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# Experimental projects on technical fishing measures to mitigate accidental catches in Spanish fisheries

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# 1. Fishing bycatch

## INTERACTIONS WITH FISHERIES: ACCIDENTAL CATCHES / BYCATCH

Bycatch can create serious conservation problems when it affects endangered species or when the level of catch is not sustainable for the affected populations.



# 1. Fishing bycatch

## Bycatch of cetaceans in Spanish Atlantic fisheries

- The scientific information available on accidental catches of protected species is incomplete.
- Very recent mitigation measures and in certain fisheries

ICES 2023: Estimate a total bycatch at Bay of Biscay and Iberian waters 2019–2021:

- 9040 [95% CI 6640–13 300] based on strandings,
- 5938 [95% CI 3081–9700] based on onboard observation



Table 2  
Estimated annual numbers of cetacean by-catches for the Galician fleet, with bootstrap estimates of 95% confidence limits; Galician waters and Grand Sole (SW of Ireland)<sup>a</sup>

Fishing area	Gear	Boats	Numbers of cetaceans by-caught annually						
			All species	All dolphins	Small dolphins	<i>Tursiops</i>	All whales	<i>Globicephala</i>	<i>Physeter</i>
Inshore	Gillnet	1068	190 (8–522)	111 (8–295)	87 (2–251)	24 (0–67)	79 (0–237)	79	0
	Line	401	12 (0–23)	12 (0–23)	6 (0–17)	6 (0–17)	0	0	0
	Traps	1153	7 (0–18)	7 (0–18)	7 (0–18)	0	0	0	0
	Trawl	250	1 (0–4)	1 (0–4)	1 (0–4)	0	0	0	0
	All gears	2872	210 (23–556)	131 (23–313)	101 (10–272)	29 (2–81)	79 (0–237)	79 (0–237)	0
Offshore	Gillnet	535	955 (81–2639)	955 (81–2639)	935 (69–2628)	20 (0–56)	0	0	0
	Line	306	1 (0–4)	1 (0–4)	0	1 (0–4)	0	0	0
	Seine	259	130 (0–389)	130 (0–389)	130 (0–389)	0	0	0	0
	Trap	628	18 (3–42)	18 (3–42)	17 (2–44)	0	0	0	0
	Trawl	243	415 (214–649)	394 (208–601)	392 (196–610)	3 (0–8)	20 (0–53)	20 (0–53)	0
	All gears	1971	1518 (464–3375)	1498 (435–3453)	1474 (420–3278)	24 (2–68)	20 (0–53)	20 (0–53)	0
All Galicia	All gears	4843	1728 (588–3794)	1629 (539–3536)	1575 (486–3723)	53 (9–114)	100 (3–285)	100 (3–285)	0
Grand Sole	Gillnet	10	18 (0–44)	18 (0–44)	18 (0–44)	0	0	0	0
	Line	63	1 (0–2)	1 (0–2)	1 (0–2)	0	0	0	0
	Trawl	82	332 (27–911)	328 (25–910)	55 (12–129)	12 (0–32)	4 (0–11)	0	3 (0–10)
	All gears	155	350 (43–904)	346 (37–903)	74 (21–157)	12 (0–32)	4 (0–11)	0	3 (0–10)
All areas	All gears	4998	2078 (791–4184)	1975 (722–3888)	1648 (557–3537)	65 (19–131)	103 (5.6–282)	100 (3–273)	3 (0–10)

<sup>a</sup> All-gears, all-species and all-areas by-catches are derived from separate runs of the bootstrap procedure and the figures will therefore not necessarily be exactly equal to the sum of figures from runs using data from single gears, species or areas. For example, not all by-caught cetaceans were identified to species and some categories (e.g. small dolphins) are subsets of more general categories (e.g. dolphins).

# 1. Fishing bycatch

## Bycatch of cetaceans in Spanish Atlantic fisheries

### CONTEXT

- High socioeconomic importance of the fisheries in north Spanish coast.
- Important number of cetacean species and other protected species
- Large number of vessels
- Information about interactions is limited and the use of bycatch mitigation measures is only mandatory for trawlers.
- Involvement of many stakeholders of different nature (policy/administration, economy/industry, science/researchers, society/citizens, etc.)

## 2 Legal framework

Council Regulation (EC) No 812/2004 obliges Member States to design and implement monitoring schemes for cetacean bycatch with observers on board commercial vessels. Poor compliance with this measure by various Member States.

REGULATION (EU) 2019/1241 on the conservation of fisheries resources and the protection of marine ecosystems through technical measures establish to continue the monitoring.



In 2019, several NGOs asked the European Commission to introduce emergency fisheries measures to reduce the bycatch of common dolphins in the Bay of Biscay and harbor porpoises in the Baltic Sea.

2019: The Commission asked the International Council for the Exploration of the Sea to evaluate these applications and provide advice on necessary actions.

2020: ICES issued this advice in early 2020, supported by the work of two of its working groups (WGBYC and WGMME) and a workshop (WKEMBYC). Maximum catch in the Northeast Atlantic: 4927 cetaceans.

2020: The European Commission requests that France and Spain take measures to address the problem of cetacean bycatch in the Bay of Biscay and Iberian waters.



## 2 Legal framework



2020: In July 2020, the European Commission opened an infringement process against the Spanish and French States for not taking adequate measures to reduce the death of common dolphins.

2020: Regulation (EU) 2020/967 details the technical specifications that acoustic devices (pingers) must meet.



2020: Order APA/1200/2020, of December 16, establishing mitigation measures and improving scientific knowledge to reduce accidental captures of cetaceans during fishing activities.

2021: The Scientific, Technical and Economic Committee on Fisheries (CCTEP-STEFCF) publishes a report classifying as insufficient the measures proposed by France and Spain to end bycatch of common dolphins in the Bay of Bizkaia

2021: October. Letter from the EC urging Spain to improve information. The uncertainty due to lack of data from France and Spain suggests the need for a closure of fisheries in the 2021/2022 winter season to avoid the mortality of thousands of dolphins.



2021: Spain presents a national plan to reduce accidental catches in fishing



2022: Resolution of March 2, 2021, of the General Secretariat of Fisheries, by which quotas are allocated for scientific purposes in the implementation of electronic observation pilot projects in the context of mitigation measures for accidental captures of cetaceans.

# 2 Legal framework



2023 EU request on mitigation measures to reduce bycatches of common dolphin (*Delphinus delphis*) in the Bay of Biscay (ICES Subarea 8)

ICES 29 June 2023: 15 scenarios



**Table 1** Scenarios used to assess possible bycatch reduction measures for the common dolphin in the Bay of Biscay (Subarea 8). Métiers of concern are those with recorded bycatch of common dolphins in ICES databases in Subarea 8 and Division 9a.

Scenario	Description	Explanation
A	Four-month closure (December–March) – all métiers	Four-month closure from December to March of all métiers of concern
B	Annual effort reduction of 40% – all métiers	Flat annual 40% reduction in total effort for métiers of concern, does not consider strandings patterns
C	Two-month closure (mid-January–mid-March) – all métiers	Two-month closure of all métiers of concern determined, using the % mortality in the peak period based on strandings
D	Six-week closure (mid-January–end of February) – all métiers	Six-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings
E	Four-week closure (mid-January–mid-February) – all métiers	Four-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings
F	Two-week closure (mid-January–end of January) – all métiers	Two-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings
G	Pinger all PTM/PTB all year and same six-week closure all other métiers	PTM/PTB to use pingers all year + a six-week closure of all other métiers of concern determined, using the % mortality in that peak period based on strandings
H	6-week closure (mid-January to end of February) all métiers (including PTM/PTB) and pinger PTM/PTB for the rest of the year	Six-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings + PTM/PTB to use pingers during the rest of the year
I	Pinger all PTM/PTB all year and same 4-week closure all other métiers	PTM/PTB to use pingers all year + a four-week closure of all other métiers of concern determined, using the % mortality in that peak period based on strandings
J	Pinger all PTM/PTB all year and same 2-week closure all other métiers	PTM/PTB to use pingers all year + a two-week closure of all other métiers of concern determined, using the % mortality in that peak period based on strandings
K	Pinger all PTM/PTB all year	PTM/PTB to use pingers all year, no other measures introduced
L	Two-month closure all (mid-January to mid-March) + pingers	Two-month closure for all fleets + pingers on PTM/PTB for the rest of the year
M	Four-month closure all (mid-January to mid-March) + pingers	Four-month closure for all fleets + pingers on PTM/PTB for the rest of the year
N	Four-month closure (three in winter [January to March] + one in summer [mid-July to mid-August]) + pingers	Closure for three months in winter and one month in summer for all fleets + pingers on PTB/PTM for the rest of the year
O	Four-month closure (three in winter [January to March] + one in summer [mid-July to mid-August])	Closure for three months in winter and one month in summer for all fleets



2024 France: Fisheries in Bay of Biscay closing during 1 month \* expected in 2024-2026



**Urgent need to reduce cetacean bycatch in EU fisheries**, in line with the requirements of the Habitats Directive, the Marine Strategy Framework Directive and the Common Fisheries Policy (Technical Measures Regulation)

Projects on technical measures in the EU and national context. Scientific institutes, Spanish Ministry of Fisheries (MAPA) and fishing associations.

1. Define well the **dimension of the problem** in each fishery.
  - Exists?
  - What species are accidentally caught,
  - What is the capture rate?
  - When captures occur,
  - Why captures occur.
2. Establish measures in **collaboration with the fishing sector**:
  - Avoid accidental captures as much as possible,
  - Maintaining fishing activity.
3. Determine **economic** losses due to interactions



## Research projects on bycatch in European waters



- **CETAMBICION (EU-DG ENV):** Coordinated strategy for the evaluation, monitoring and management of cetaceans in the subregion of the Bay of Biscay and the Iberian Coast (2021-2023)



- **MERMACIFRA (MAPA-CSIC):** Monitoring, Evaluation and Reduction of Accidental Mortality of Cetaceans due to Interactions with the Spanish Fleet – Review and Action (2021-2024)



- **CIBBRINA (EU-LIFE):** Coordinated Development and Implementation of Best Practice in Bycatch Reduction in the North Atlantic, Baltic and Mediterranean Regions (2023-2027)



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## Actions to evaluate the effectiveness of technical devices to reduce accidental captures of cetaceans

Methodological approach based on type of interaction

- Identified 3 types of cetacean-fishing interactions

1. Bycatch / accidental catch:

- Mortality due to capture
- Injuries

2. Fish predation in fishing gear

- Decrease in fishing yields
- Reduction in economic value of fish

3. Damage due to broken fishing gear

- Presence of cetaceans makes fishing difficult
- Interaction causes breakages and damage to the gear with economic losses



## Actions to evaluate the effectiveness of technical devices to reduce accidental captures of cetaceans

### 3 Projects on mitigation technical measures

#### Methodological approach: fishers engagement

1. To carry out different **tests on board** to evaluate the operation and adaptation of the devices to the fishing gear and test their effectiveness in the presence of cetaceans in fishing nets.
2. Obtain **information from the fishers** about the types of interactions and possible measures. Especially taking into account the opinion of the sector and even designing own measures that reduce interactions.
3. Obtain results that allow for **robust reporting** on real problems and characterization of interactions.
  - Meetings and interviews
  - Experiments on board different collaborative boats changing vessels and fishing jobs throughout the year.

# Actions to evaluate the effectiveness of technical devices to reduce accidental captures of cetaceans

## Methodological approach: fishers engagement

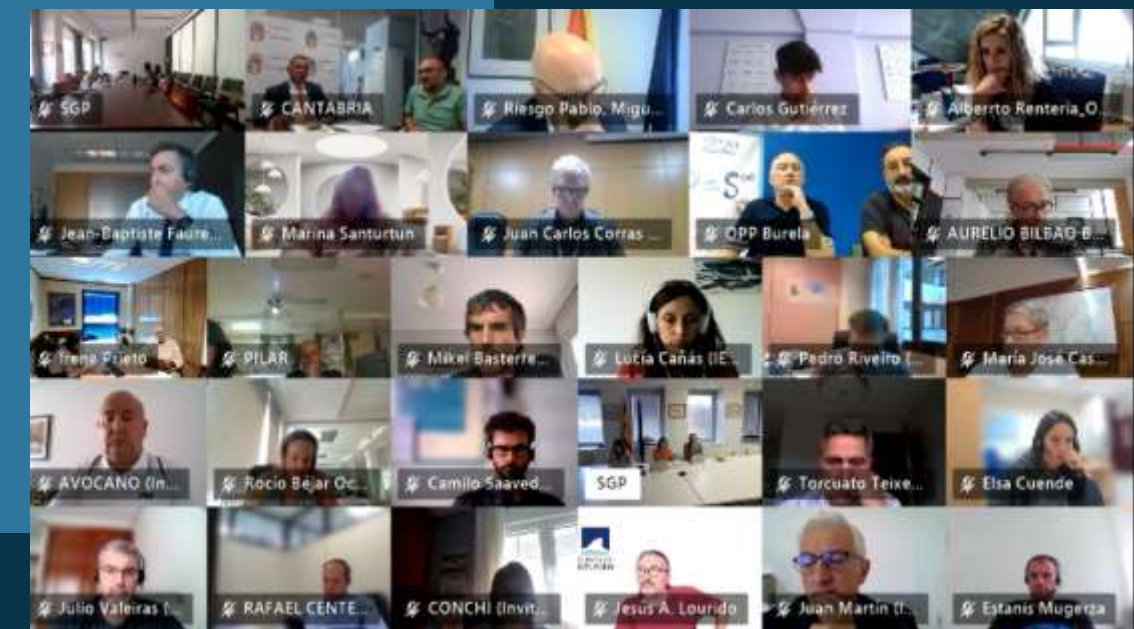
4. Technical phases of concept, methodological design, manufacturing and experimental tests required the direct participation of fishermen's associations, shipowners, skippers and netters

- Workshops and meetings
- Research projects diffusion in sectorial technical seminars

Stakeholders collaboration:

- OPP83 - Sociedad Cooperativa Gallega del Mar Santa Eugenia
- FNCP - Federación Nacional de Cofradías de Pescadores
- FGCP – Federación Galega de Confrarías de Pesca
- OPP82 ACERGA - Asociación de armadores de cerco de Galicia
- AVOCANO – Asociación de Volanteros del Cantábrico

5. Coordination with SGP MAPA - Fisheries General Secretary (Ministry of Agricultural, Fisheries and Food)



## Types of technical measures to mitigate the bycatch

Improved visibility  
of fishing gear

Modification of the  
fishing gears

Changes in fishing  
practices

Fishing effort  
limitation and  
management

Regulatory and  
incentive  
measures

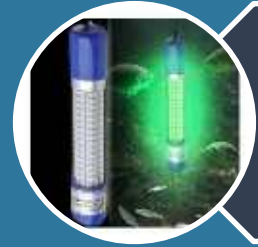
## Improved visibility of fishing gear



Acoustic repellents



Acoustic reflectors



Lighting of the nets



Informative signals

Improved visibility of fishing gear

4. Technical mitigation measures

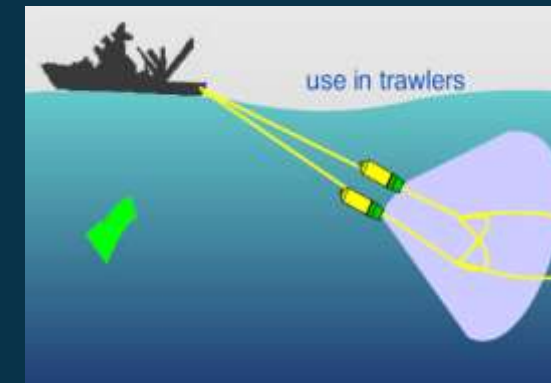


Acoustic repellers (Pingers)



Pelagic and semipelagic trawling

Pingers DDD



Development of new pingers for trawling

Fixed nets

Pingers on the net

Repellent signs

Informative signs

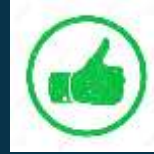


Pingers under the hull of the ship

Repellent signs



# Pingers



## Advantages



### EFFECTIVENESS:

- The reduction of accidental catches of cetaceans has been demonstrated for some species and in some fisheries over time.
- They do not usually affect the target captures.

### WORKING TIME:

- Ease of use by fishermen.

### ECONOMIC:

- The initial cost can be low depending on the fishery and the brand to be used.



# Pingers

## Disadvantages



### EFFECTIVENESS:

- They do not always work, it depends on the species and even the population of each species.
- Reduces, but does not eliminate accidental captures.
- Risk of habituation/attraction of certain species, "Dinner bell" effect.
- For pingers to be effective, it is necessary that they be used in those areas where the fishing effort of gillnet fleets coincides with the species' distribution area.
- For the pingers to be effective, it is necessary to use the appropriate type of pinger for each gear.

### ACOUSTIC EFFECTS:

- Esonification of the environment:
  - Not well known effects of noise pollution on the marine ecosystem
  - Very long operating times in trawl and gillnet fisheries
  - Losses: risk of causing noise when pingers are lost that are not equipped with an automatic shut-off system in case of loss at sea.
- The response of marine mammals to these measures is unknown; it could have consequences on their behavior and distribution. Extensive use of pingers could induce habitat exclusion in certain species of cetaceans, causing displacement of their feeding and breeding areas.

### ECONOMIC:

- The initial cost can be high depending on the fishery and the brand to be used.
- Battery maintenance.

# Trammel net fishery at Galicia

## Pingers

Pinger performance evaluation experiments: captures and predation

- Work in progress (2023-2024)

12 experimental surveys  
79 sets in trammel nets



Trial	Fishery/metier	Vessel	Fishing sets	Control sets	PINGER SETS
MERMACIFRA0323-1	Trammel nets	Cro Tres	5	5	0
MERMACIFRA0323-2	Trammel nets	Cro Tres	6	4	2
MERMACIFRA0323-2	Trammel nets	Cro Tres	8	4	4
MERMACIFRA0323-2	Trammel nets	Cro Tres	5	3	2
MERMACIFRA0423-5	Trammel nets	Cro Tres	7	3	4
MERMACIFRA0423-5	Trammel nets	Cro Tres	8	3	5
MERMACIFRA0523-6	Trammel nets	Cro Tres	5	2	3
MERMACIFRA0523-6	Trammel nets	Cro Tres	4	2	2
MERMACIFRA0523-7	Trammel nets	Cro Tres	6	4	2
MERMACIFRA0323-3	Trammel nets	Varamar	9	9	0
MERMACIFRA0323-3	Trammel nets	Varamar	8	7	1
MERMACIFRA0323-4	Trammel nets	Varamar	8	7	1
<b>TOTAL</b>			<b>79</b>	<b>53</b>	<b>26</b>



4. Technical mitigation measures

# Pingers

## Gillnet fishery at Galicia

Pinger performance evaluation experiments: captures and predation

- Work in progress (2024)

12 experimental surveys

18 fishing sets with pingers in gill nets targeting European hake



Trial	Fishery/metier	Vessel	Fishing sets	Control sets	PINGER SETS
CAPIN24001	Hake gillnets	Nuevo Peñil	4	4	0
CAPIN24002	Hake gillnets	Nuevo Peñil	4	2	2
CAPIN24003	Hake gillnets	Nuevo Peñil	4	2	2
CAPIN24004	Hake gillnets	Nuevo Peñil	4	2	2
CAPIN24005	Hake gillnets	Nuevo Peñil	4	2	2
CAPIN24006	Hake gillnets	Nuevo Peñil	4	2	2
CAPIN24007	Hake gillnets	Nuevo Peñil	4	2	2
CAPIN24008	Hake gillnets	Mascato Tres	3	2	1
CAPIN24009	Hake gillnets	Mascato Tres	2	1	1
CAPIN24010	Hake gillnets	Mascato Tres	2	1	1
CAPIN24011	Hake gillnets	Mascato Tres	4	2	2
CAPIN24012	Hake gillnets	Mascato Tres	2	1	1
<b>TOTAL</b>			<b>41</b>	<b>23</b>	<b>18</b>



# Purse seining fishery at Galicia

## Pingers

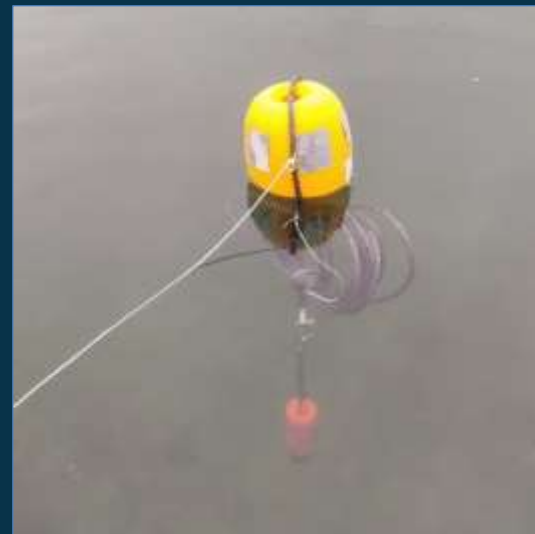
### Pingers performance evaluation experiments: damage to gear by dolphins

- Work in progress (2023-2024)
- Evidence of the deterrent effect of the pinger DDD03H in purse seine was observed during interactions with bottlenose dolphins
- In Portugal, the risk of accidental capture is reduced by 100% with the use of DDD



2 experimental surveys  
58 sets in purse seine nets

Trial	Fishery/metier	Vessel	Fishing sets	Control sets	PINGER SETS
<b>MERMACIFRA0623-8</b>	Purse seining	Cha-Veiga	6	5	1
	Purse seining	Cha-Veiga	5	5	0
	Purse seining	Cha-Veiga	8	7	1
<b>MERMACIFRA0723-9</b>	Purse seining	Novo Cristo d	5	2	3
	Purse seining	Novo Cristo d	4	2	2
	Purse seining	Novo Cristo d	5	2	3
	Purse seining	Novo Cristo d	4	0	4
	Purse seining	Novo Cristo d	5	3	2
	Purse seining	Novo Cristo d	6	4	2
	Purse seining	Novo Cristo d	6	2	4
	Purse seining	Novo Cristo d	4	1	3
	<b>TOTAL</b>			<b>58</b>	<b>33</b>



4. Technical mitigation measures

# Types of technical measures to mitigate the bycatch

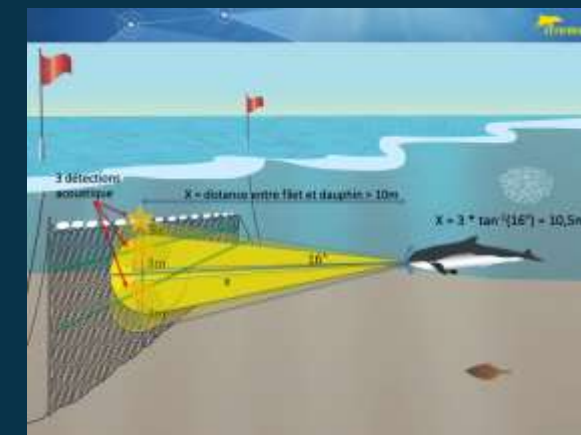
Improved visibility of fishing gear

4. Technical mitigation measures

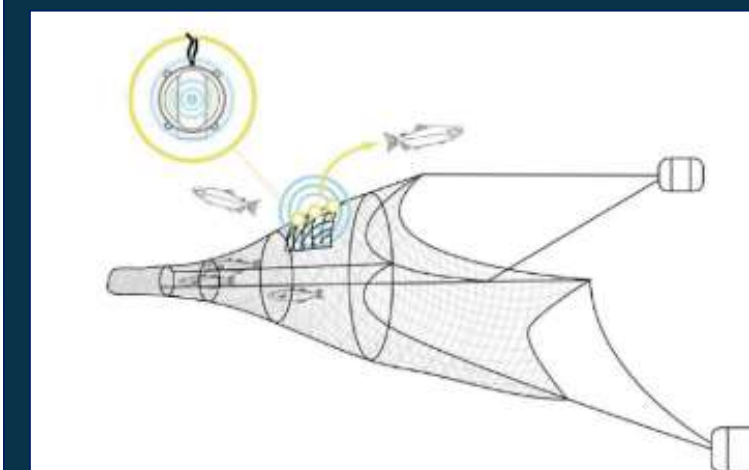


Acoustic reflectors

- Narium sulfate (USA, UK, Portugal)
- Iron oxidos (North Sea, Argentina)
- Acrylic beans (Baltic and Black Sea)
- Poliester yarn (Francia)
- Reflective buoys (Francia)
- Glass or plastic bottles (Peru, Kenya)



Lighting of the nets



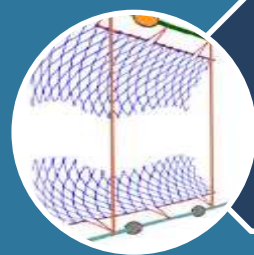
# Types of technical measures to mitigate the bycatch

## Modification of fishing gear

4. Technical mitigation measures



Cetacean exclusion devices



Reduction of the vertical profile of the fixed net (hanging coefficient)



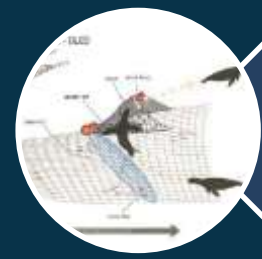
Modify the breaking strength of the net.



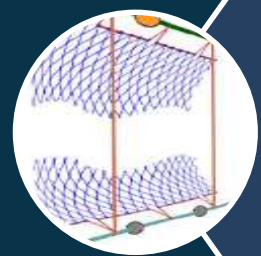
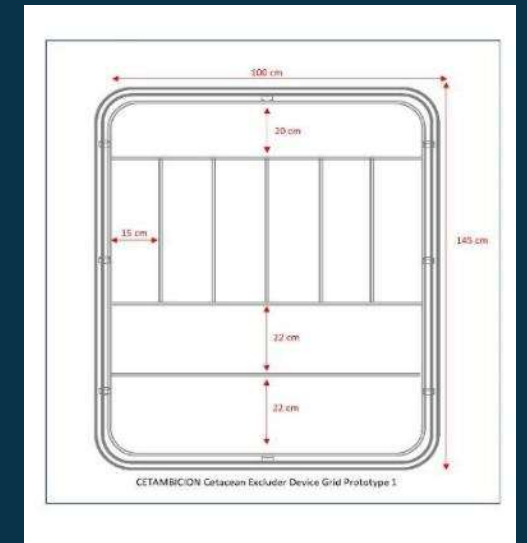
Reduce net floatation

# Modification of fishing gear

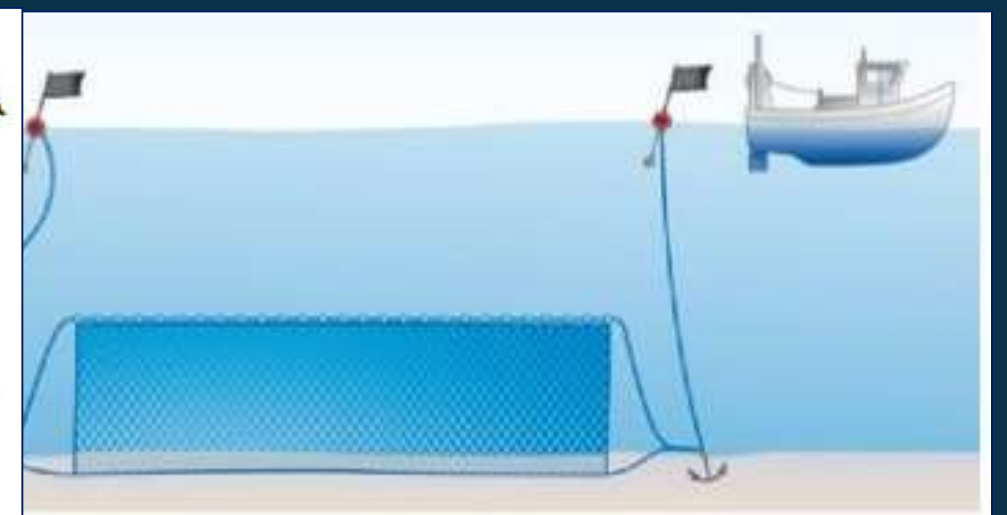
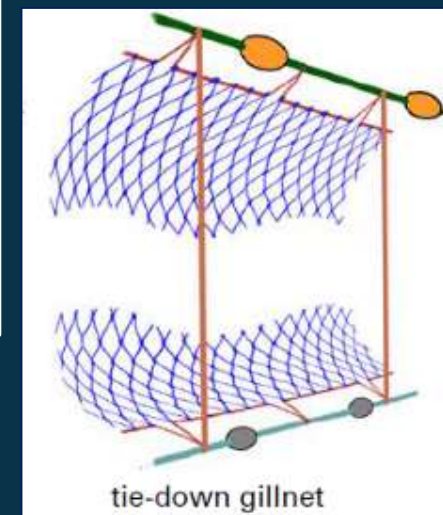
## 4. Technical mitigation measures



Cetacean Excluder Devices (CEDs)



Modification of the vertical profile of the fixed net (hanging coefficient): increase tension or decrease vertical profile by tie-downs



# Cetacean Excluder Devices (CED)

## Trawl fisheries

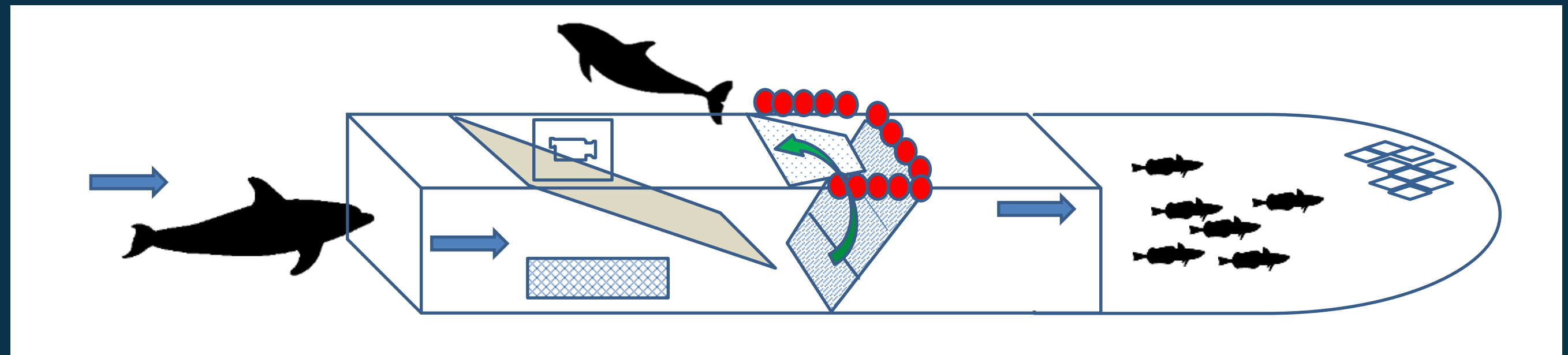


The cetacean Excluder Devices (CED) are modifications of fishing gears that allow to catch target fishing species but block the pass of marine mammals to the codend of the gear. That's because the large size of the cetacean. Finally, the device has an open section at the top of the tunnel, that acts as an escape hatch

CEDs are a solution to mitigate the bycatch of incidental catches of protected species and they are compulsory in many fisheries in the world.

- It is necessary a case by case CED design to improve acceptance by fishers.
- Potential use instead pingers.
- Potential use in high risk areas or seasons.

It is necessary to know the behavior of the species and the escape responses, the body size and the differences in the shape between the fish species and the species to be avoided.





# Cetacean Excluder Devices (CED)

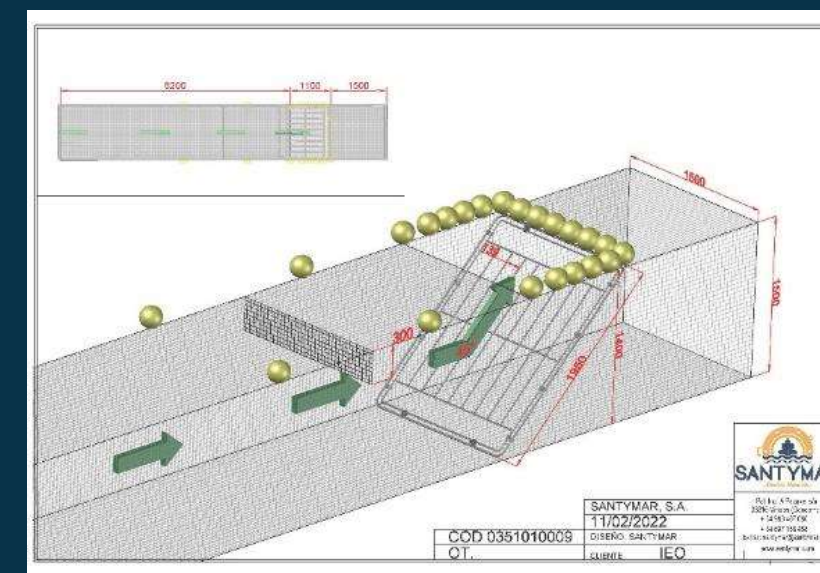
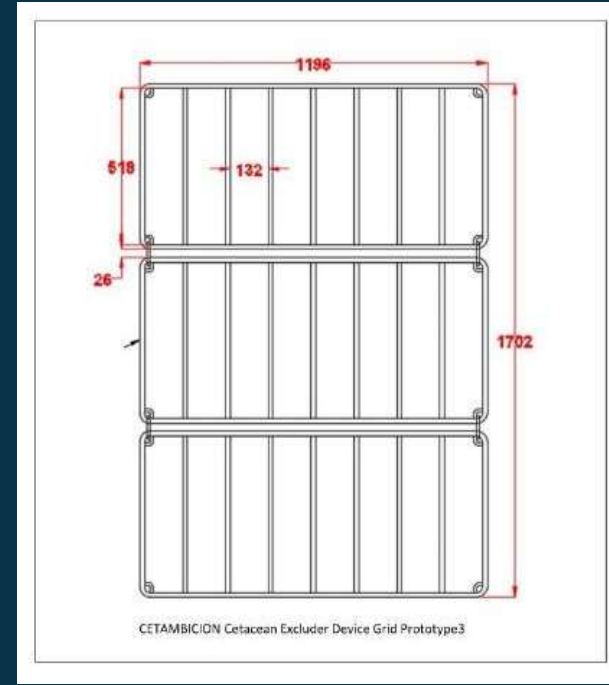
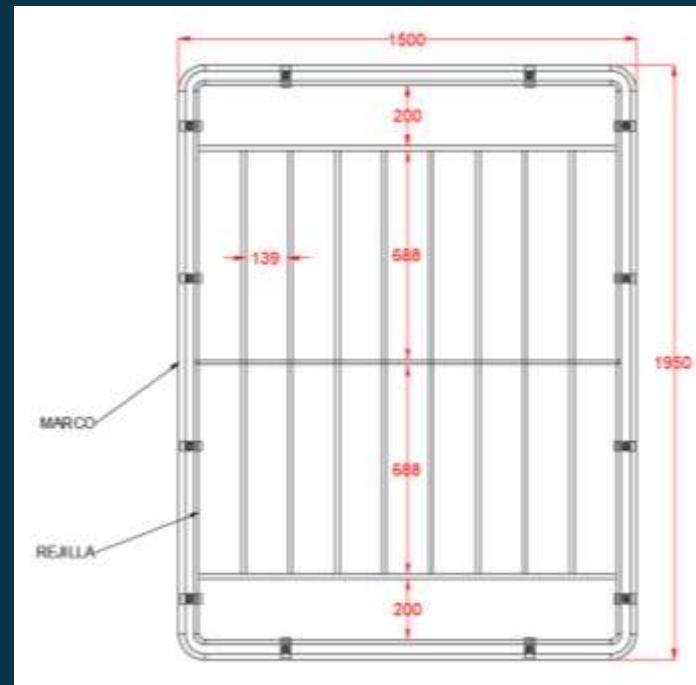
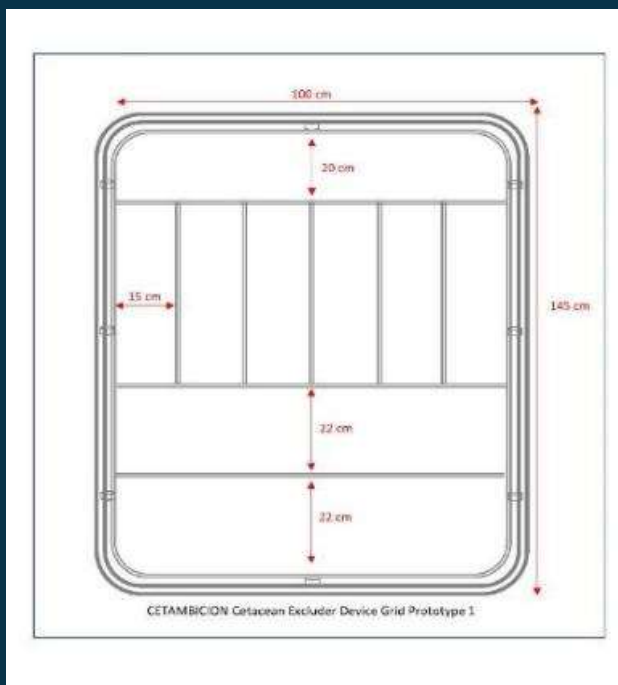
## Pair trawl fishery at Galicia



Technical characteristics of designed Cetacean Excluder Devices tested in CETAMBICION

Process of thinking, designing and building a suitable device for the pair trawl fishery: 3 prototypes

4. Technical mitigation measures

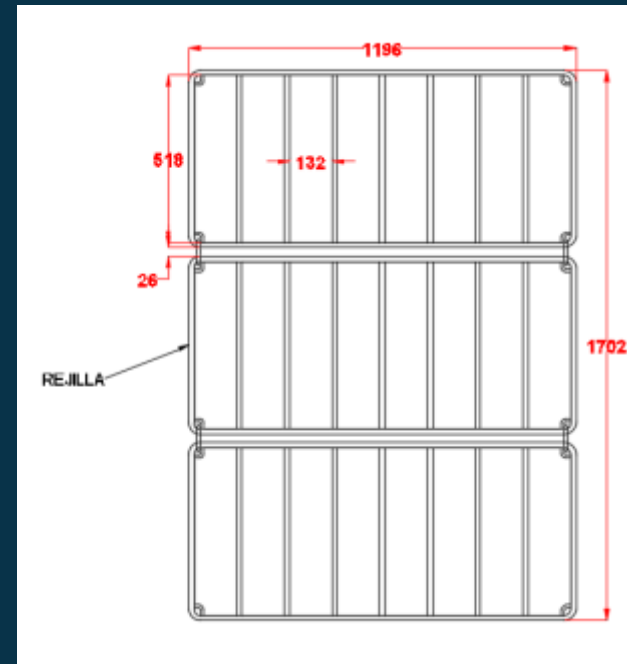


# Cetacean Excluder Devices (CED)

## Pair trawl fishery at Galicia



- Differences in handling of CED prototypes: difficulties to maneuver on deck.
- CED must be adapted to the deck space and maneuver conditions in different vessels.
- The CED-Prototype 3 is more suitable for the handling onboard



## Cetacean Excluder Devices (CED)

### Pair trawl fishery at Galicia



BYCATCH SPECIES: sharks, rays and large fish

Several species were retained on the CED device cover, evidencing the effectiveness of the device to separate and release unwanted species:

- Porgeable shark (*Lamna nasus*). This species is classify as 'Critically Endangered'
- Monkfish (*Lophius piscatorius*). Large size fish were retained by the grid.
- Skates and rays of different species (*Raja clavata*, *Raja montagui*, *Leucoraja circularis*)



Porgeable shark (*Lamna nasus*) bycaught



Monkfish (*Lophius piscatorius*) bycaught

# Cetacean Excluder Devices (CED)

## Pair trawl fishery at Galicia

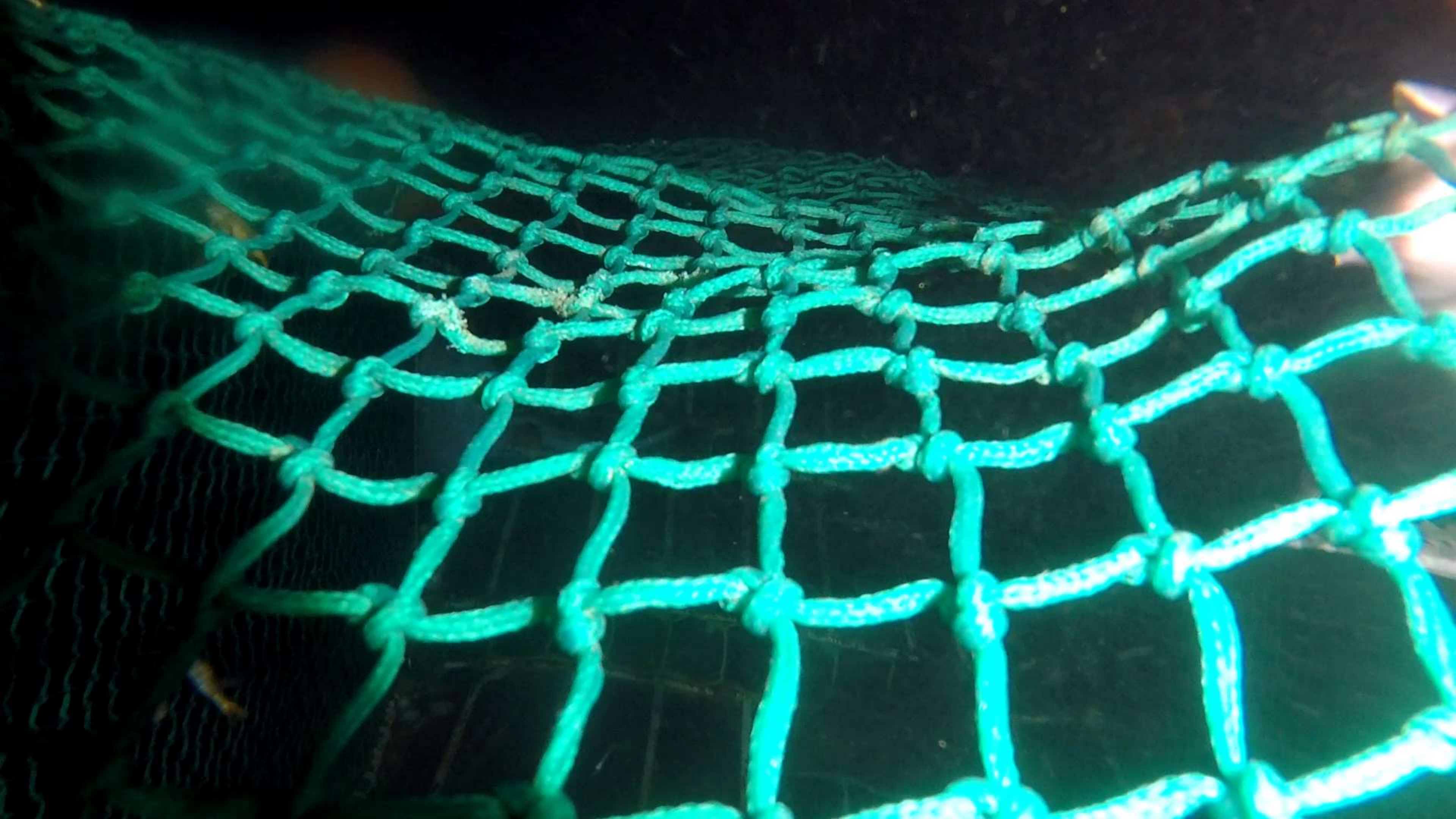


4. Technical mitigation measures



Escape sequence of a thornback skate through the CED







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