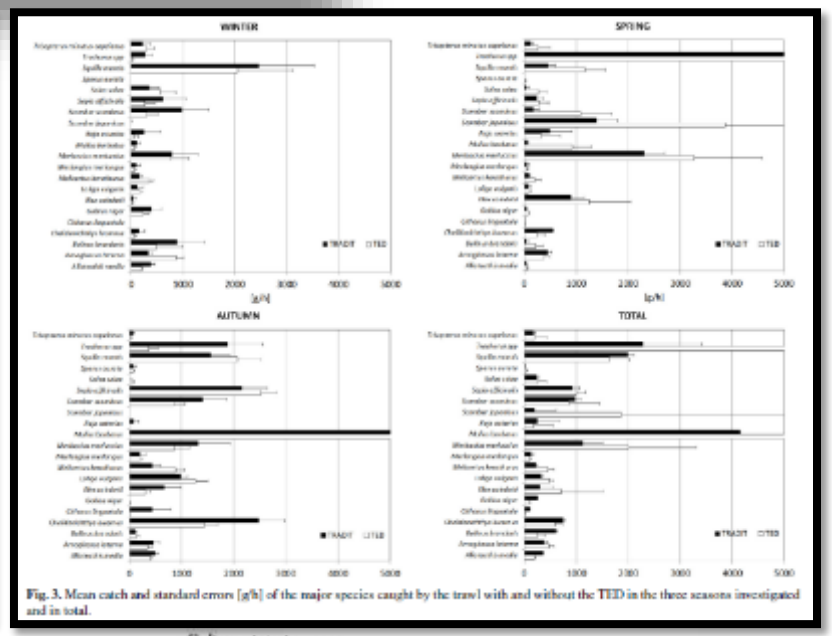
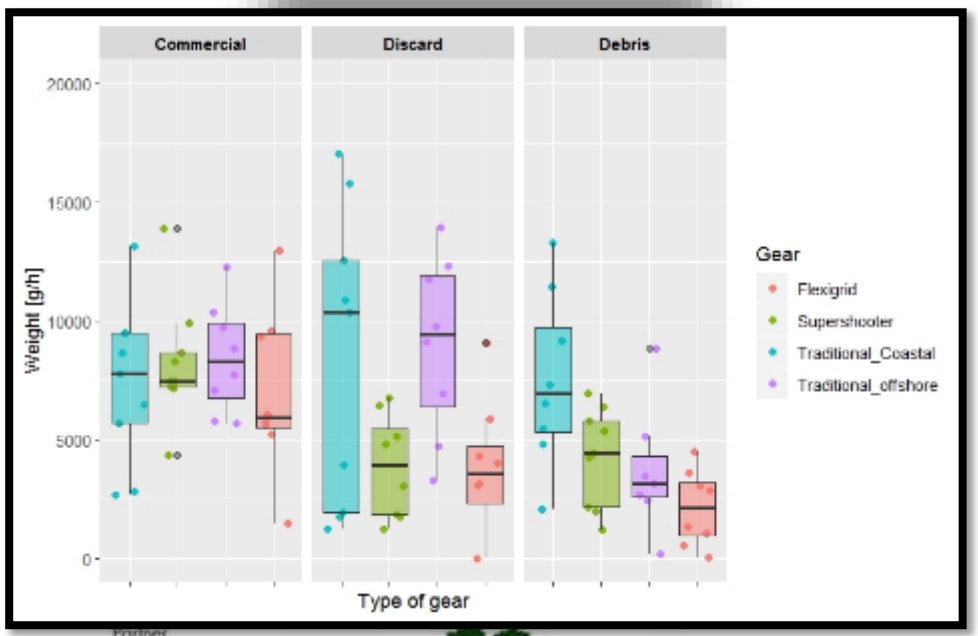


Fig. 3. Mean catch and standard errors [g/h] of the major species caught by the trawl with and without the TED in the three seasons investigated and in total.



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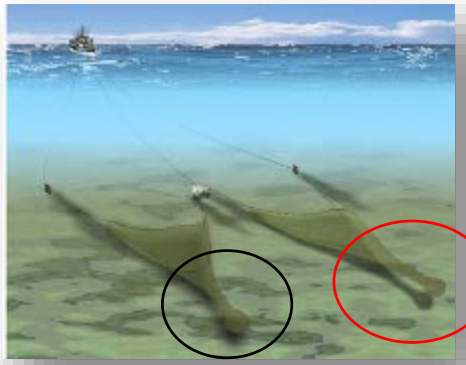
Turtle Excluder Devices (TEDs)

The bycatch of sea turtles (mostly *Caretta caretta*) was absent.



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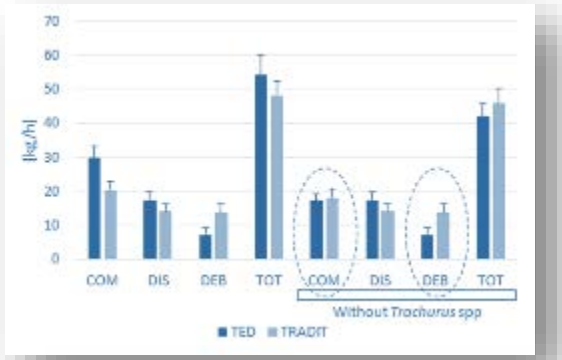
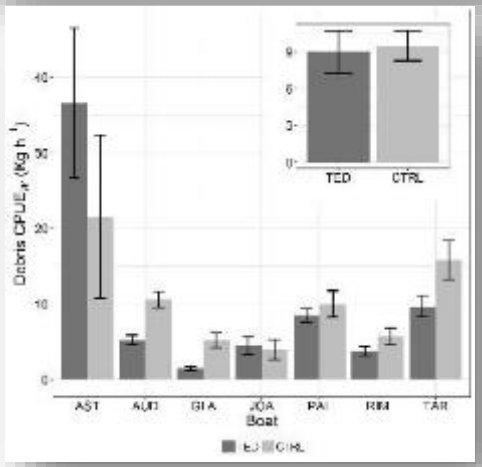
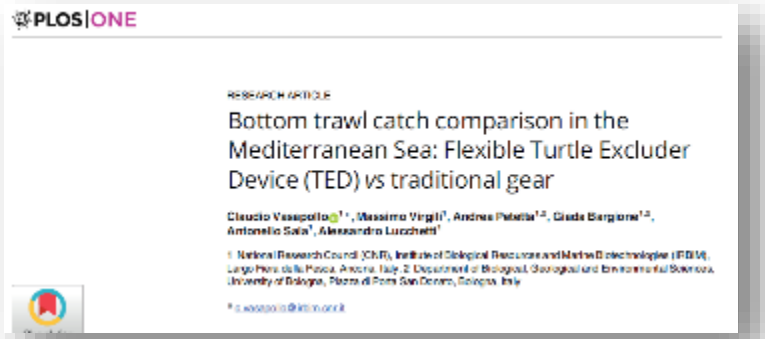
Turtle Excluder Devices (TEDs)

The TEDs allowed to reduce the catch of marine debris and help improving the quality of the commercial catch.







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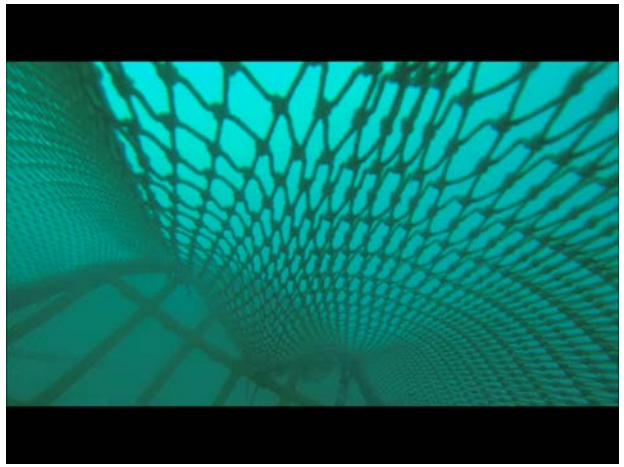
Turtle Excluder Devices (TEDs)

Reduction of marine litter better fish quality



Reduction sea turtle bycatch Bycatch

13 tartarughe pescate in assenza di TED

LIFE 18 NAT/IT/000846

Life Elife

GOAL: evaluate the effectiveness of sorting grids (SED, Shark Excluder Device) in the Adriatic Sea and in the Sicilian Channel

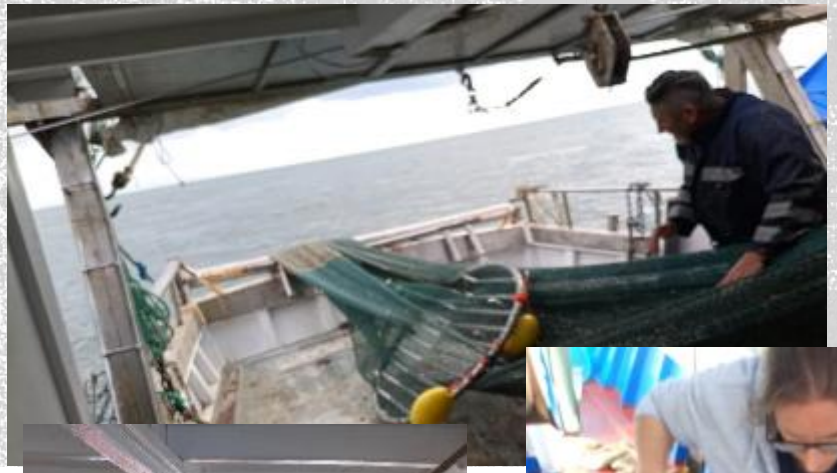
Life Elife

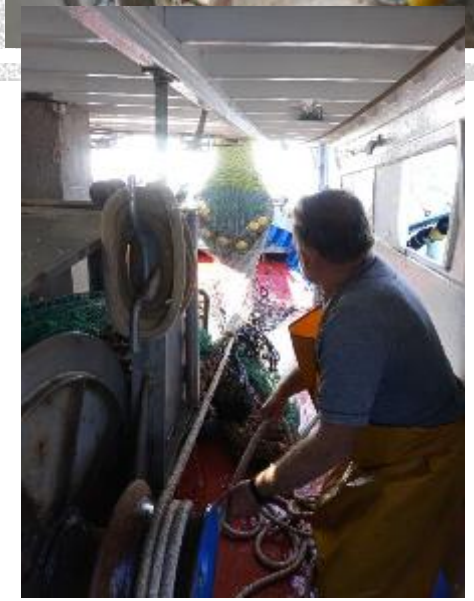
WHAT HAS BEEN DONE SO FAR

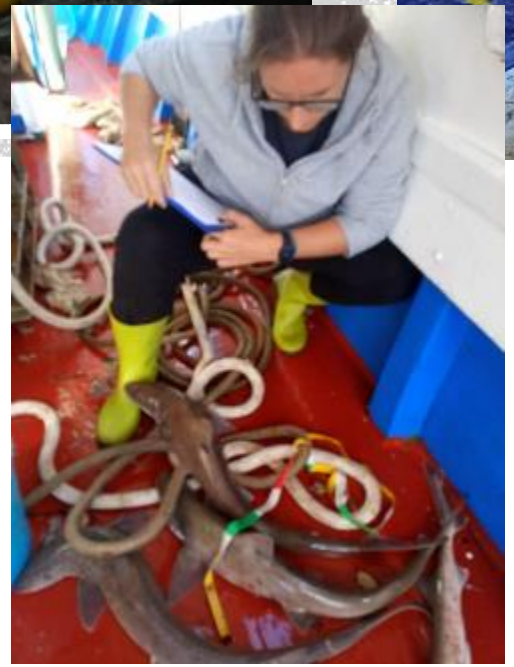
- Sea trials DONE
- Sea trials are planned for Feb 2022
- Sea trials should start during summer 2022

Life Elife

WHAT HAS BEEN DONE SO FAR





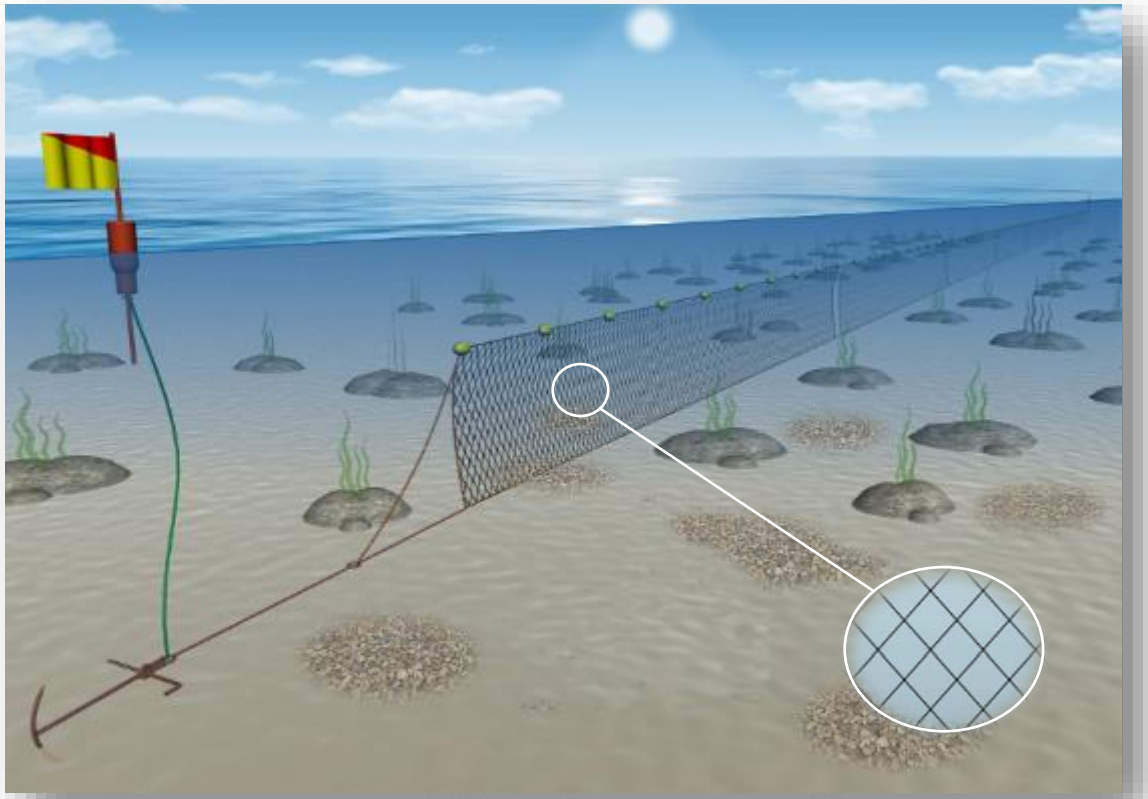


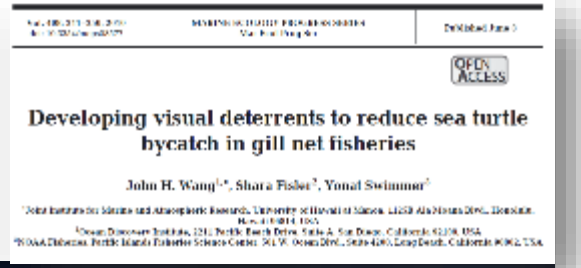
Life Elife

WHAT HAS BEEN DONE SO FAR

UV-LED Lamps

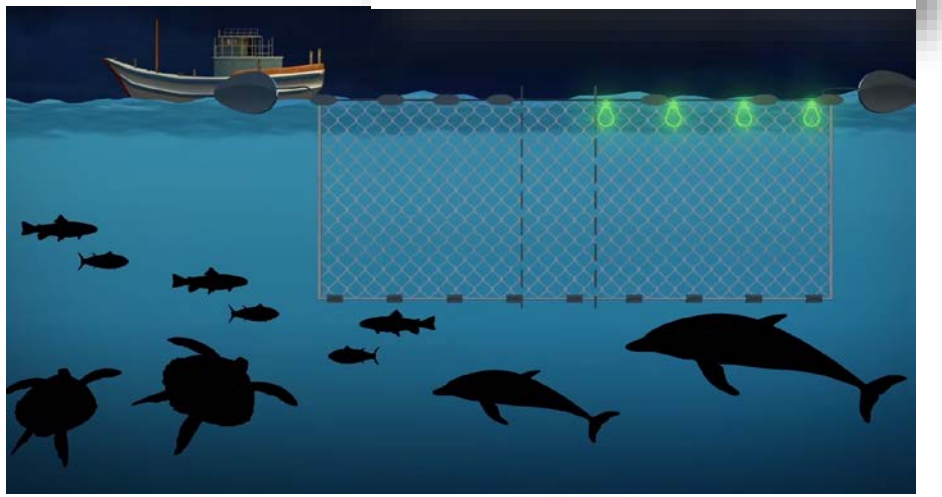
The UV-LED lamps act as visual deterrents for sea turtles; they are similar to the light sticks used in set and drifting longlines, but they have been tested in bottom gillnets.





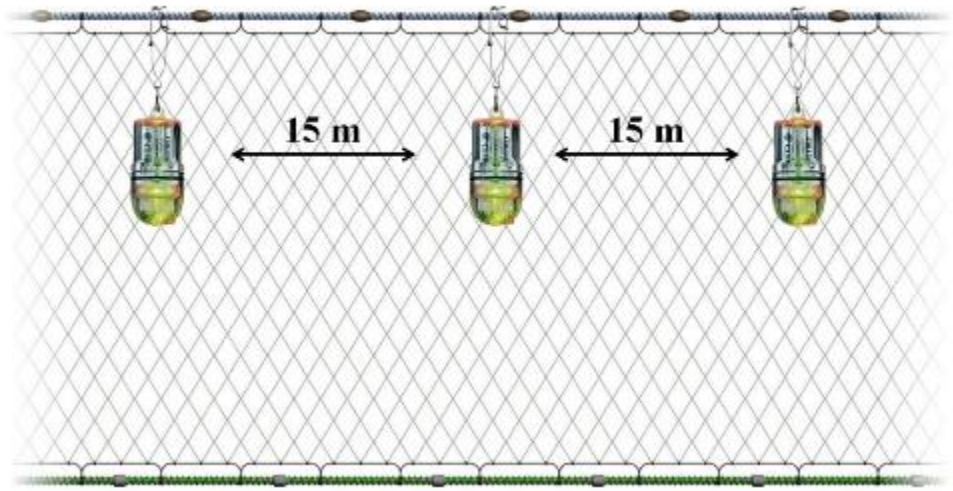
Developing visual deterrents to reduce sea turtle bycatch in gill net fisheries

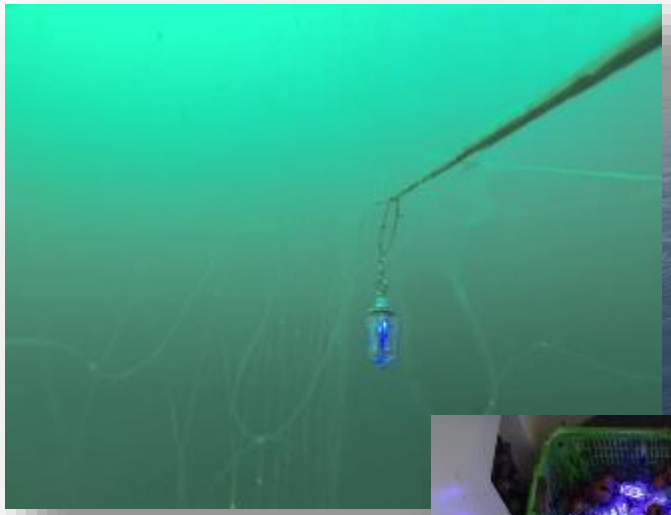
John H. Wang[1,*], Shara Fisler[2], Yonat Swimmer[3]



UV-LED Lamps

UV-LED lamps were attached to gillnet float lines at a distance ~ 15 m (corresponding to 70 lamps/km) to maximize gear performance (buoyancy) and net illumination.





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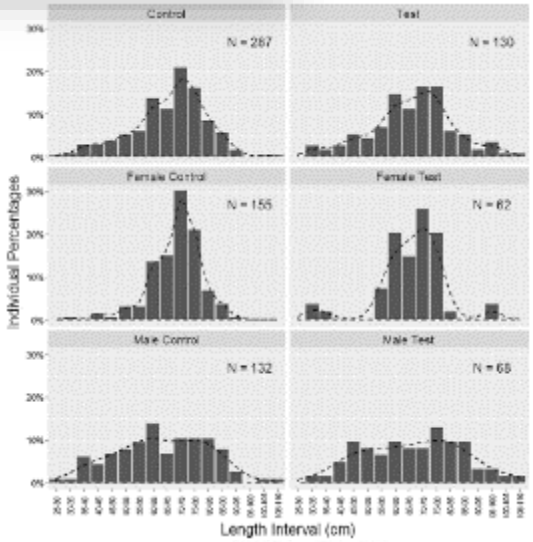
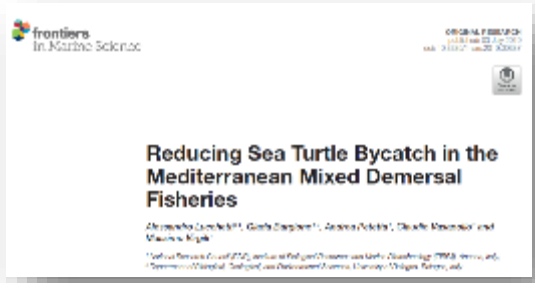
UV-LED Lamps

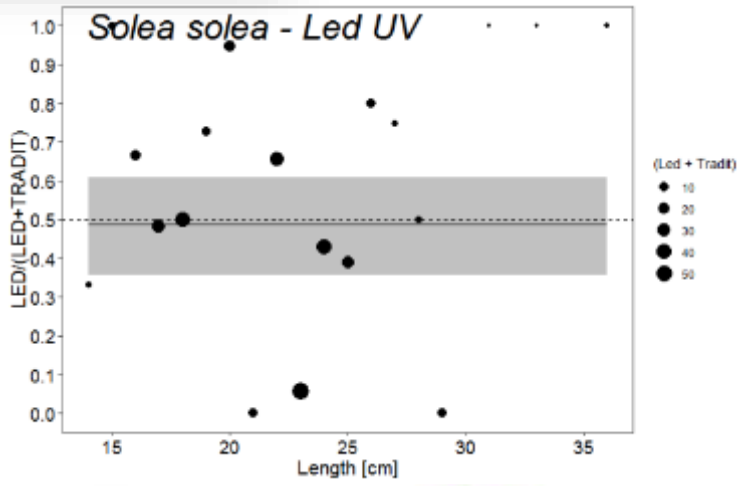
Both offshore and inshore trials revealed no significant differences in the composition of commercial catch.

Raja clavata





Solea solea



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UV-LED Lamps

All the loggerhead sea turtles (11) were caught in the control nets without the visual deterrents. The mortality rate was 30%.


Fisheries Research

Can ultraviolet illumination reduce sea turtle bycatch in Mediterranean set net fisheries?

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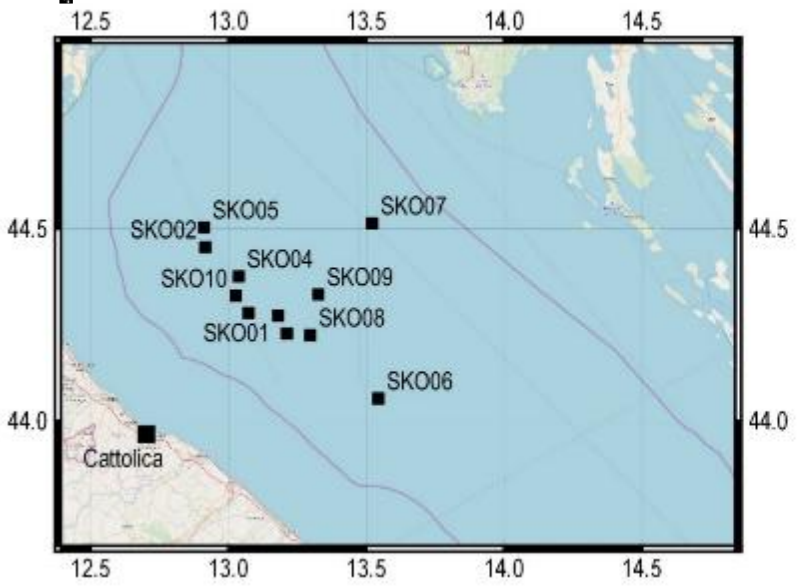
UV-LED Lamps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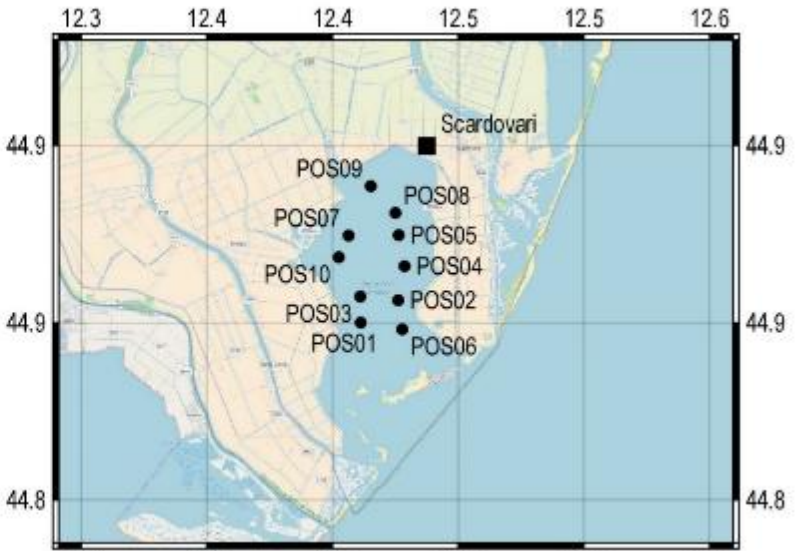
Cattolica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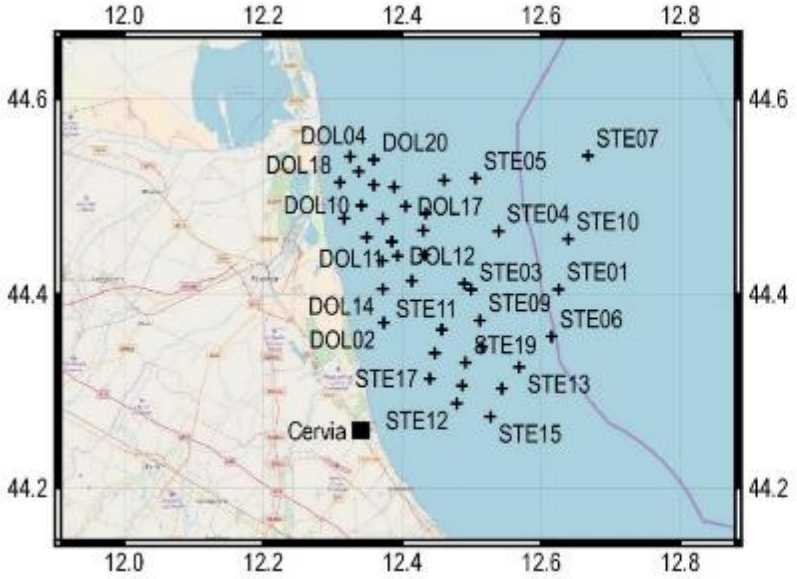
POS06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STE10
DOL11
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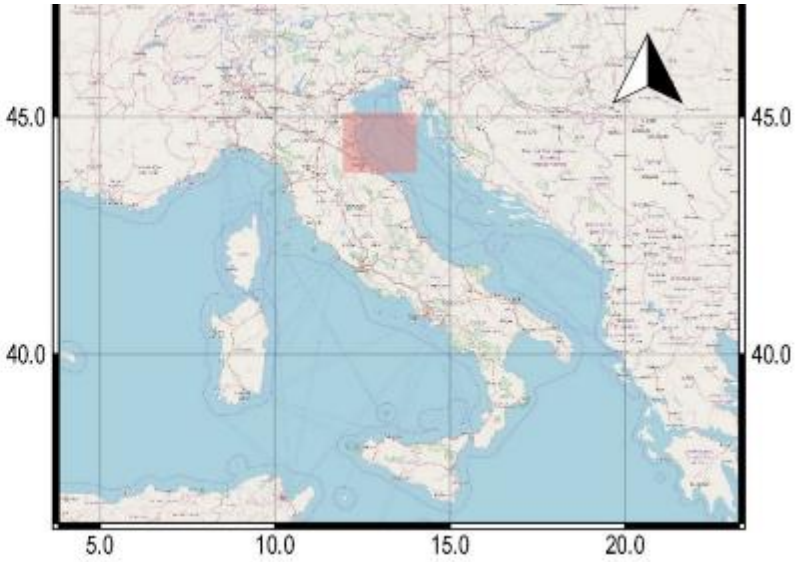
Cervia
STE12
STE15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40.0
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10.0
15.0
20.0

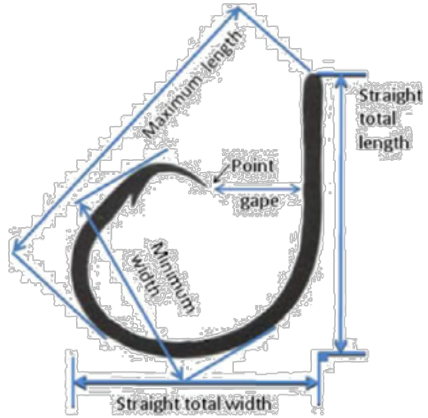
UV-LED Lamps

Reduction of sea turtle bycatch: 100%

11 turtles caught with nets without lapms (direct mortality rate 30%).

Circle Hooks

Circle Hooks were disseminated in the drifting longline targeting swordfish (*Xiphias gladius*). A smaller C hook was tested compared to previous experiments following fishers' advice, and was compared with traditional J hooks with the same gape.



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Circle Hooks

C hooks caught less but significantly bigger individuals of swordfish than J hook, meaning that the larger width leads to a higher size selectivity.

250 trials

60 trials

N° individuals caught	**677 (mean: 2.7 ind/haul)**
Kg caught	**11941 (mean weight per ind: 16.2 kgl)**

N° individuals caught	**263 (mean: 4.4 ind/haul)**
Kg caught	**4030 (mean weight per ind: 14.8 kg)**

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Circle Hooks

- ✓ 250 sea trials with circle hooks
- ✓ 53 vessels in 29 harbours in 9 Regions
- ✓ 239 fishermen involved

	Prove realizzate	Prove previste
Unimar	210	210
Legambiente	14	14
PN Asinara	16	16
AMP Pelagie	10	10
Totale	250	250

Circle Hooks

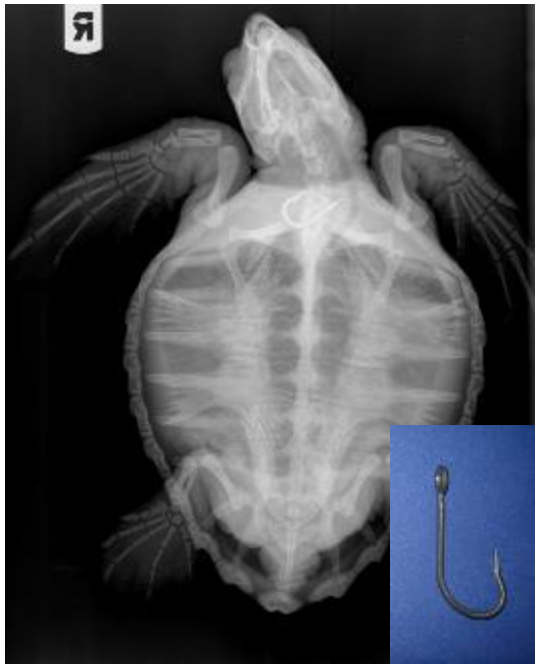
	Circle hooks	J Hooks
N° hauls	250	60
N° turtle caught	15 (mean 0,06/haul)	10 (mean 0,17/haul)
N° tartarughe rilasciate vive	15	15
N° tartarughe morte	0	0
N° *Pteroplatytrygon violacea*	15 (mean 0,06/haul)	40 (mean 0,67/haul)

Circle Hooks

Circle Hooks

Circle Hooks

All the loggerhead sea turtles (15) caught with C hooks were hooked in the mouth, while 2 out of 12 sea turtles caught with J hooks did swallow the hook.



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Circle Hooks

Regardless of the species caught, C hooks were pierced in mouth of the prey, while J hooks were more easily swallowed, leading to higher direct mortality rate.

Pteroplatytrygon violacea

Coryphaena hippurus

Prionace glauca

2020 - ongoing

WHAT TO DO

LOWERING FISHING INTERACTIONS

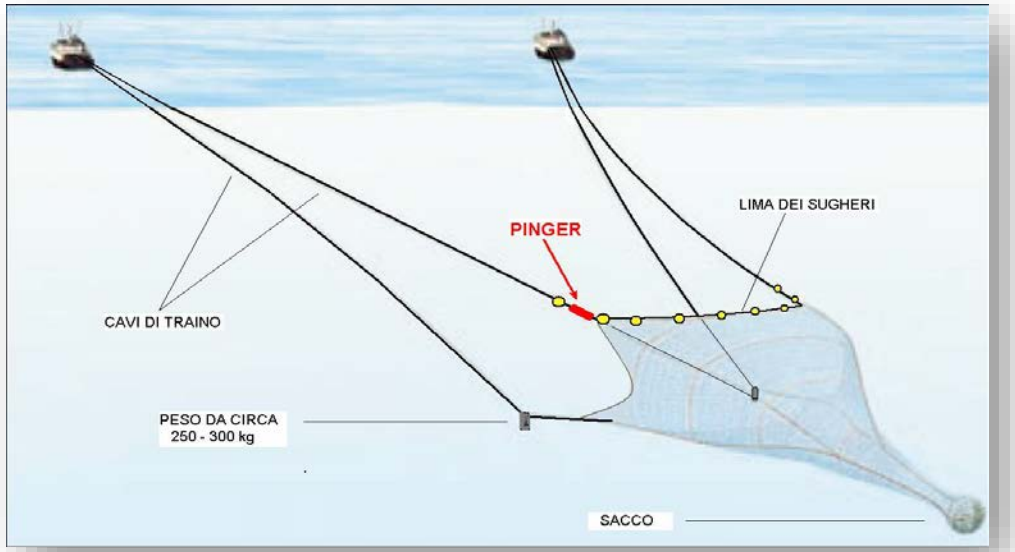
life DELFI

Source: Bearzi e Bonizzoni, 2018

"Traditional" Pingers

Traditional pingers (DDD, AQUAMARK) are acoustic deterrent devices that emit a continuous noise.

No statistical evidence was found on the sightings of bottlenose dolphins in midwater pair trawling.



DDD 03H

(STM, IT)

AQUAMARK

(AQUATEC, UK)

Midwater pair trawl

BYCATCH PROJECT – EC 812/2004
(2009-2016)

Coordinating beneficiary

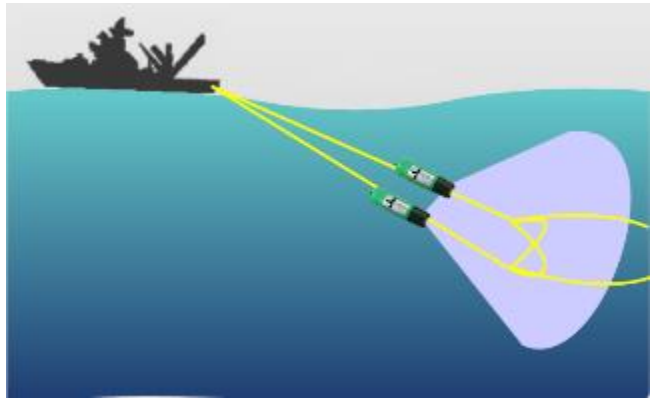
Associated beneficiary

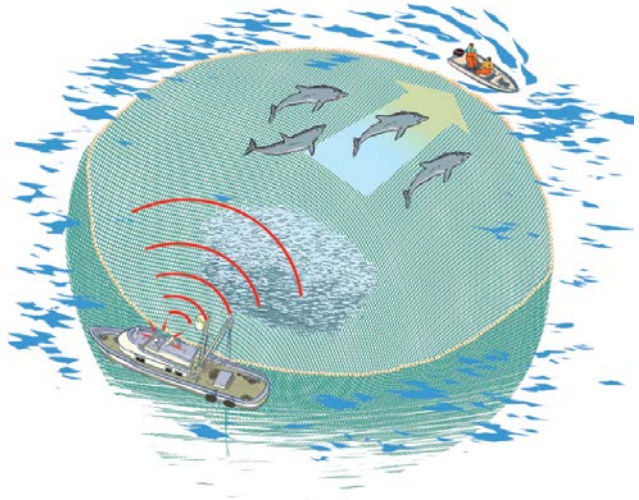
www.lifedelfi.eu

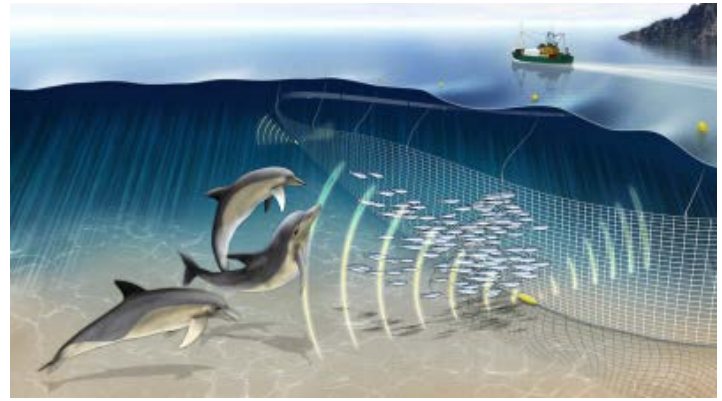
Interactive Pingers

Interactive pingers (DiDs, STM, IT) specifically designed to emit deterrent signals only in response to dolphin echolocations clicks.

Therefore they minimize dolphins habituation to acoustic stimuli, reduce the noise pollution and improve battery duration.

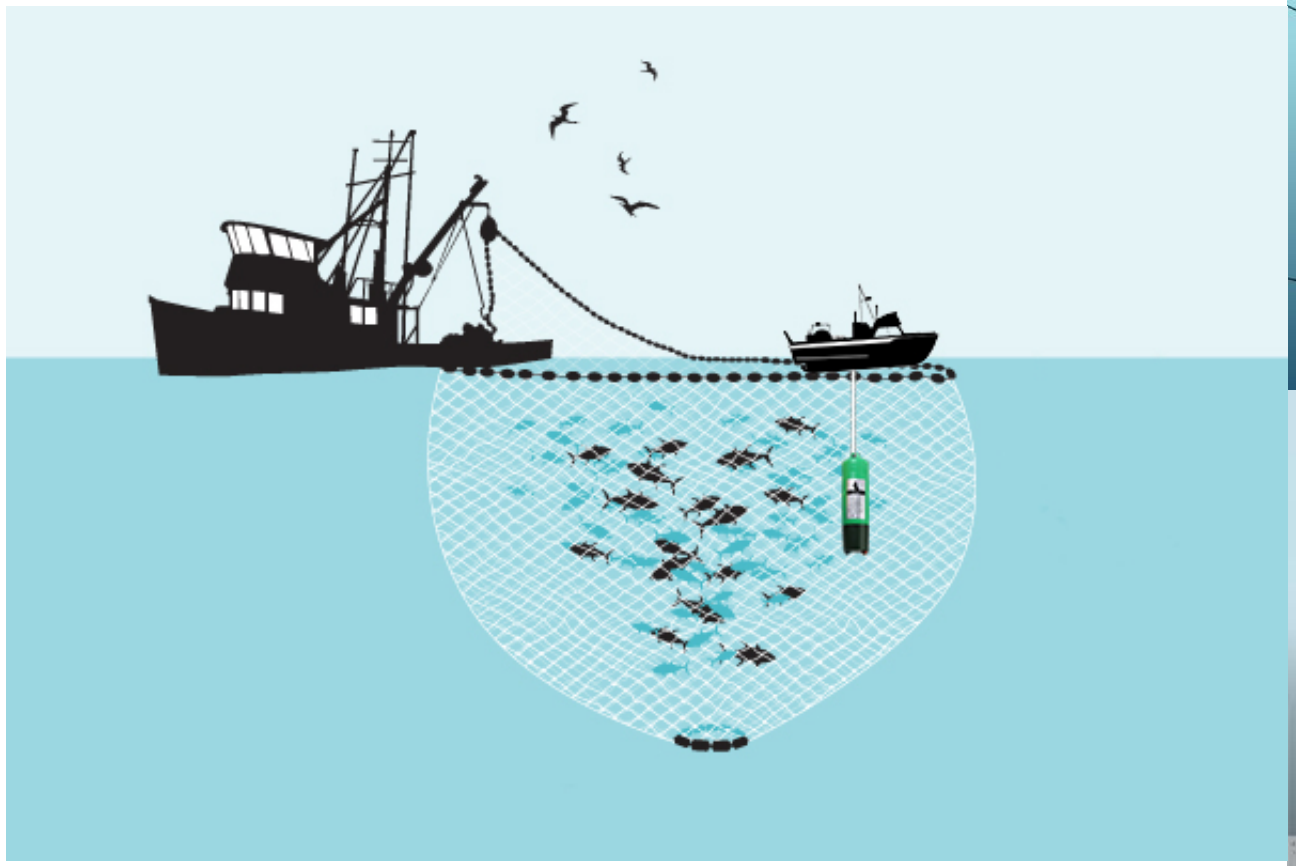


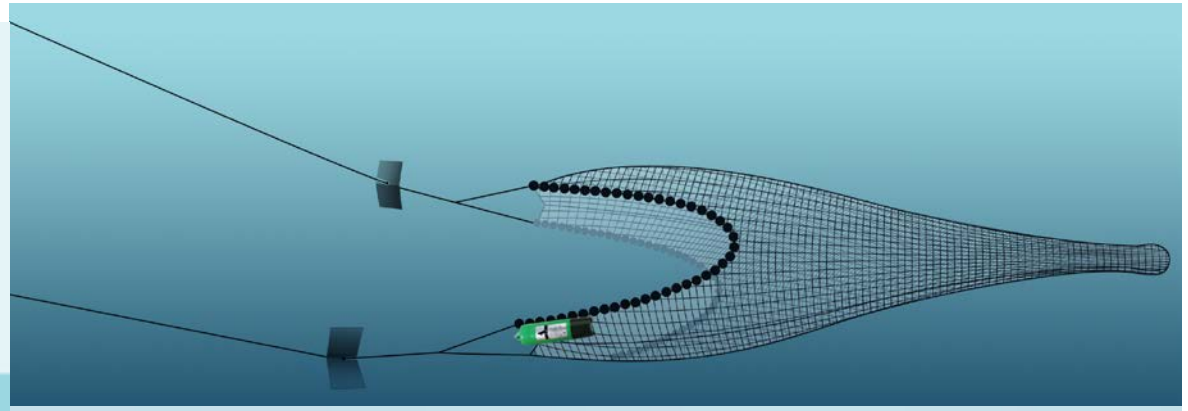


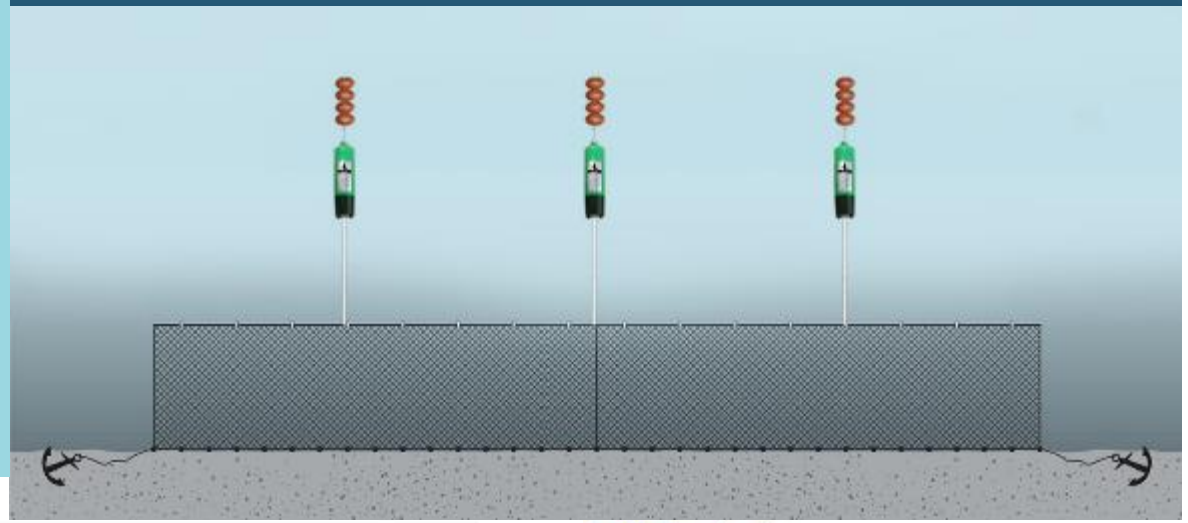


Interactive Pingers

DiDs will be tested in purse seines, bottom trawl and set nets.







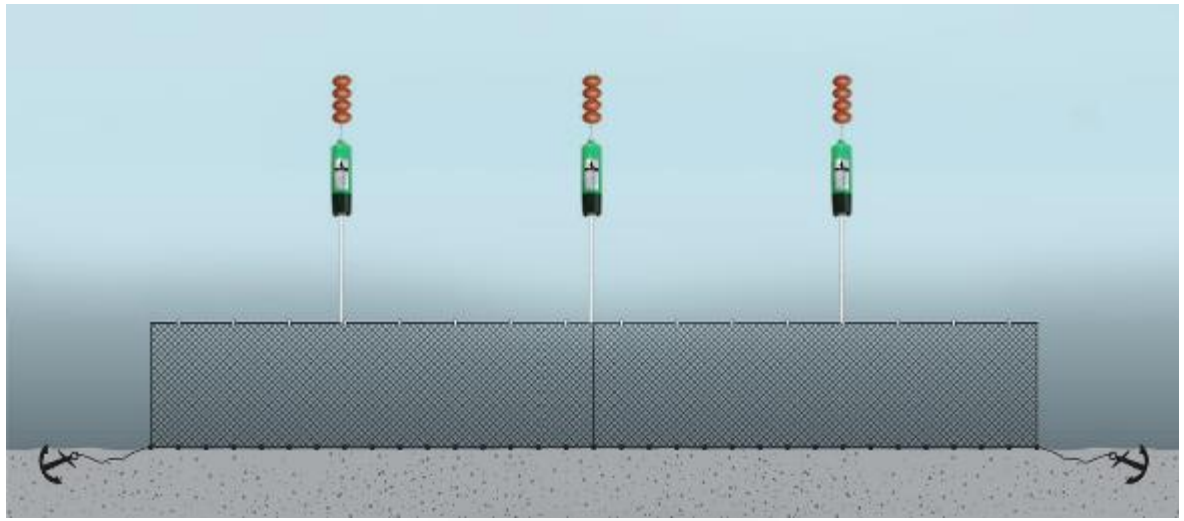
Coordinating beneficiary

Associated beneficiary

www.lifedelfi.eu

Interactive Pingers

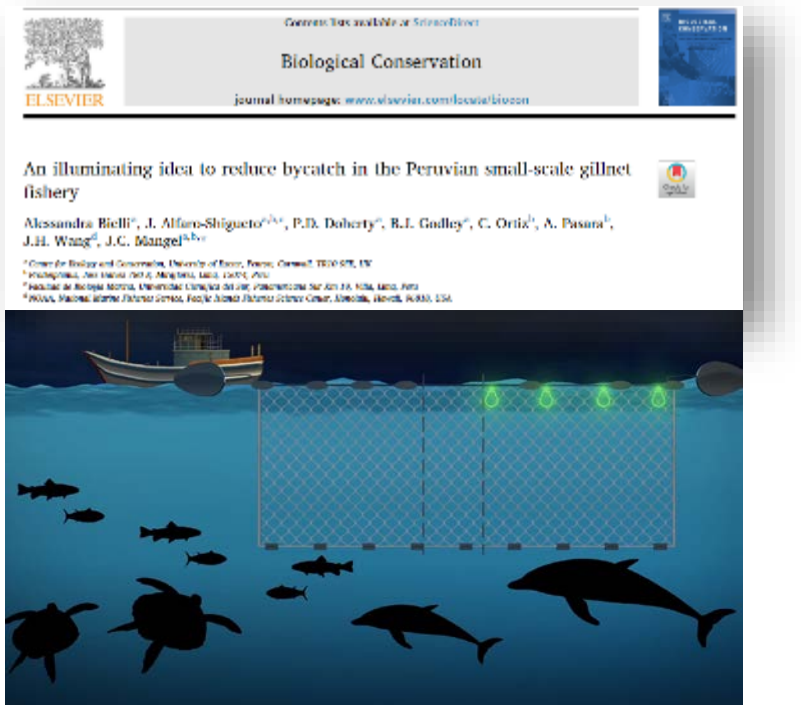
DiDs have already proven to be effective in gillnets targeting common sole in the summer period.



Solea solea

Green LED Lamps

Green LEDs act as visual deterrents and are a promising, cheap and easy way to minimize bycatch of a range of endangered species (multi-taxa BRDs).



Biological Conservation

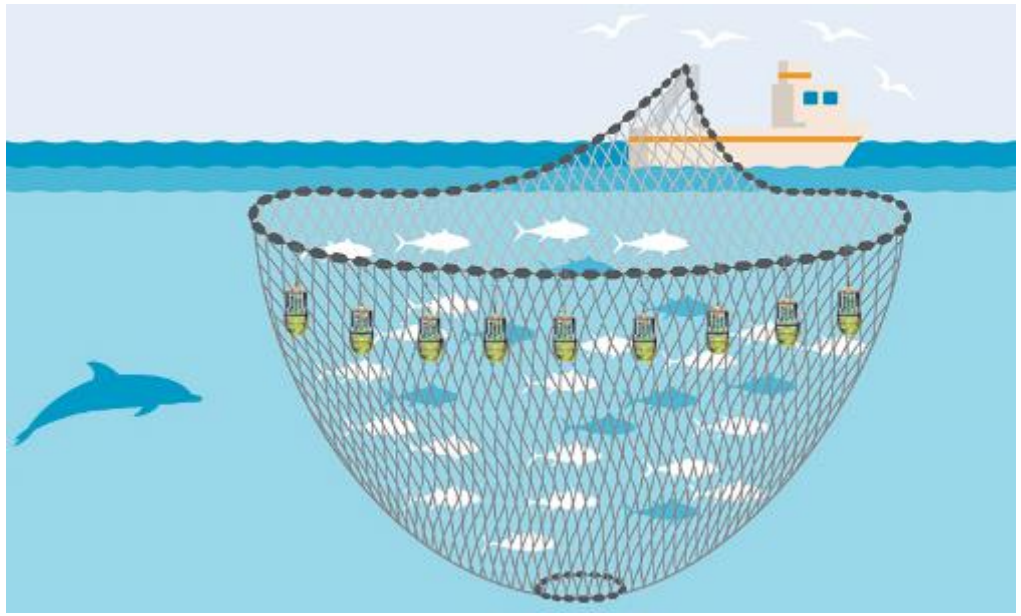
journal homepage: www.elsevier.com/locate/biocon

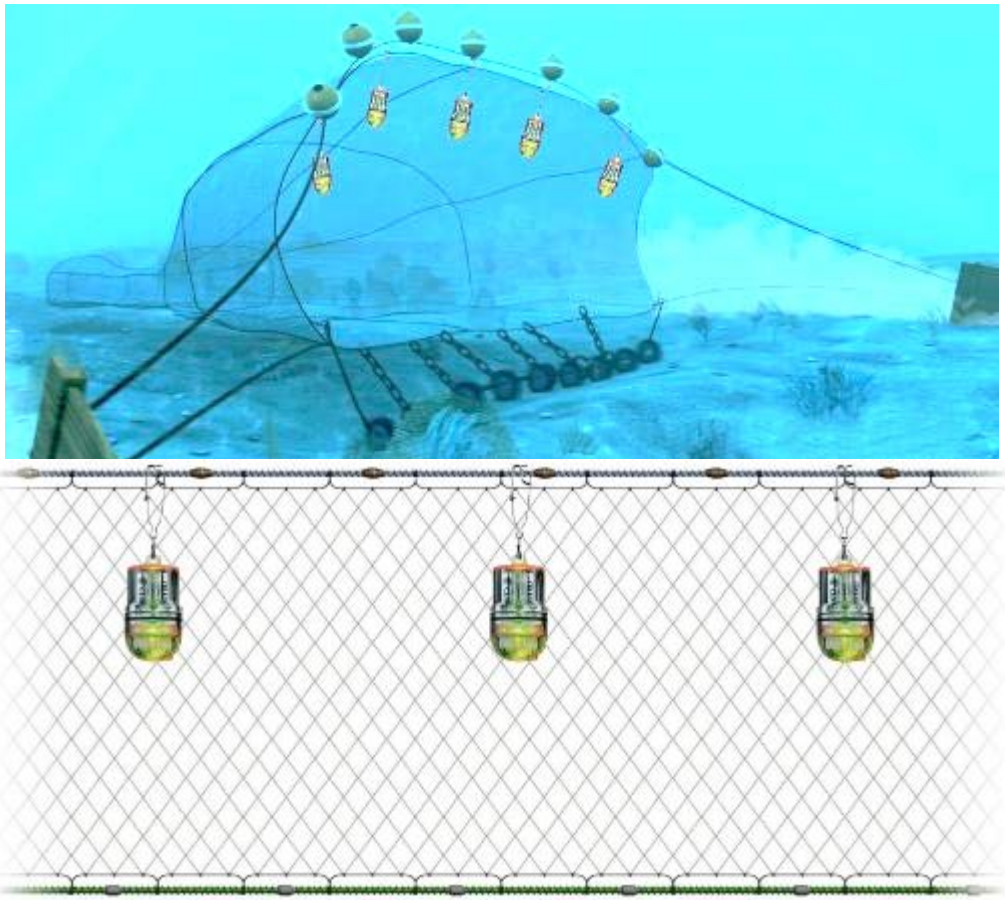
An illuminating idea to reduce bycatch in the Peruvian small-scale gillnet fishery

Alessandra Bielli[a], J. Alfaro-Shigueto[a,b,c], P.D. Doherty[a], B.J. Godley[a], C. Ortiz[b], A. Pasara[b], J.H. Wang[d], J.C. Mangel[a,b,c]

Green LED Lamps

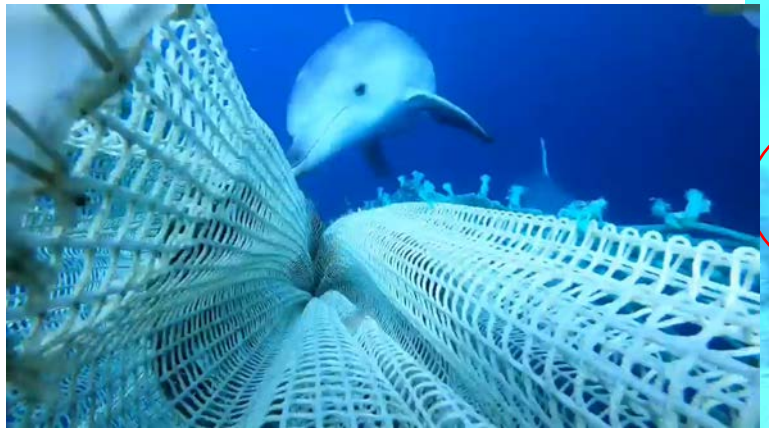
Green LED Lamps will be tested in purse seines, bottom trawl and set nets.

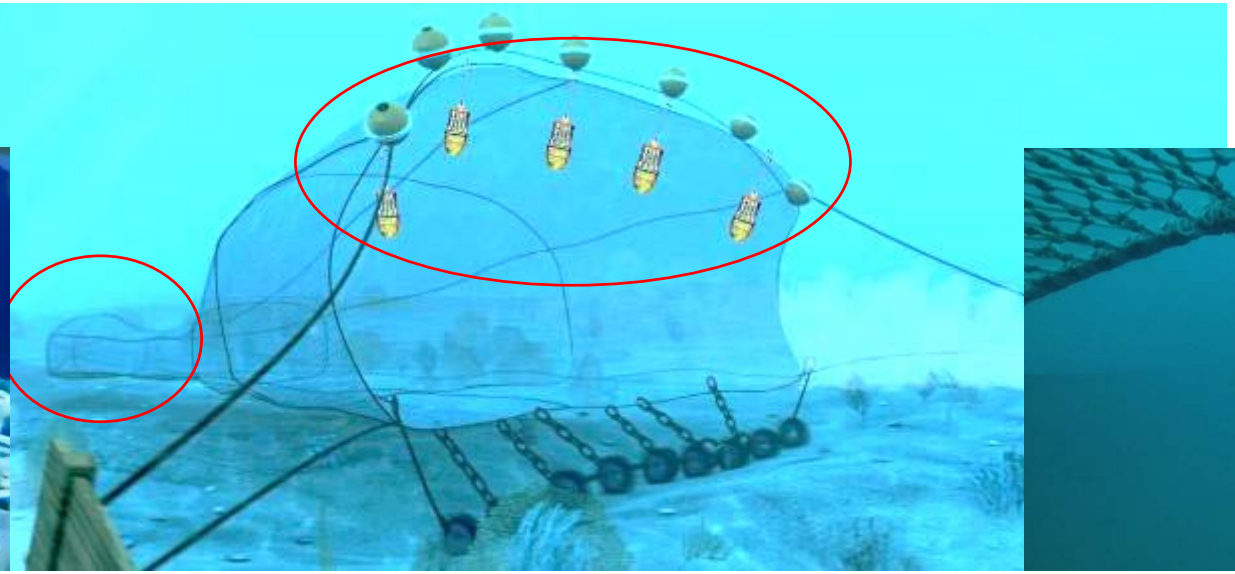




Green LED Lamps

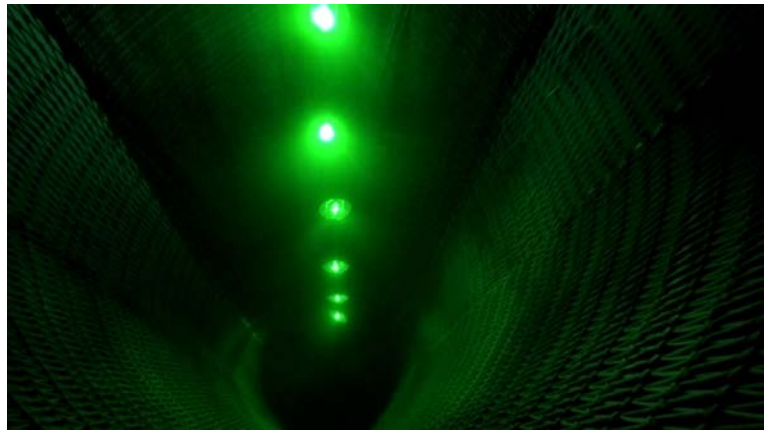
Green LED Lamps will be tested in different parts of the trawl net, since dolphins have been observed both in front of the mouth and behind the codend.





Other visual deterrents?

There are new devices (prototypes) that can be set to different wavelengths, at various intensities and flashing rates.

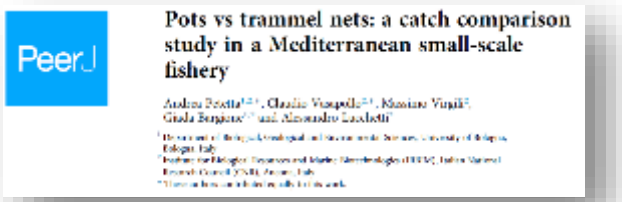


SafetyNet TECHNOLOGIES

"PISCES CAN REDUCE BYCATCH BY UP TO 90%... WE ARE REALLY HOPEFUL THAT IT WILL BE A GAMECHANGER FOR THE INDUSTRY"

Alternative gears

Another objective of both LIFE projects is to promote pots as alternative and more sustainable fishing gears than traditional ones, such as set nets. Pots will allow to reduce depredation and bycatch events.



TartaLife

LOWERING FISHING INTERACTIONS
life DELFI

Collaboration

A constant collaboration with fishers is a key issue for the reduction of bycatch and interactions among fishing gears and protected species.

TartaLife → LOWERING FISHING INTERACTIONS life DELFI

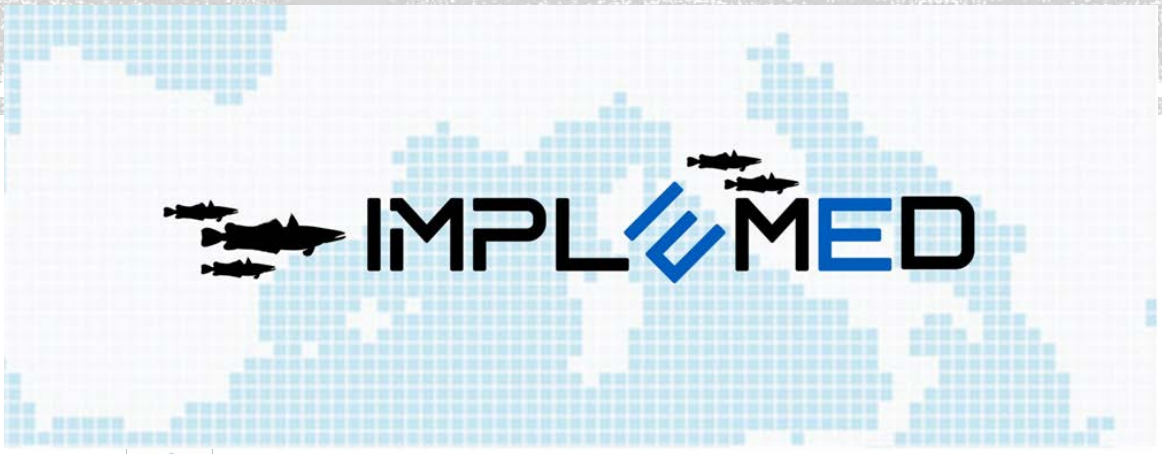
Certification

A code of conduct addressing the problem of interaction between dolphins and fishing activities and providing standard procedures applicable in case of dolphin bycatch or in any different interaction will be drafted through a participated path with fishers.

This action will represent the starting point for a future ECO-Labeling certification of the fish products, as "Dolphin Safe" label

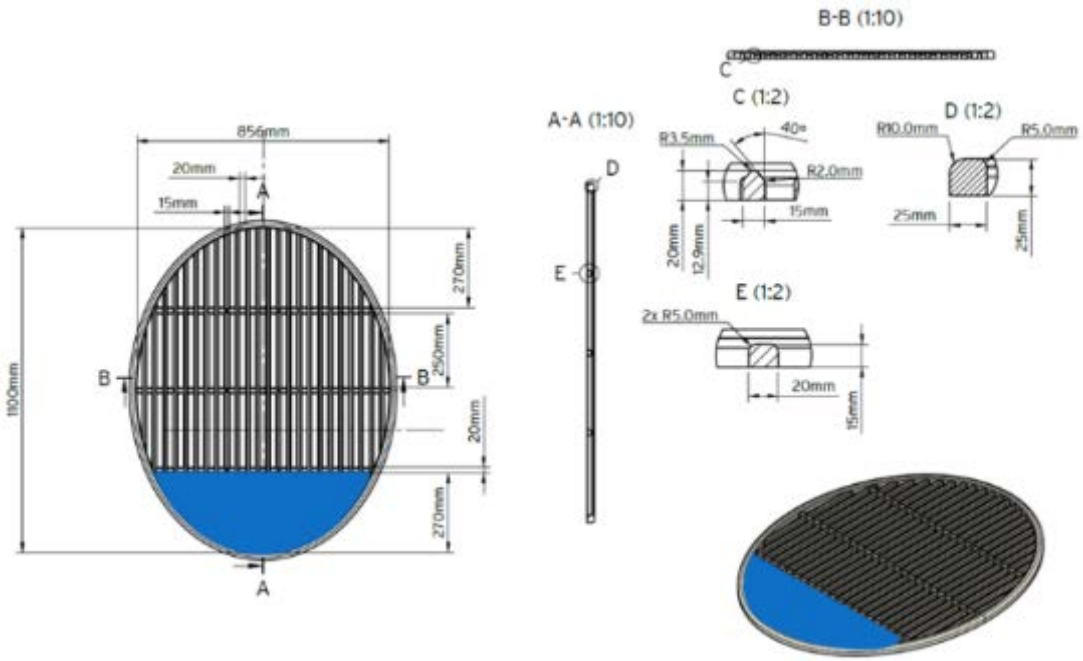
MAREA - Framework Contract No EASME/EMFF/2016/032

Improving the selectivity of trawl gears in the Mediterranean Sea to advance the sustainable exploitation pattern of trawl fisheries

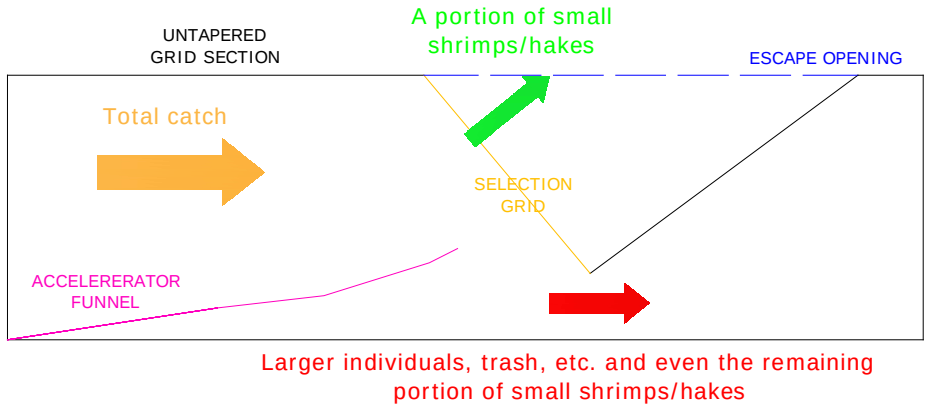


SubTask 2.1 – Juveniles Selection Grid (JTED)

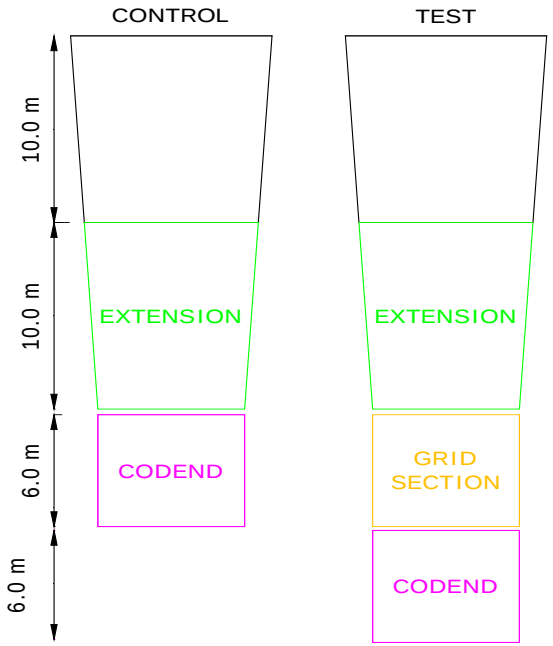
- The 2-section juveniles selection grid selected for the sea trials is the “FLEXGRID”.
- It is a very light grid made of an alloy of high-strength plastic material, which ensures a remarkable elasticity and ability to withstand considerable bends and to resume its natural shape when the mechanical stresses are finished .
- The upper section is made of bars spaced 20 mm each, to let only juveniles pass through the grid and reach an escape opening. The lower section has a hole that guides large animals (i.e. the commercial catch) towards the codend.



SubTask 2.1 – Juveniles Selection Grid (JTED)



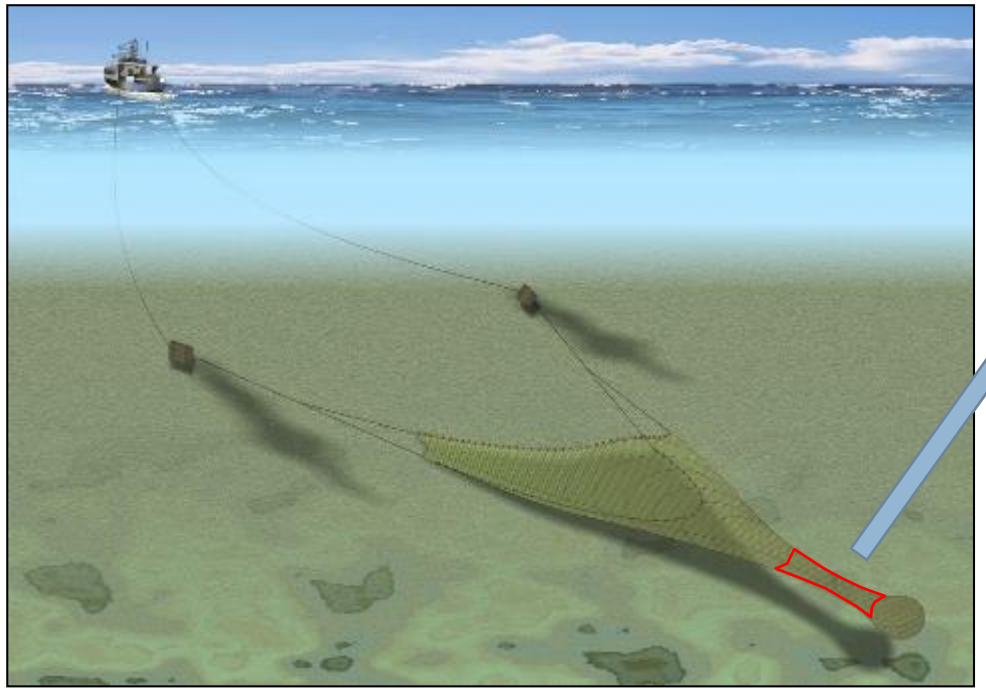
The grid is mounted on a tubular netting section with a tilt angle of 46° and placed in the extension piece, in front of the codend.



The test configuration is obtained by inserting the grid section between the extension and the codend

SubTask 2.1 - T90 in the extension piece

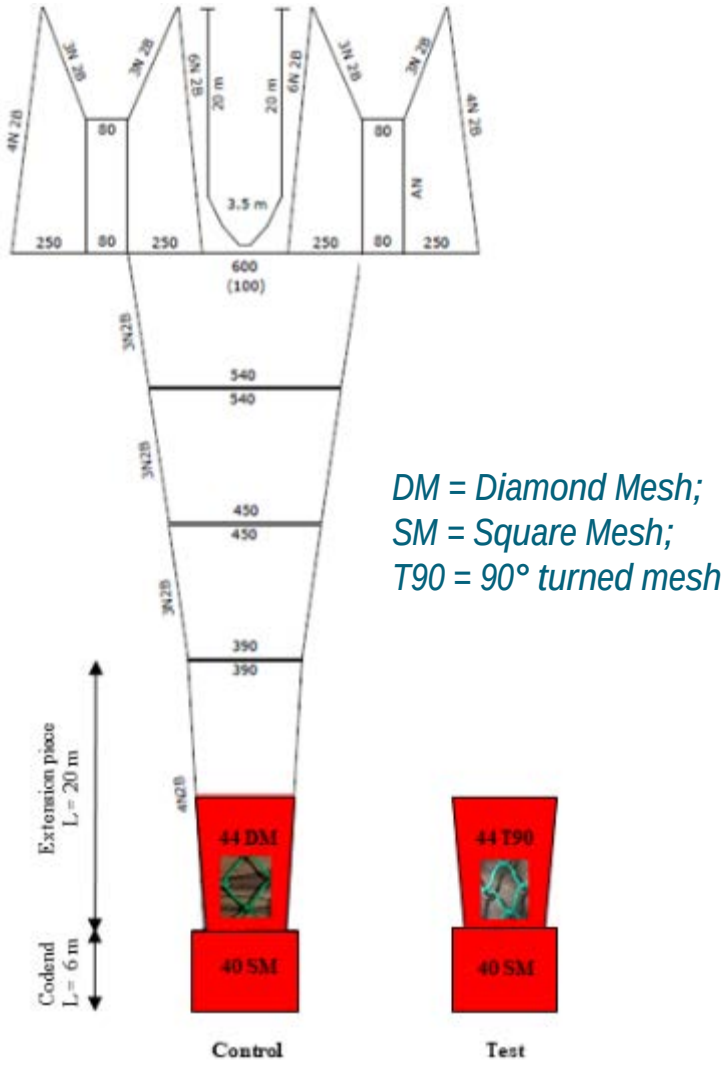
- The 90° turned mesh configuration is a simple rotation by 90° of a traditional diamond mesh netting; as a result, the meshes remain more open under the weight of the catch, enabling smaller specimens to escape.
- An extension piece made of T90 netting has been tested and compared to a traditional diamond mesh extension piece.



Diamond *T90*

- Both configurations were constructed from the same netting panel of 44 mm mesh size.
- The resulting extension pieces were identical except for the mesh configuration.
- The codends are maintained identical (40 mm square mesh).

SubTask 2.1 - T90 in the extension piece

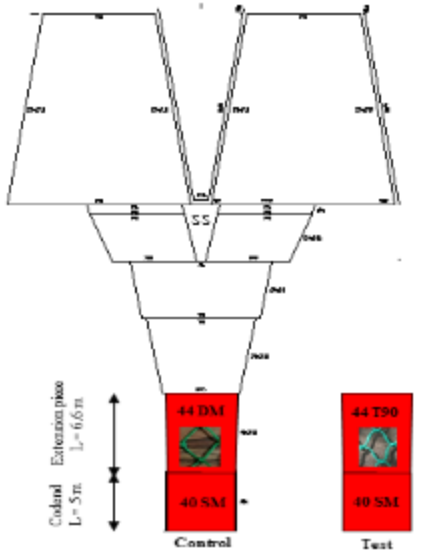


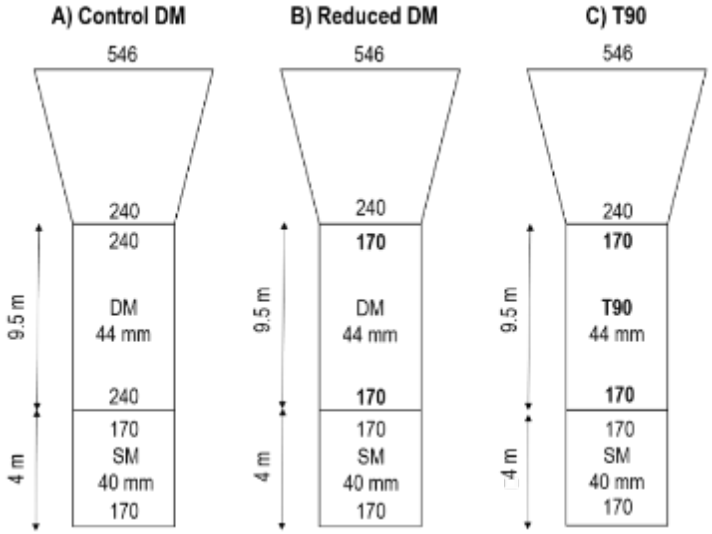
DM = Diamond Mesh;
SM = Square Mesh;
T90 = 90° turned mesh

GSA 9 experiment

- In the trawl design used in GSA9, only the last 10 meters of the extension piece are replaced.

SubTask 2.1 - T90 in the extension piece





GSAs 11, 17 (east) experiment

- In the trawl designs used in eastern GSA17 and in GSA11, the entire extension piece is replaced.

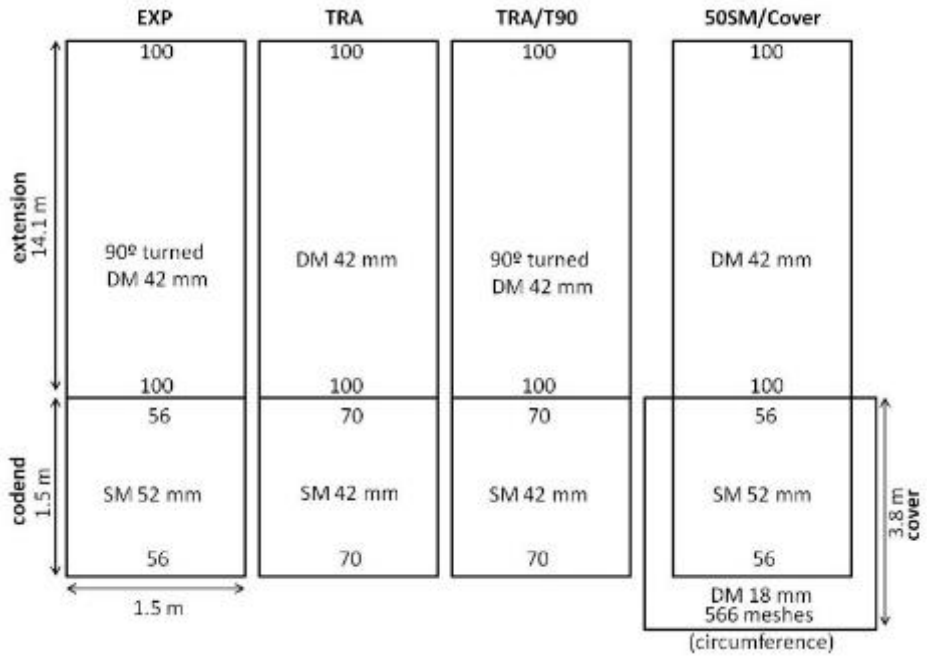
GSA 17 (west) experiment

- In the trawl designs used in western GSA17, the entire extension piece is replaced.
- In addition to the control and the test net with T90, a third net with diamond meshes in extension piece but reduced number of meshes in circumference is tested, to isolate this effect.

SubTask 2.1 - T90 in the extension piece & 50 mm square mesh codend

- In GSA6 (Spain), sea trials testing the T90 in the extension piece are done simultaneously with the testing of a 50 mm square mesh codend.

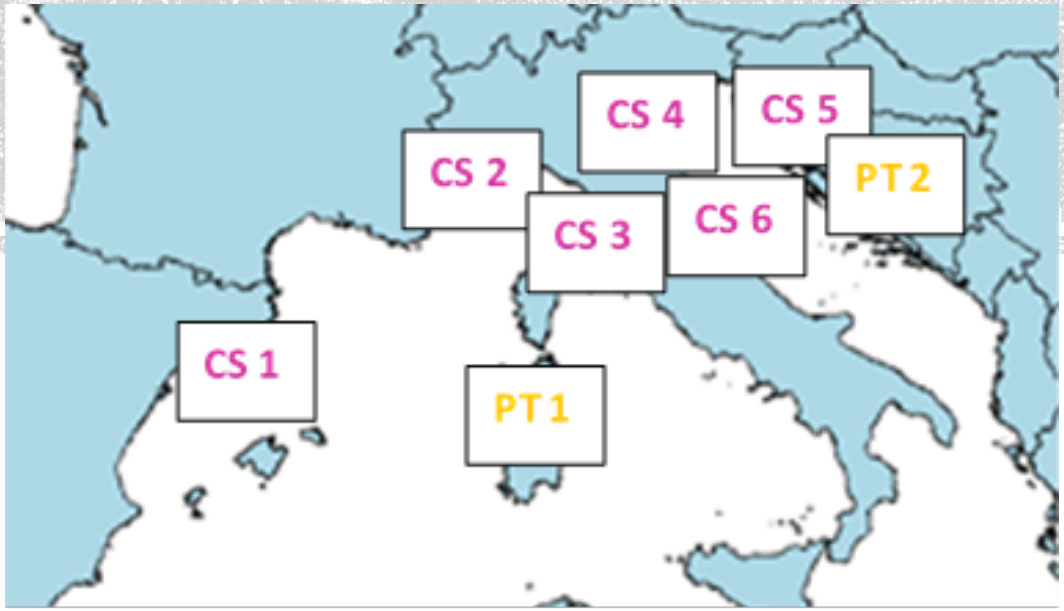
- Four different trawl designs are tested. In addition to the control and test net with T90, both an experimental net with 50 mm SM codend/T90 extension and another net with 50 mm SM codend/DM extension are designed. The latter is tested through a covered codend methodology to determine the selectivity of the 50 mm SM codend.



GSA 6 experiments

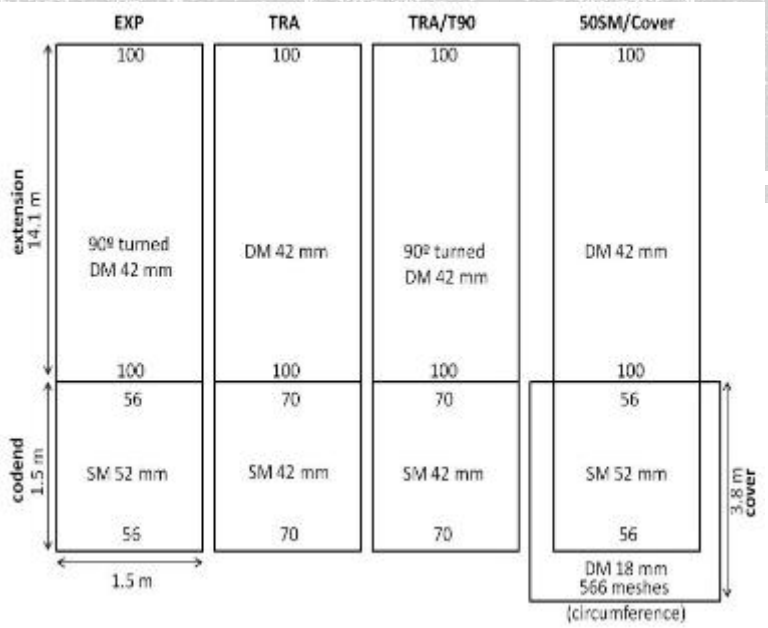
Task 3 was aimed at testing the devices defined in the Sub-task 2.1 using the protocols and methodology defined in the Sub-Tasks 2.2 and 2.3.

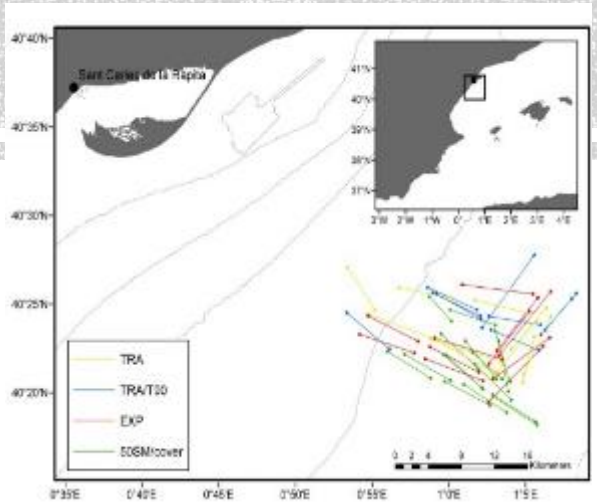
- The experiments were performed using different selectivity devices in five areas/fisheries of the Mediterranean and Adriatic Sea, identified as **Case Studies (CS)** and **Pilot Tests (PT)**.



Case Study 1 - Objective: testing T90 net and 50 mm square mesh codend in GSA 6
Target species: European hake, red mullet. **Method**: alternated hauls.

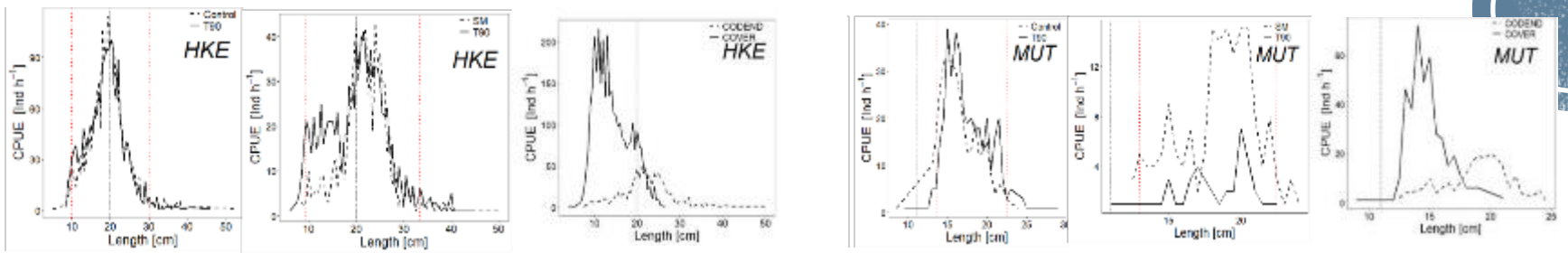
1) Bottom trawl with 40 mm DM extension piece mounted in T90, with a 50 mm SM codend - **EXP**.
2) Bottom trawl with 40 mm DM extension piece, with a 40 mm SM codend – **TRA**
3) Additional hauls with T90 extension piece and the traditional 40 mm SM codend - **TRA/T90**.
4) Bottom trawl with 40 mm DM extension piece, with a 50 mm SM codend and a cover of 18 mm - **50 SM/COVER**.





Case Study 1 - Main results:

- No substantial improvement in selectivity was obtained using the T90 net configuration. In the case of European hake, T90 configuration seemed more effective to catch individuals under MCRS.
- The 50 SM codend produced a generalized increase of the size at first capture (L50) of the main target species when compared to the 40 mm SM mesh codend
- The 50 SM mesh codend also produced an important reduction of commercial yields, as for *M. merluccius* and *M. barbatus.*



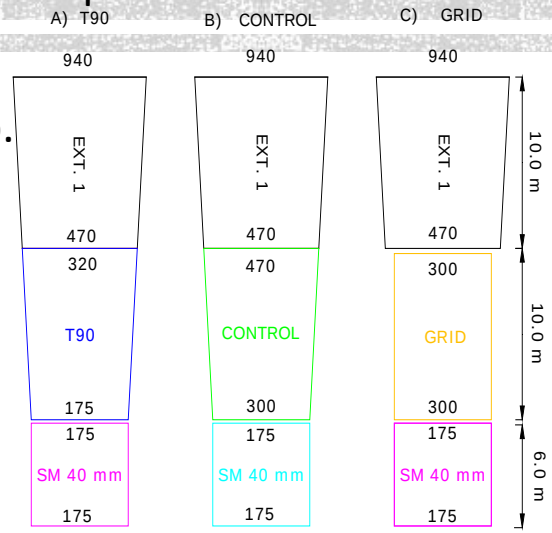
Case Studies 2 and 3 - Objective: testing T90 net and grids GSA 9

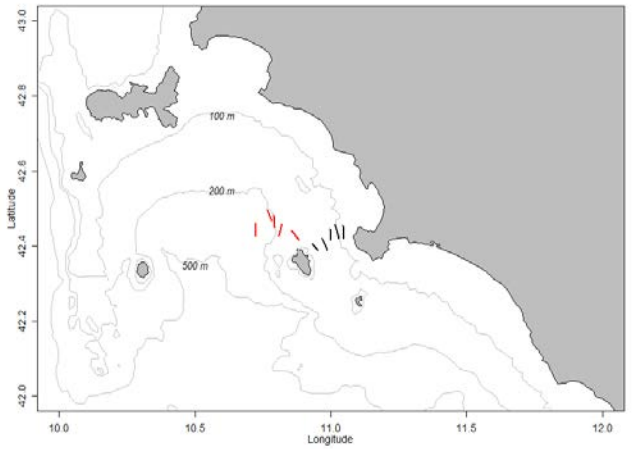
Target species: European hake, deep-water rose shrimp, red mullet. **Method**: alternated hauls.

1) A bottom trawl with the T90 extension piece and the 40 mm SM codend - **T90**.
2) A bottom trawl with the traditional 40 mm SM codend – **CONTROL.**
3) A bottom trawl with the juveniles selection grid and the 40 mm SM codend - **GRID**.
4) Additional hauls with 40 mm SM codend provided with 20 mm DM cover, to estimate selectivity.mance of a commercial bottom trawl gear with that of an experimental gear, equipped with the T90 modification in the extension piece and with an experimental net equipped with a selective grid.

Duration of the activities: from 20th August 2020 to 20th April 2021. Period of the survey: from August 3rd to August 27th 2020.

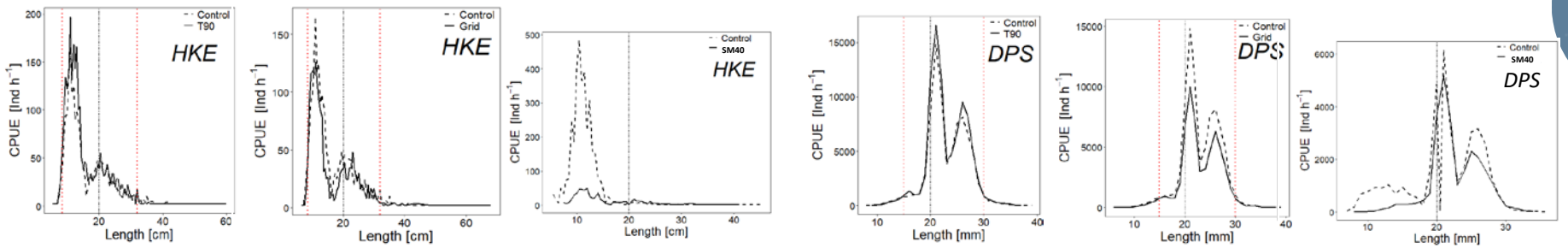
Target species: European hake, deep-water rose shrimp.





Case Studies 2 and 3 - Main results:

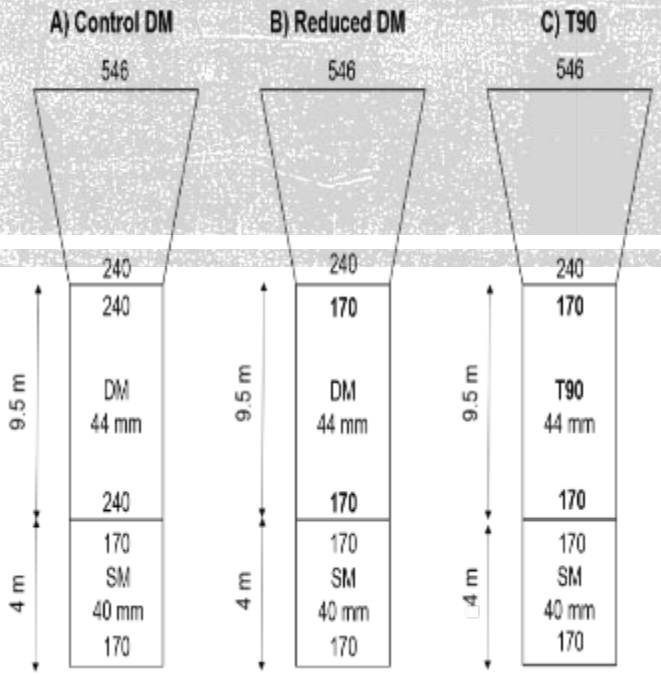
- The CONTROL net and the T90 showed very similar performance. Any significant improvement in selectivity was obtained using the T90 extension panel.
- The GRID resulted effective in reducing the catch of small sized individuals, also of the catches of undersized European hake obtained with the GRID. However, this improvement comes together with a significant loss in commercial catches, in particular of deep-water rose shrimp and broadtail shortfin squid.
- The study on the selectivity on the net with 40 SM showed both for European hake and deep-water rose shrimp, that the resulting L50 is still below the MCRS of the two species.

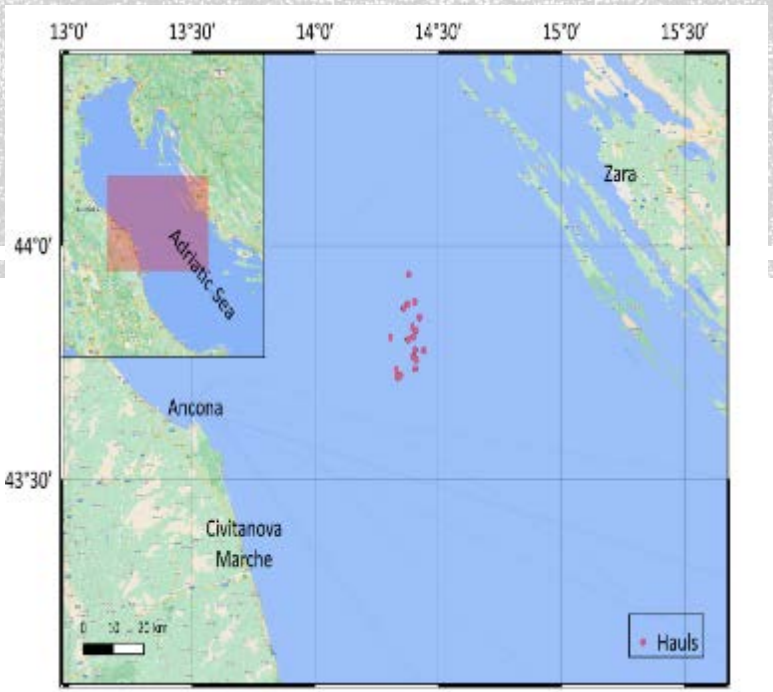


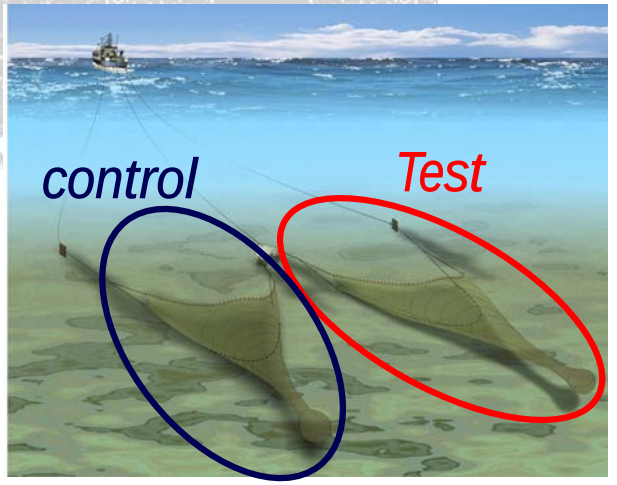
Case study 4 - Objective: testing T90 mesh geometry in GSA 17 (west side, Italy)

Target species: European hake, red mullet. **Method**: twin trawl.

1)A bottom trawl with 40 mm SM codend and 240 meshes at circumference - **Control DM**.
2)A bottom trawl with 40 mm SM codend and 170 meshes at circumference - **Reduced DM**.
3)A bottom trawl with 40 mm SM codend with T90 extension piece and 170 meshes at circumference - T90.

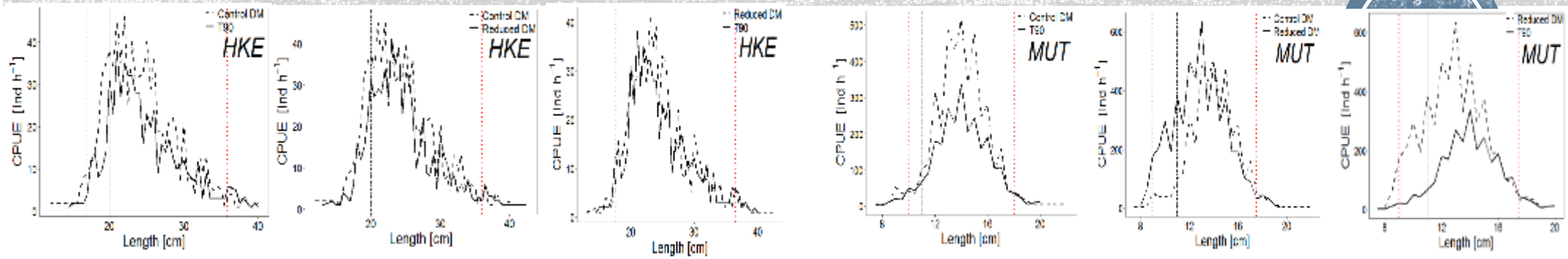






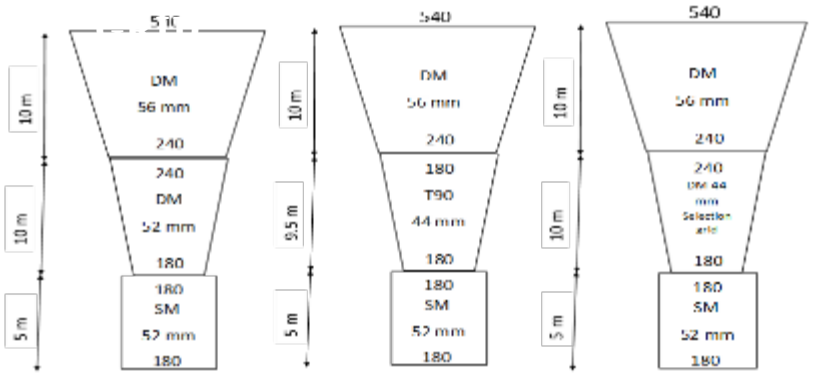
Case Study 4 - Main results:

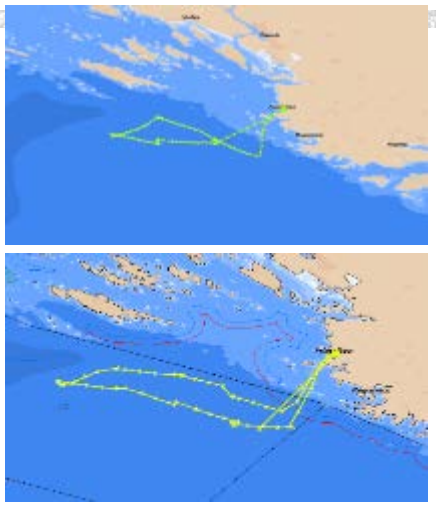
- Focusing on the European hake, no significant differences emerged among the three nets, also considering the individuals < the MCRS of 20 cm.
- No substantial improvement in size selectivity for this species, going from a traditional trawl net to nets with reduced circumference and a T90 configuration in the extension piece.
- Concerning red mullet, the Reduced DM net was less selective than Control DM net. Despite this, the T90 net was the most size selective net, but implied also a significant loss of individuals above the MCRS of 11 cm TL.



Case study 5 and Pilot Test 2 - Objective: testing T90 net and grid in GSA 17 (east side, Croatia)
Target species: European hake, red mullet, Norway lobster, rose shrimp. **Method**: alternated hauls.

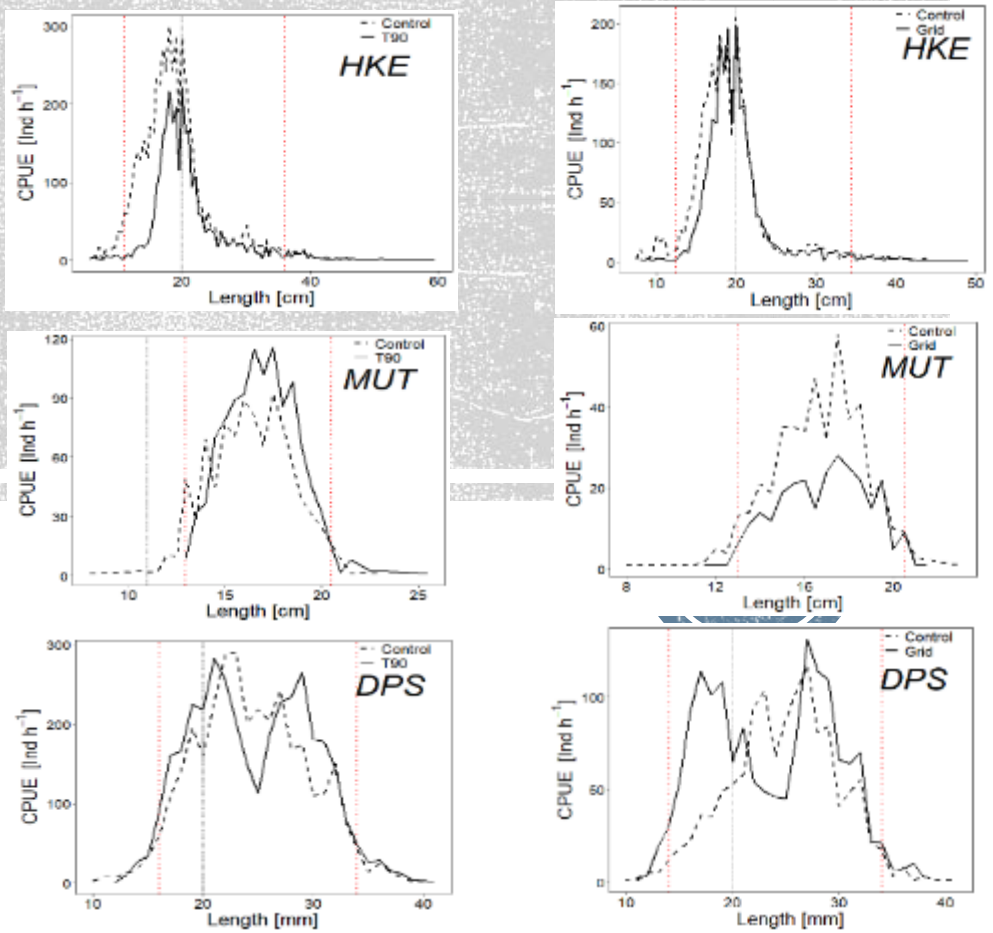
1)Bottom trawl with 50 mm SM – **CONTROL.**
2)Bottom trawl with 50 mm SM and T90 on the extension piece - **T90.**
3)Bottom trawl with 50 mm SM and juvenile selection grid - **GRID**.
4)of the activities: from 20th August 2020 to 20th June 2021. Period of the survey: the survey was carried out in two periods, the first part from 16th to 26th October 2020, while the second part from 25th to 26th March 2021.
Target species: European hake, red mullet, Norway lobster, deep-water rose shrimp.





Case Study 5 and Pilot Test 2 - Main results:

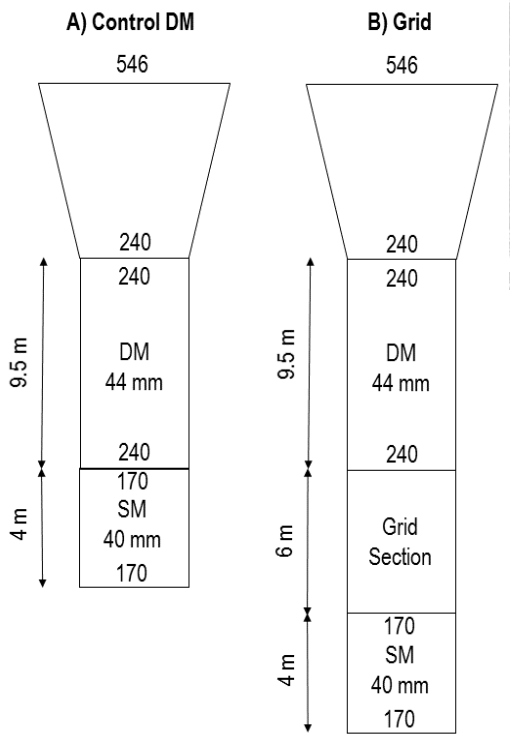
- As regards European hake, the results showed that both the T90 and the GRID caught significantly <u>less undersized</u> (below 20 cm) individuals than the Control.
- T90 caught significantly <u>larger numbers</u> of red mullet than the CONTROL net for lengths ranging from 16 to 20 cm TL, whereas for the largest lengths the catch was <u>comparable</u>.
- GRID had significantly <u>lower catch efficiency</u> respect to the Control DM for all the length classes.
- For deep-water rose shrimp and Norway lobster <u>no positive effect</u> was observed in terms of reduction of smaller individuals between CONTROL and the experimental nets (T90 and GRID).

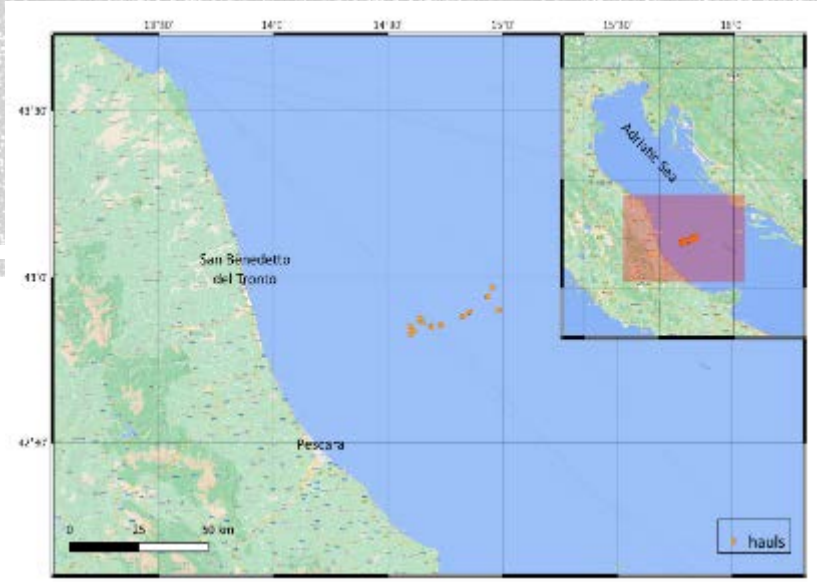


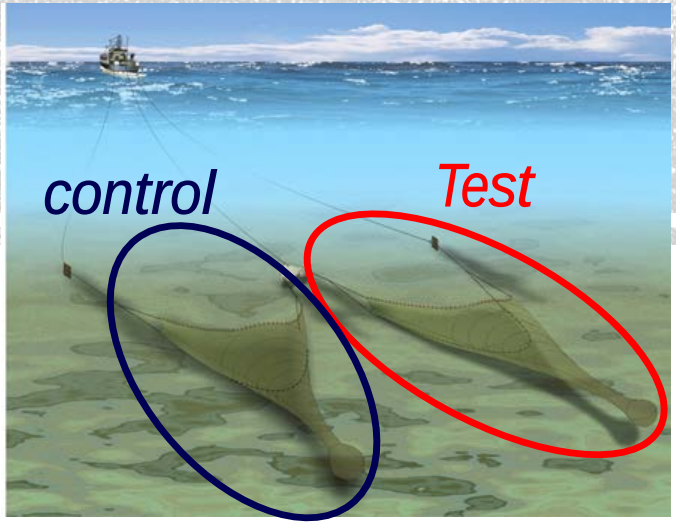
Case study 6 - Objective: Testing grid for Norway lobster in GSA 17

Target species: Norway lobster, European hake, deep water rose shrimp. **Method**: twin trawl.

1)Bottom trawl with 40 mm SM codend – **CONTROL SM**
2)Bottom trawl with 40 mm SM codend net provided of the GRID in the extension piece - **GRID**.

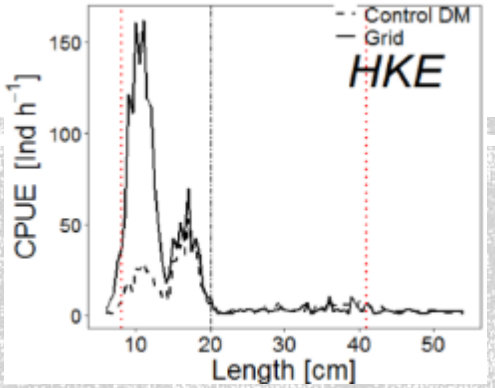


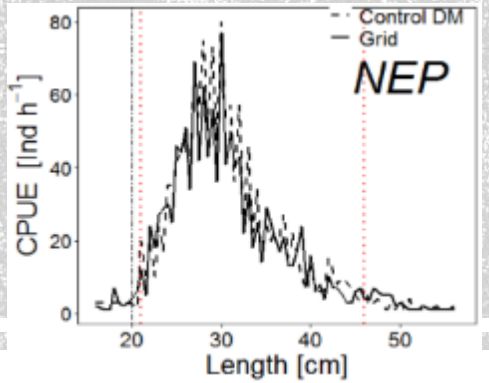


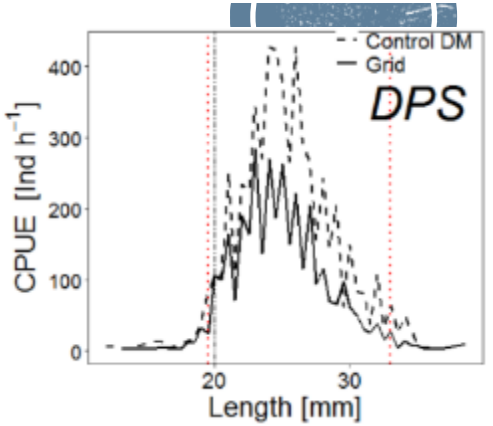


Case Study 6 - Main results:

- For the European hake, GRID caught significantly more undersized individuals than the CONTROL. This finding was rather unexpected. However, the size selectivity was not improved for this species by shifting from the CONTROL net to the GRID.
- The catches of the other target species were not significantly different between the two nets.
- Concerning Norway lobster, no differences were found in the performance of the two nets.
- A significant loss in the catch of deep-water rose shrimp with the GRID was observed for all the length classes, meaning that also commercial individuals are able to pass through the 20 mm bar spacing of the grid





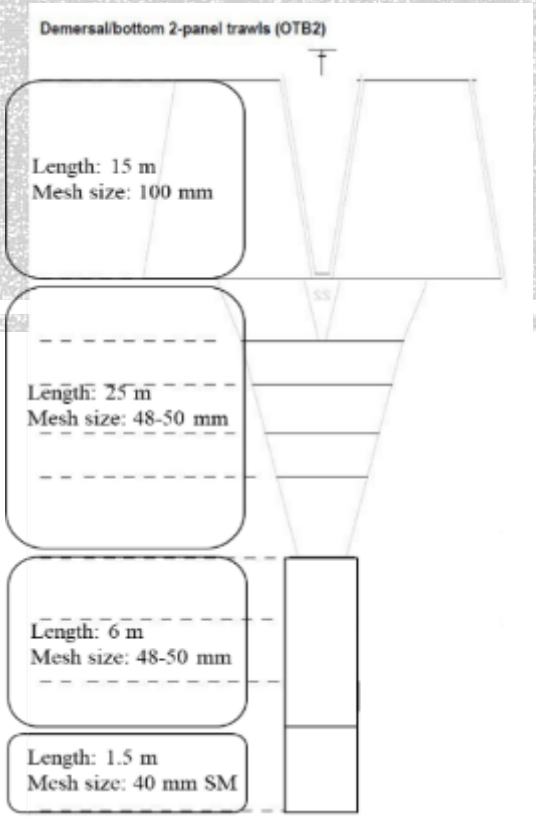


Pilot test 1 - Objective: Testing T90 geometry in GSA 11

Target species: European hake, red mullet. **Method**: alternated hauls.

1)Bottom trawl with 40 mm SM codend – **CONTROL**

2)Bottom trawl with 40 mm SM codend net provided with T90 extension piece **– T90**.



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THANK YOU FOR THE ATTENTION

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