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BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

High impact science and technology for a healthy
and sustainable society

www.azti.es

Gorka Gabiña
ggabina@azti.es

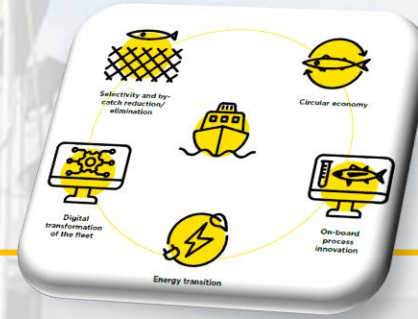
TECHNOLOGY FOR SUSTAINABLE FISHERIES

SUSTAINABLE FISHING TECHNOLOGIES

Team: 15 people (~75% PhD)

Background: engineering, environmental sciences, oceanography, marine biology, marine science, cartography, computer science, fishing master

Experience in vessels and fishing operations (boarding and work on board, ports) and laboratory - computational



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**Focused on the sustainability of the fishing sector (fishing fleet):
knowledge and applied technology.**

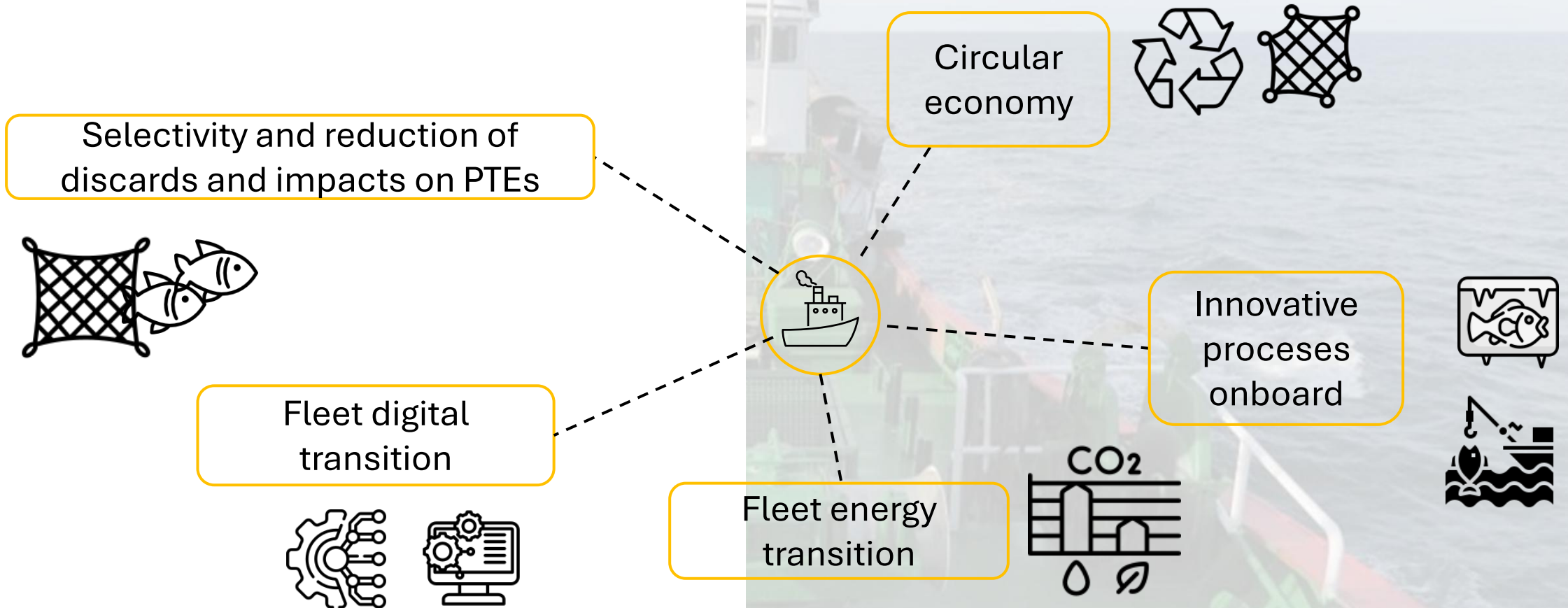
We:

- Develop innovative solutions based on technology and processes
- Provide high value services
- Transfer knowledge
- Do science

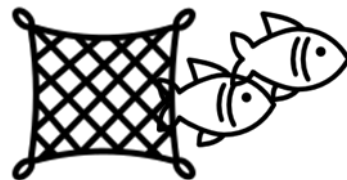
<https://www.azti.es/en/productos/report-technology-for-sustainable-fisheries/>



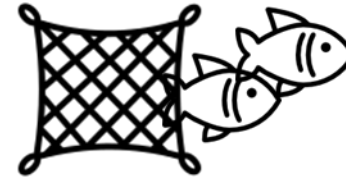
SUSTAINABLE FISHING TECHNOLOGIES



Selectivity and reduction of discards and impacts on PTEs



Selectivity and reduction of discards and impacts on PTEs



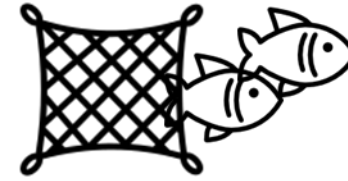
LOW IMPACT FISHING

We work in close collaboration with fishing industry and stakeholders



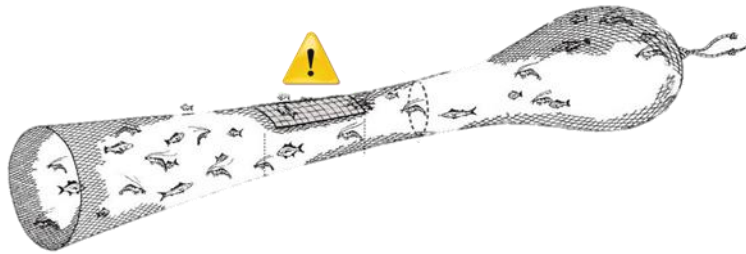
- Fishing gear selectivity
- Development of new designs for onboard testing
- Field work on research and commercial vessels
- Application of statistical models to fisheries data
- Capture of underwater images
 - Behavior analysis
 - Fishing gear performance

Selectivity and reduction of discards and impacts on PTEs



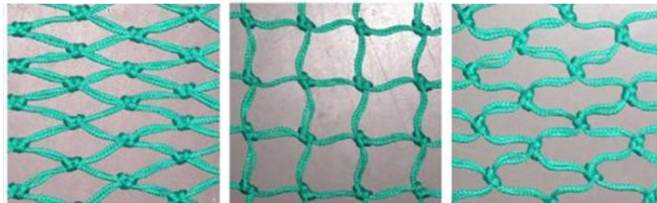
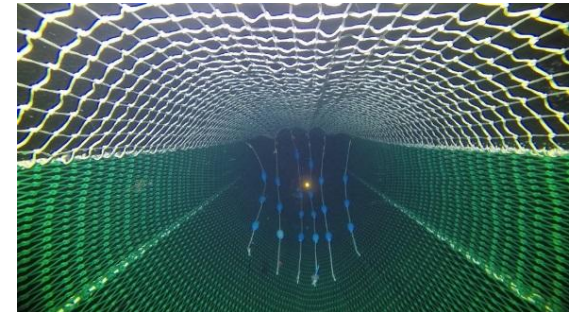
Trawl gear selectivity

Tailored to the challenges faced by fleets in relation to current regulatory frameworks



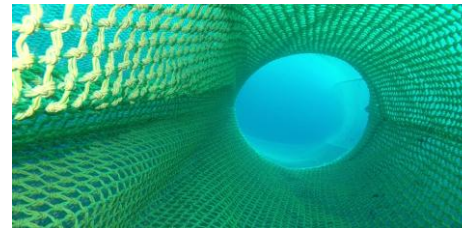
Improving the efficiency of selective devices in trawl gears (e.g. square mesh panels)

- Use of lights
- Mechanical stimulators
- Modification of size/position



↻ 45°

↻ 90°

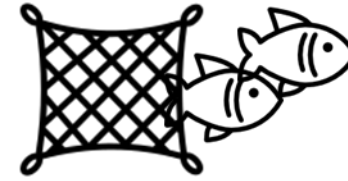


Change codend mesh shape/size

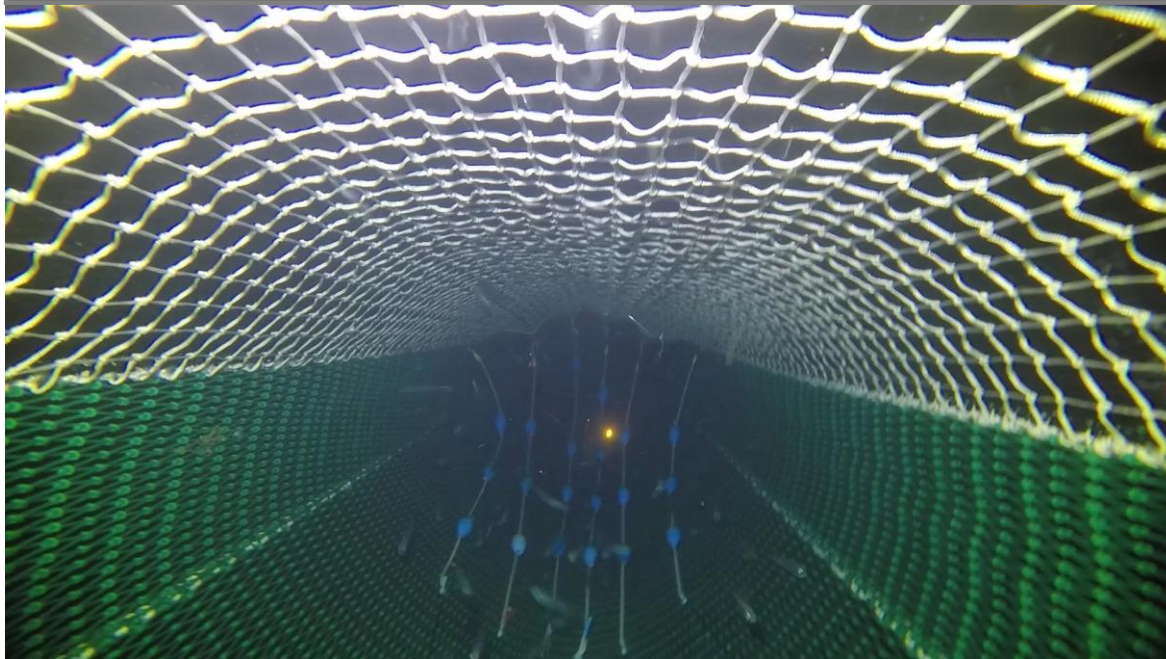


Change in hanging ratio

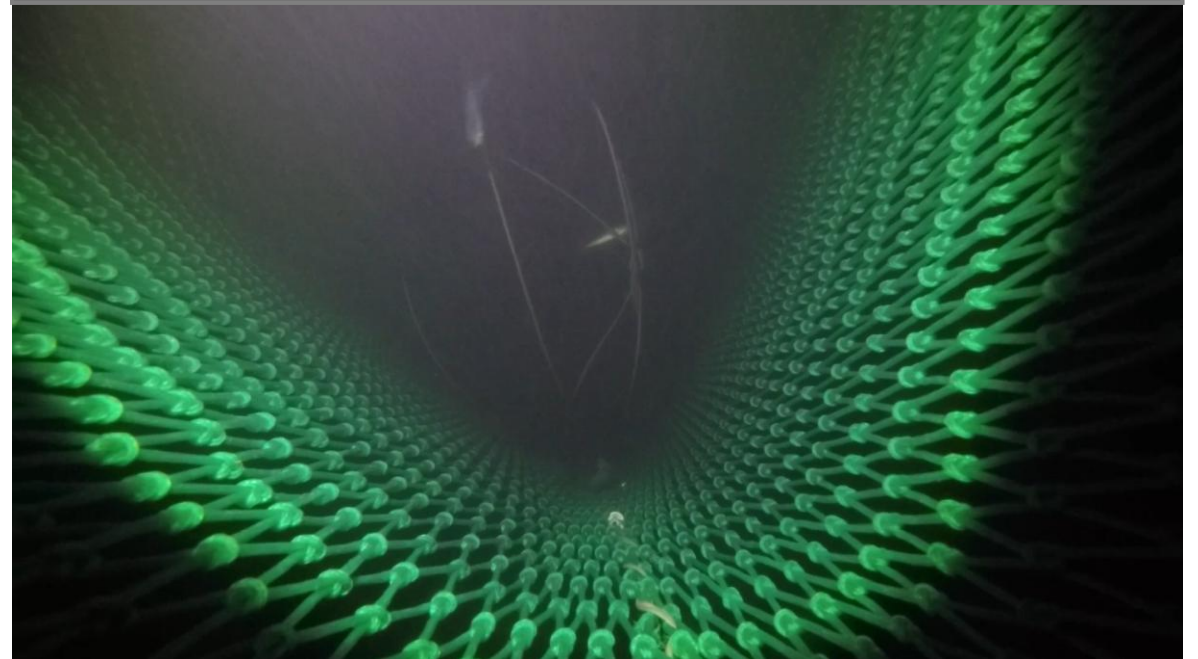
Selectivity and reduction of discards and impacts on PTEs



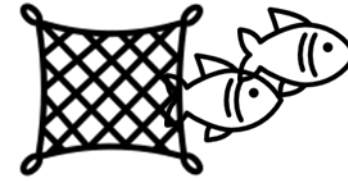
La perlita muestra un comportamiento activo y errático que resulta en un mayor contacto



La merluza nada cerca del fondo y es desplazada hacia el copo de manera pasiva. No muestra comportamiento de escape.

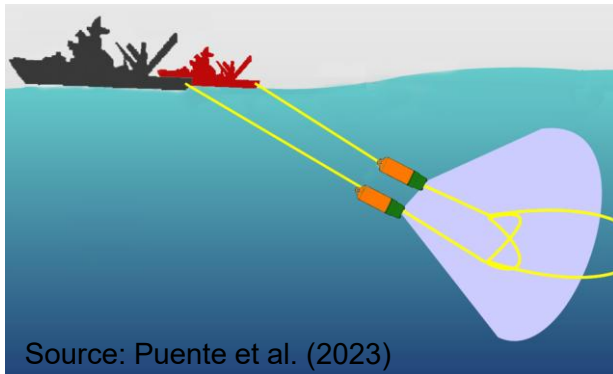


Selectivity and reduction of discards and impacts on PTEs



Bycatch mitigation of sensitive species - Pingers

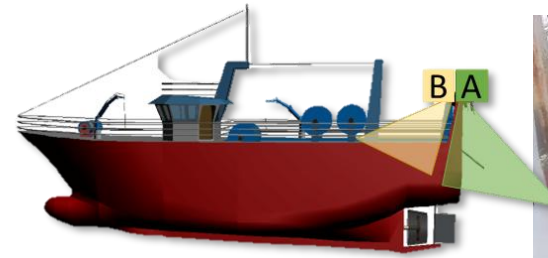
Effectiveness testing



Source: Puente et al. (2023)



Remote electronic monitoring



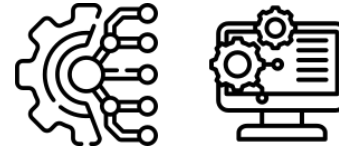
Fisheries Research
Volume 267, November 2023, 106819



Bycatch of short-beaked common dolphin (*Delphinus delphis*) in the pair bottom trawl fishery of the Bay of Biscay and its mitigation with an active acoustic deterrent device (pinger)

Esteban Puente ^a, Leire Citores ^b, Elsa Cuende ^a , Iñigo Krug ^a, Mikel Basterretxea ^a

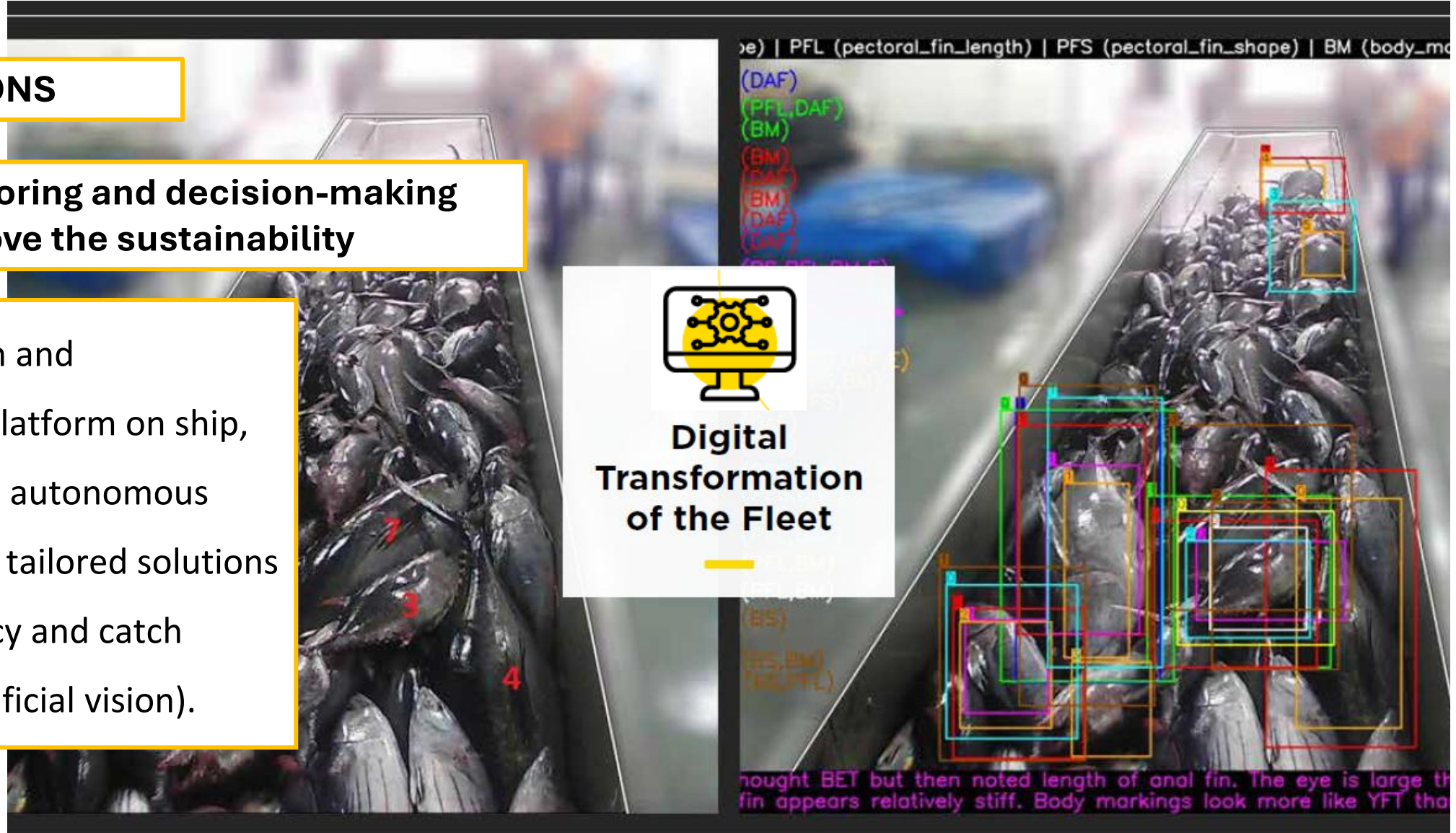
Fleet digital transition



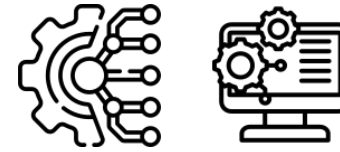
DIGITAL SOLUTIONS

Innovative monitoring and decision-making systems to improve the sustainability

- Data acquisition and proportioning platform on ship, AI assessments, autonomous vessels/drones, tailored solutions
- Fishing efficiency and catch monitoring (artificial vision).



Fleet digital transition



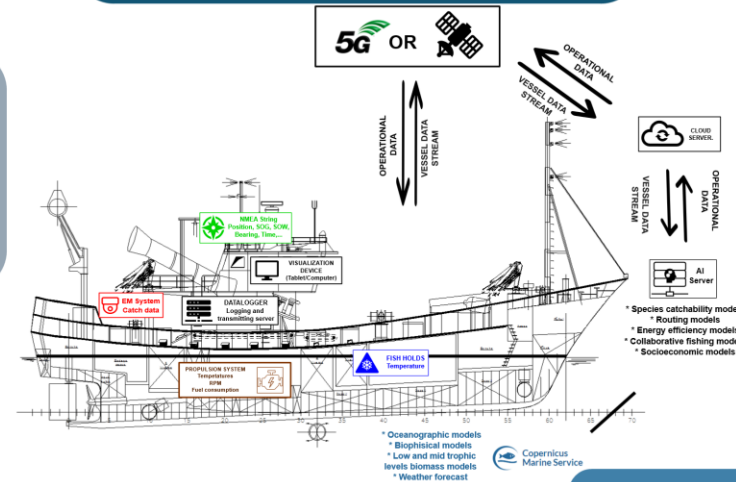
Climate-friendly and
resilient fisheries through
innovation and co-learning
From June 2025 on



Case studies in different European
seas and fisheries in their social
and economic context.

VESSEL DIGITALIZATION

Development of route, increased
probability of fishing, change in
species distribution, estimated
time of arrival, associated fuel
consumption and expected
selling price **models**.

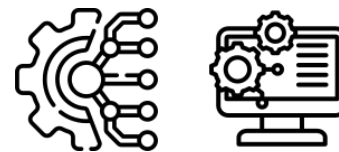


Decision support systems to
reduce fuel intensity and
increase fuel efficiency in a
wide variety of fisheries.

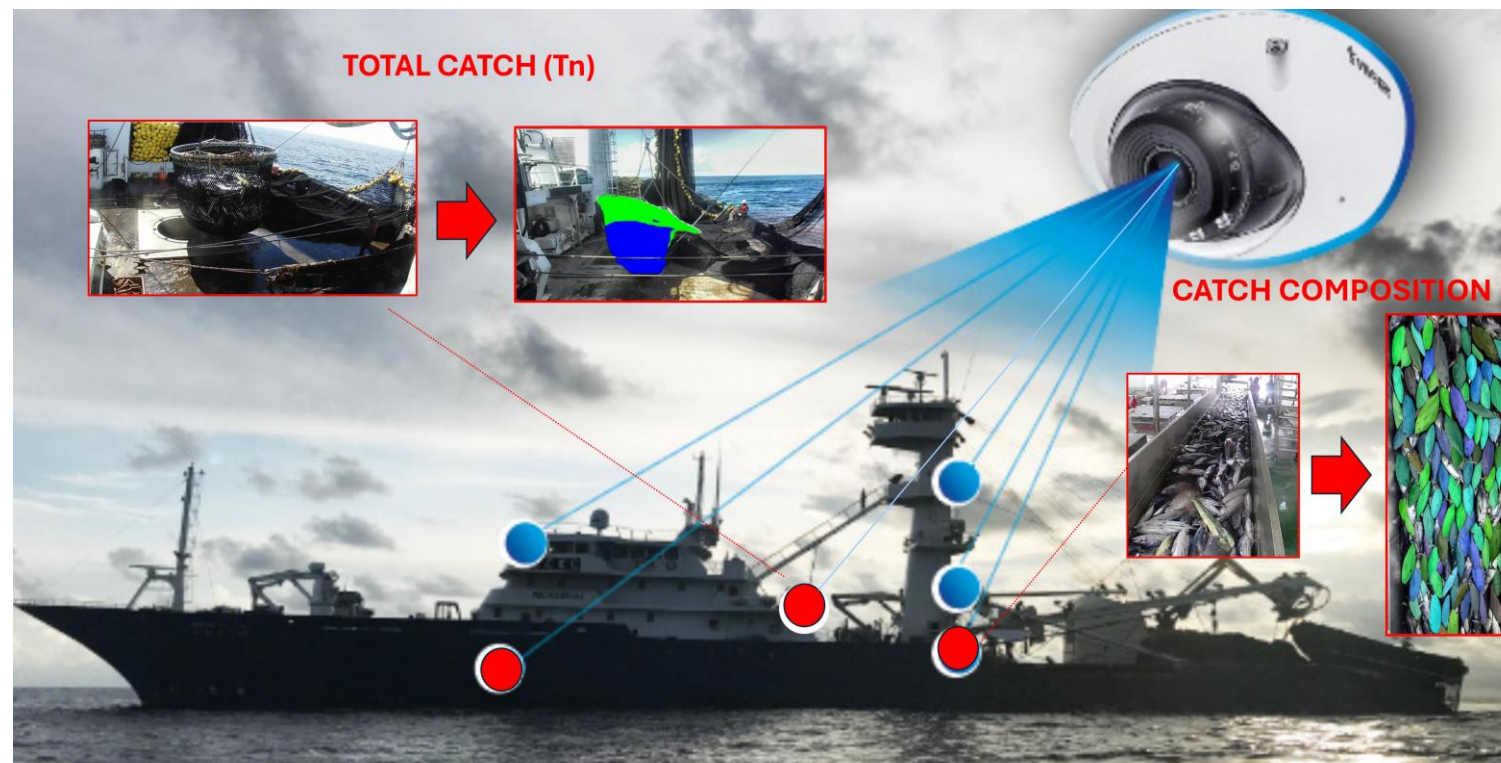
Testing in several vessels.

Onboard visualization of the near
real time outputs of the models.

Fleet digital transition



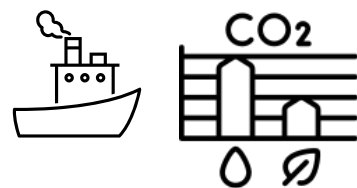
Digital transition of catch monitoring in European fisheries



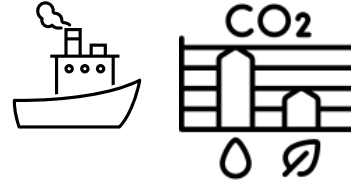
● Cameras where Artificial Vision (AV) is applied



Fleet energy transition



Fleet energy transition

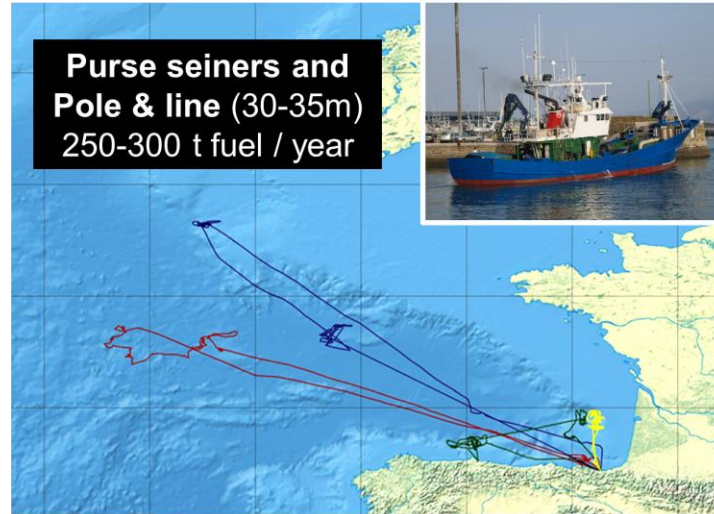


FISHING VESSELS ARE DIVERSE: ONE-FITS-ALL SOLUTIONS DO NOT EXIST

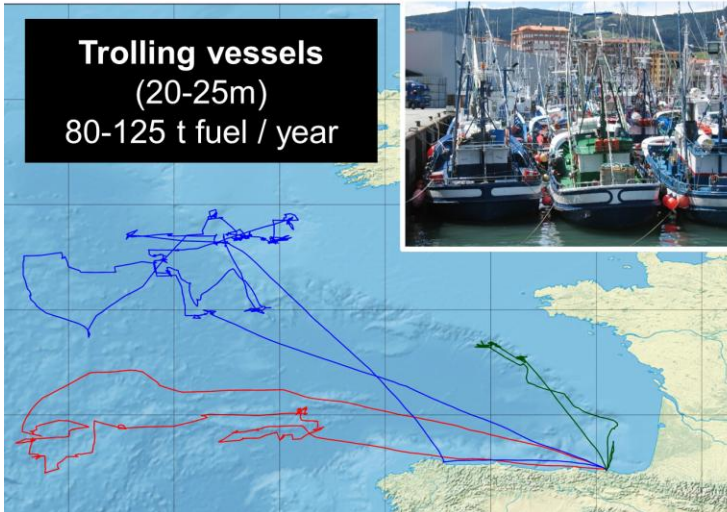
Artisanal (<15m)
20-30 t fuel / year



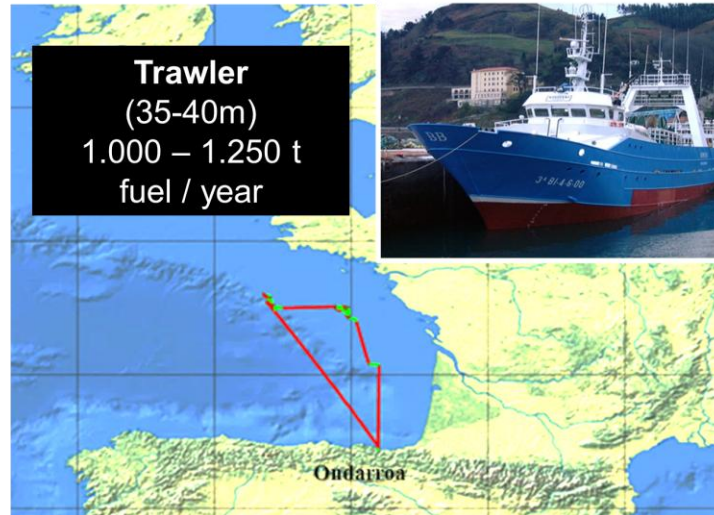
Purse seiners and Pole & line (30-35m)
250-300 t fuel / year



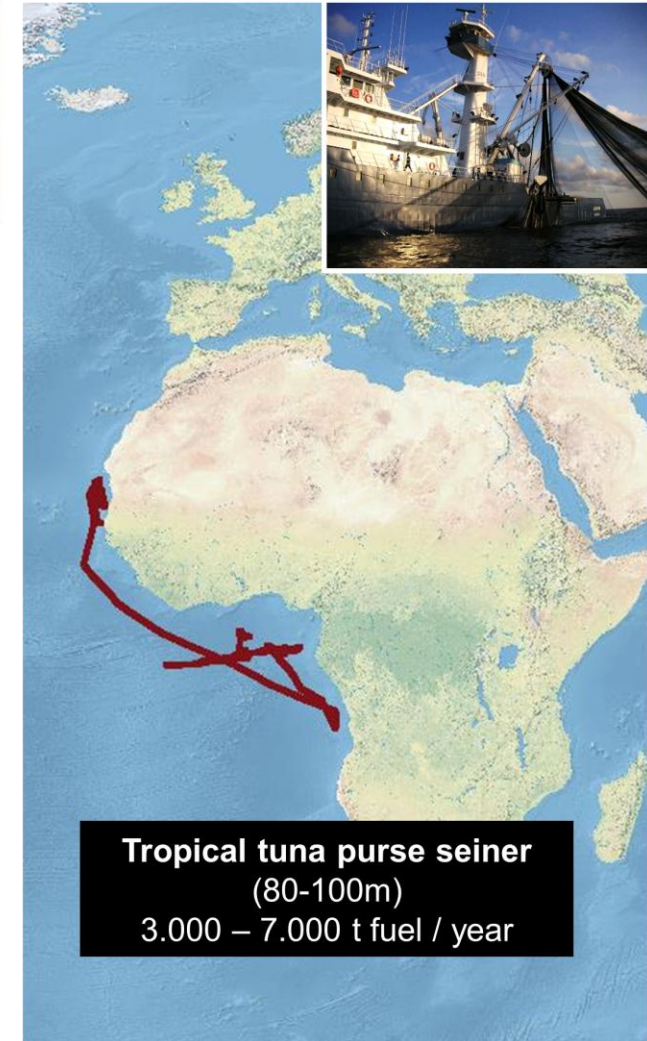
Trolling vessels (20-25m)
80-125 t fuel / year



Trawler (35-40m)
1.000 – 1.250 t
fuel / year

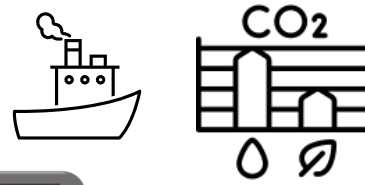


Tropical tuna purse seiner (80-100m)
3.000 – 7.000 t fuel / year



Fleet energy transition

Tailored solutions



Energy consumption management

Route optimization

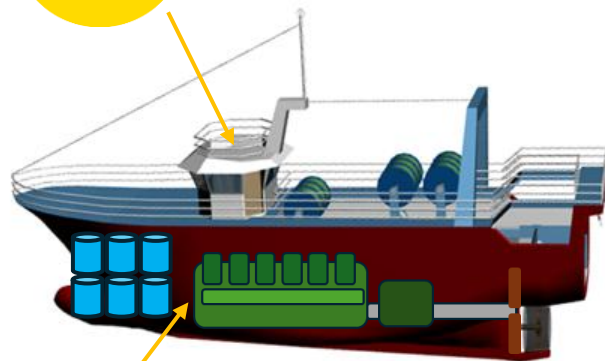
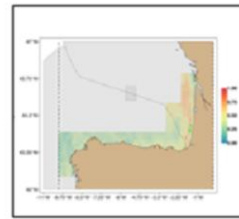
Fishing zones forecast

Fishing tactics

STRATEGY



DAILY PREDICTIVE MAPS



VESSEL
STRUCTURE
& EQUIPMENT

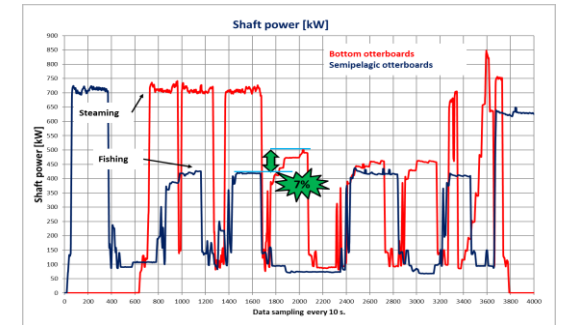
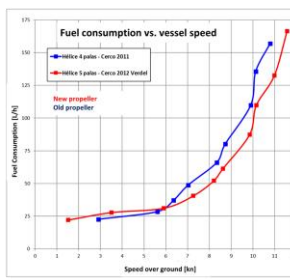
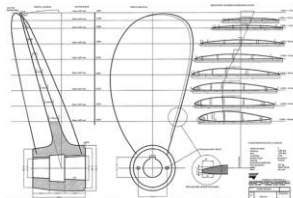


Propulsion efficiency: hull-engine-propeller

New low carbon fuels and renewable energy sources

Auxiliary machinery: lightening, freezing system, frequency converters, ...

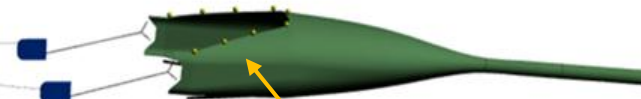
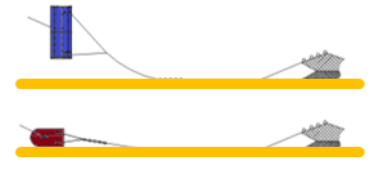
Heat waste recovery



Gear shifting

New gear and netting design

Gear control



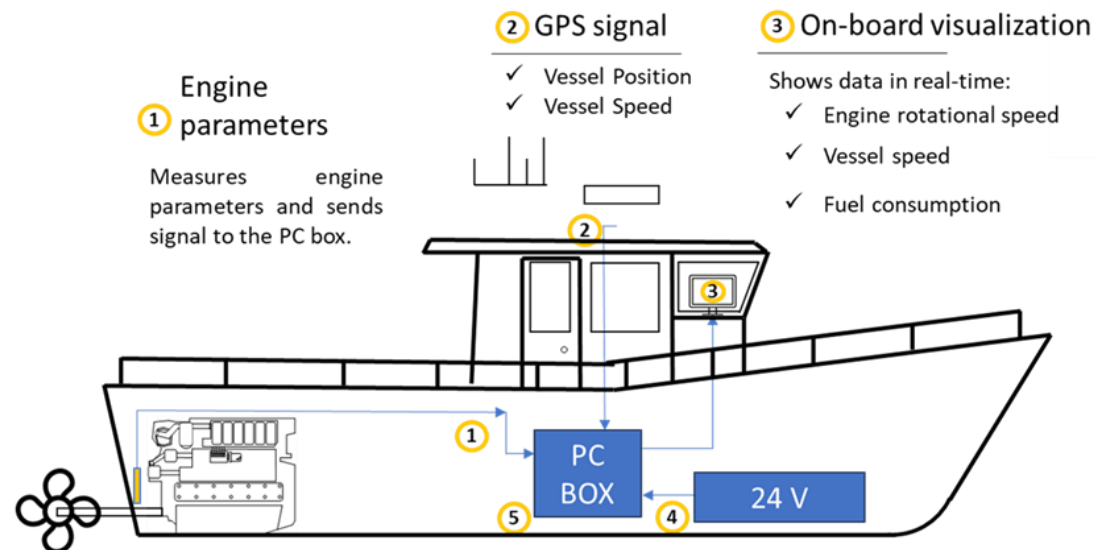
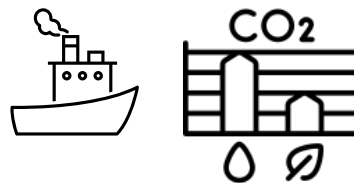
FISHING
GEAR



Basurko O.C. et al, Workshop on the European Green Deal – Challenges and opportunities for EU fisheries and aquaculture, Part I: Decarbonisation & circular economy aspects for fisheries, Presentation for the Committee on Fisheries (PECH), 2023.



Fleet energy transition

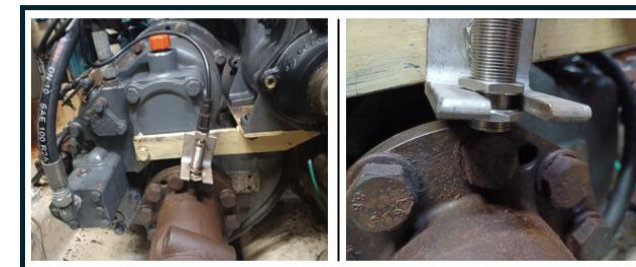


5 PC BOX

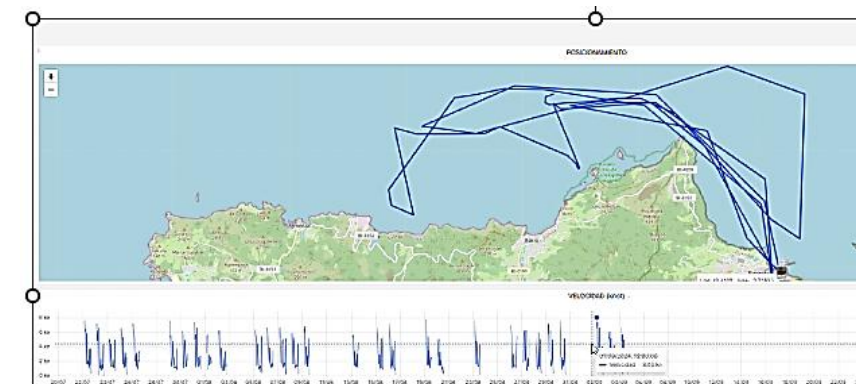
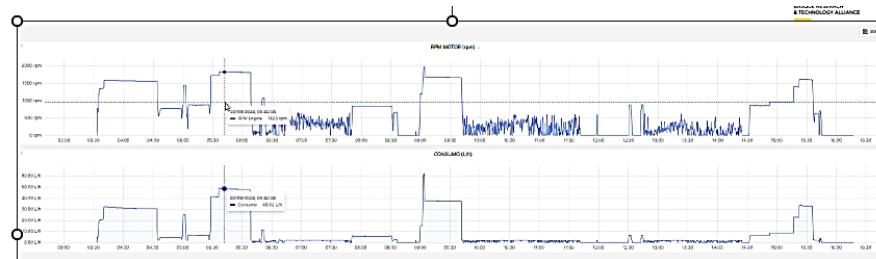
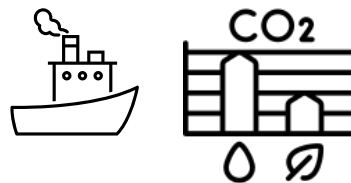
Receives all the data from the acquisition devices, and calculates the fuel consumption in real time. Internet connection. Any modifications can be carried out remotely. Data coupling and uploading to the server via internet.

4 Connection to vessel batteries

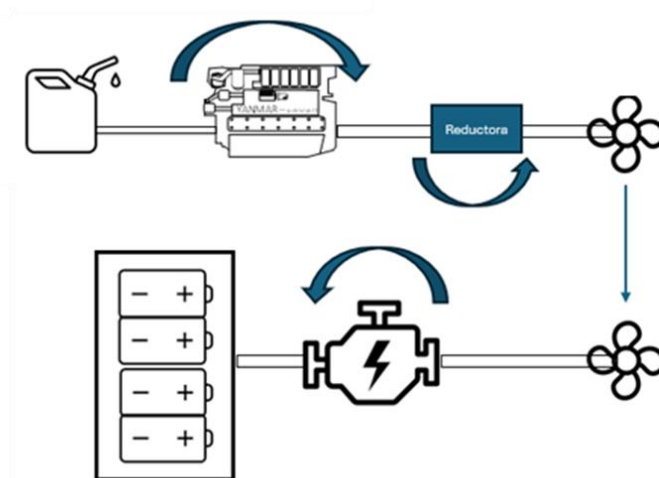
Powered with 24 V → Low electric consumption to be installable in the artisanal and small-scale fishing vessels. 220 V powered version is also developed.



Fleet energy transition



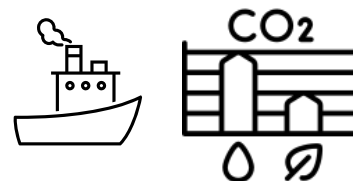
Results after analyzing 506 trips.



Ship	Fishing gear	Tides with maximum fuel consumption				
		Time [h]	Distance [miles]	Fuel consumption [L]	Energy consumption [kWh]	Required volume* [m3]
V#1	Trolling	47.61	256.72	475.69	1868.85	12.98
	Hake longline	13.02	39.04	74.67	293.36	2.04
V#2	Gillnet	12.63	45.94	62.50	245.54	1.71
	Gillnet	12.86	43.36	132.25	519.57	3.61
V#3	Vertical line of hooks	12.62	54.09	188.81	741.78	5.15
V#4	Gillnet	12.02	31.84	104.27	409.65	2.84
V#5	Conger longline	12.23	32.66	33.35	131.02	0.91
	Hake longline	15.06	44.25	47.56	186.85	1.30
	Vertical line of hooks	12.52	64.70	67.05	263.42	1.83
V#6	Gillnet	6.25	27.79	80.53	316.38	2.20

*Considering energy densities of 144 kWh/m3 for batteries.

Fleet energy transition



Vessel #01



Hybrid driveline:

- Methanol engine
- Li-Ion batteries
- Electric motor



Onshore charging



Antifouling Ecoating



Vessel #02



Plug-in Hybrid driveline:

- Biodiesel engine
- Batteries
- Electric motor



Onshore charging



Antifouling Ecoating



Vessel #03



Plug-in Hybrid driveline:

- Modern combustion engine
- Batteries
- Electric motor



Onshore charging



Antifouling Ecoating



Vessel #04



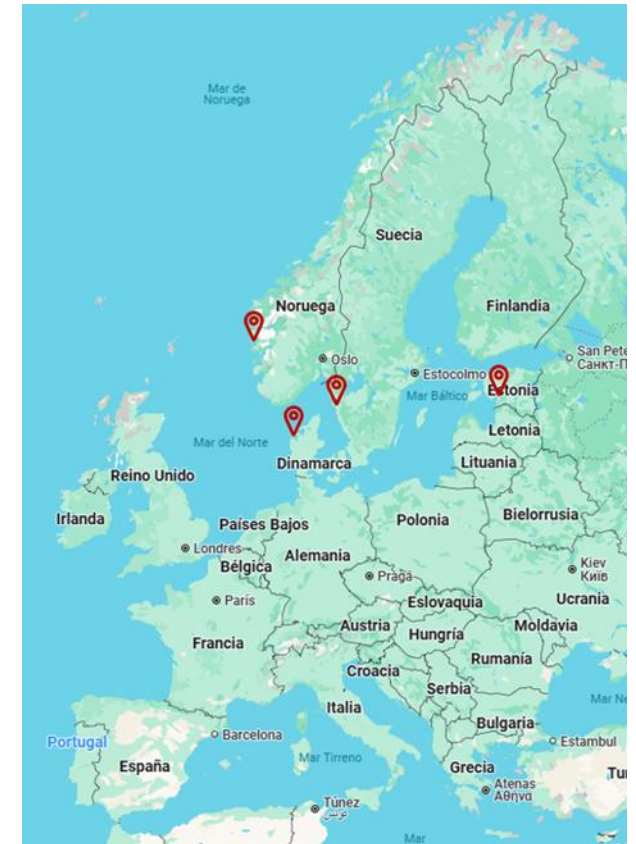
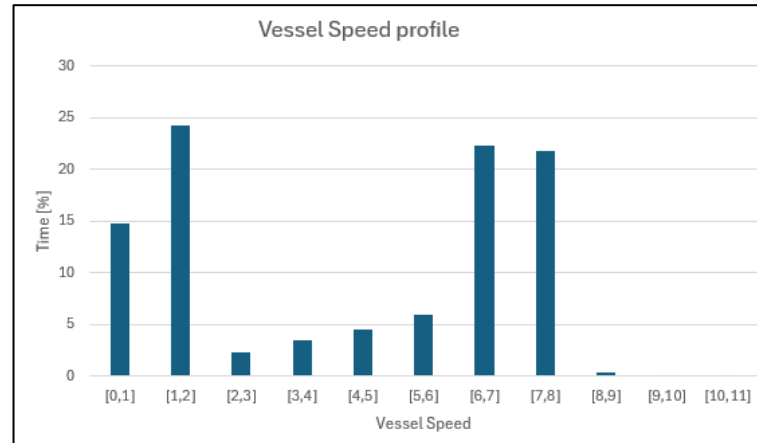
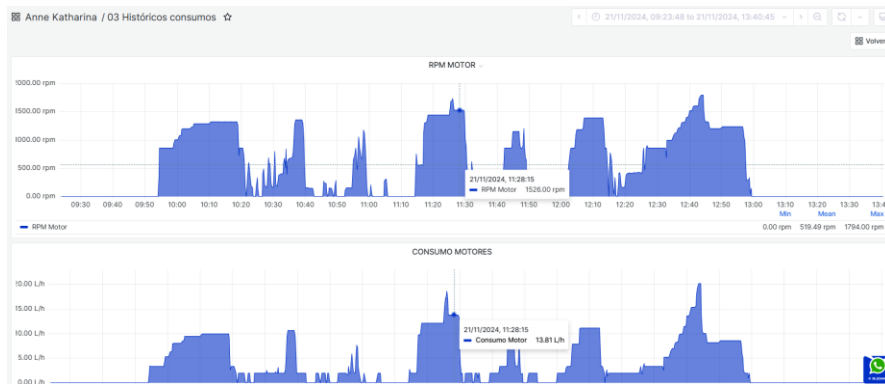
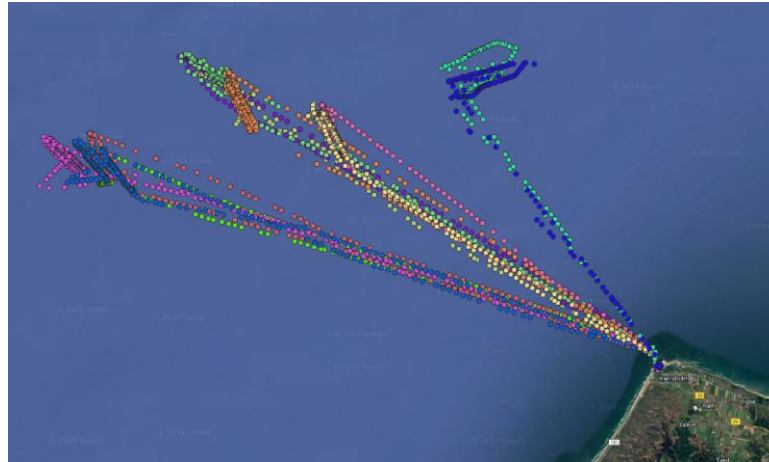
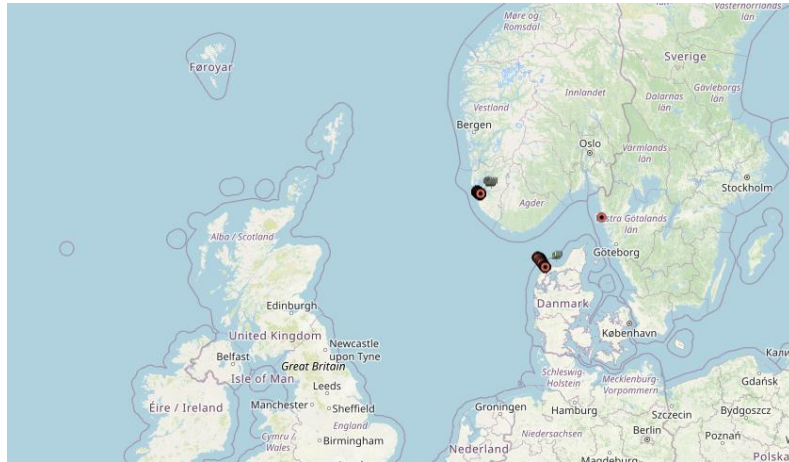
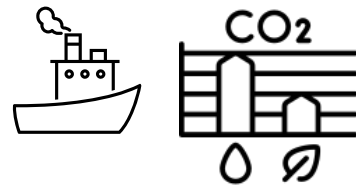
Antifouling Ecoating



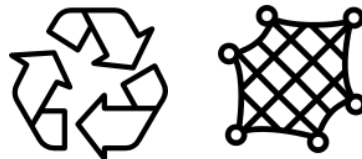
Which is their operational and energy consumption pattern?

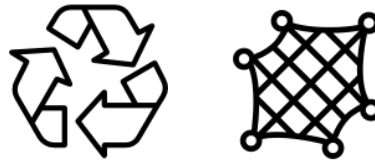


Fleet energy transition

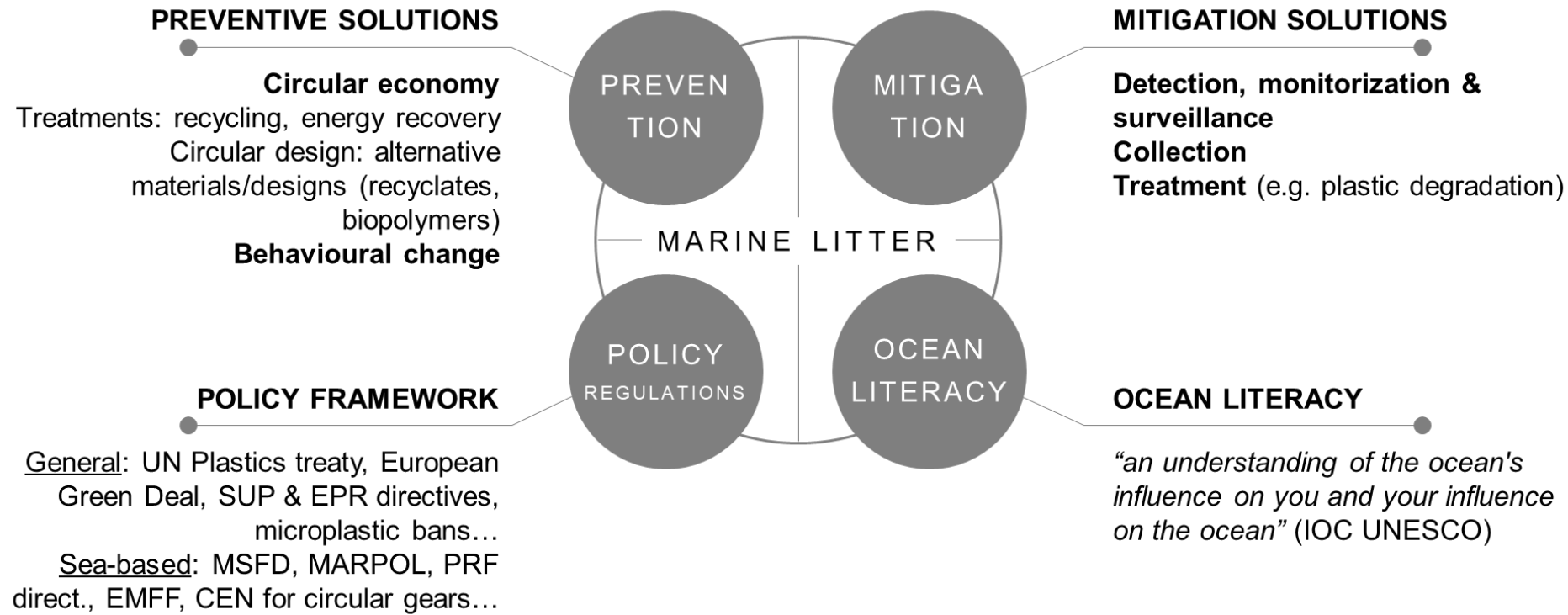


Circular economy

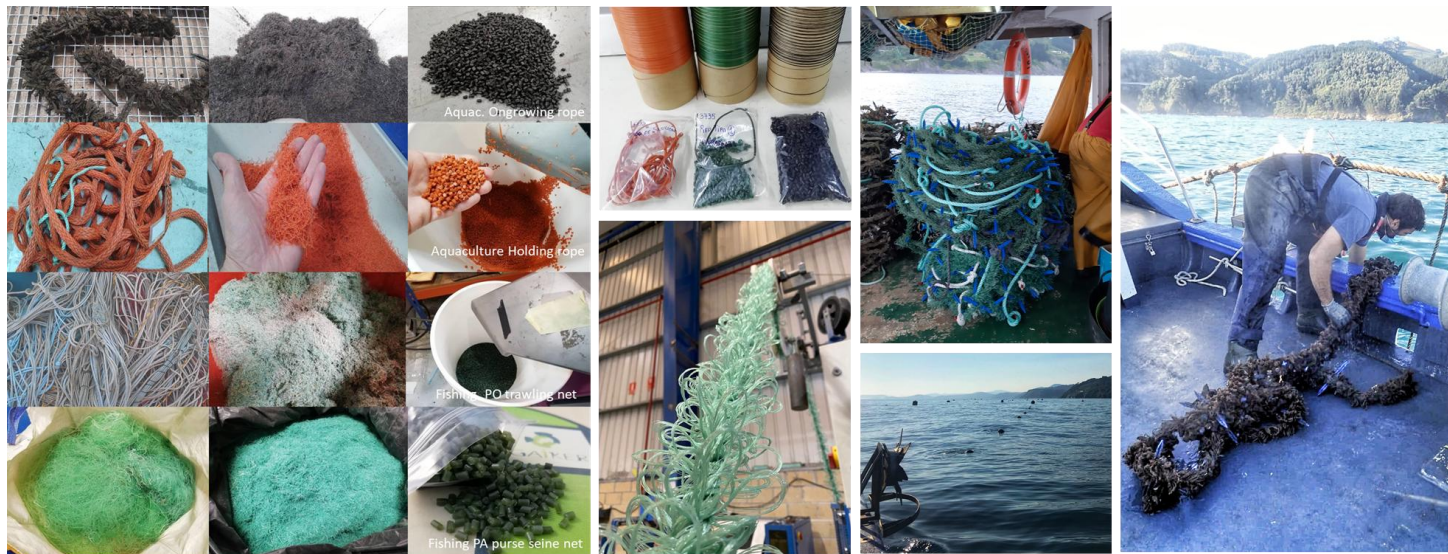




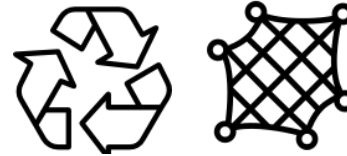
SOLUTION for MARINE LITTER



Circular economy



Circular economy



SEARCULAR consortium

Partners: 11 + (2 subcontracted: ISSF and SENBIS)

SEARCULAR is an international project involving **industry specialists and research organisations** from across **6 countries** and **13 organisations**.

Together we are working in close **collaboration with the fishing industry** to pave the way for implementation of circular solutions for fishing gear.

Target region: OSPAR and HELCOM regions

Duration: Sept. 2023 – Aug. 2026

Budget: 2,327,522 €



Subcontracted:

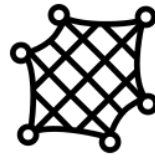


SENBIS
POLYMER INNOVATIONS



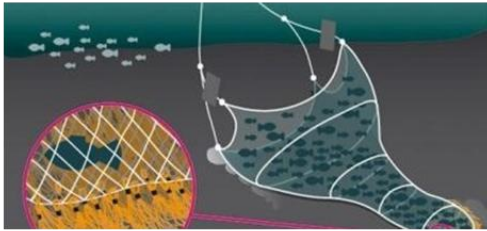
SEARCULAR
Circular Solutions for Fishing Gears

reserved



Our solutions

Trawlers (dolly ropes)



The problem

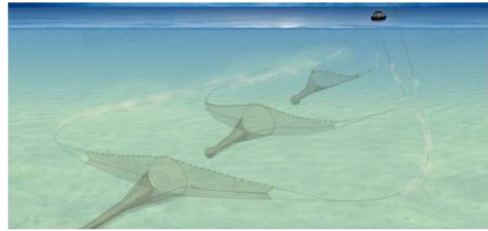
- Life span: 3 weeks to 6 months
- 325 - 3500 kg PE / yr & vessel
- 10-25% ends up as marine litter

SEARCULAR solutions:

Recycled PA dolly ropes

- Dolly ropes made of recycled PA tuna purse seine nets.
- More resistant material.
- Less marine litter / circular economy

Demersal seines (ropes)



- 20-30% loss per season
- 311 t microplastic (PP/PE) /yr (Europe)

Bio-seine ropes

- Seines covered with marine biodegradable polymer with higher (3x) resistance to abrasion.
- Less microplastics.

Tropical purse seine (FADs)



- 40% of FADs lost (Atlantic Ocean)
- 529 t/yr for French fleet alone
- Designs must include biodegradable materials

Ecodesigned JellyFAD

- Eco-designed version of the JellyFAD
- Less marine litter.

End of life (EOL) fishing gear

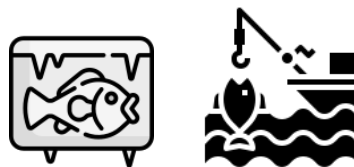


- Poor management for EOL fishing gear in port.
- Low recycling rate for EOL fishing gears.

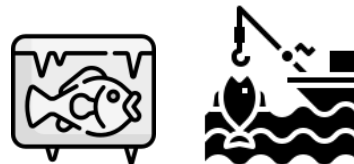
Port-based solutions

- Blue point for EOL fishing gear.
- Pyrolysis of rejects (Plastic2Plastic)
- Circular economy.

Innovative processes onboard



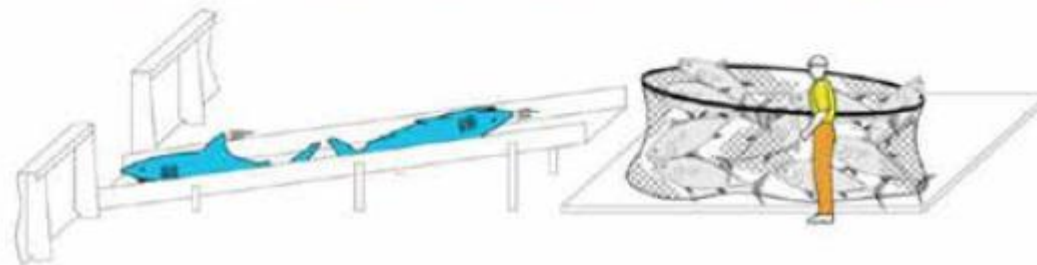
Innovative processes onboard



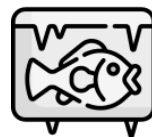
3.2.4 Release devices and survival of vulnerable species

In the case of tuna purse seiners, the capture of **small sharks and turtles** is relatively common. These species **need to be returned to the sea to continue their life cycle**, and various release systems have been developed to achieve this.

Ramp-mounted **hoppers**, for example, simplify the process of returning unwanted species to the sea, minimizing their stress and improving fishermen's safety. As a result, the percentage of **accidentally caught sharks that can be released directly thanks to the devices developed is 95%.**



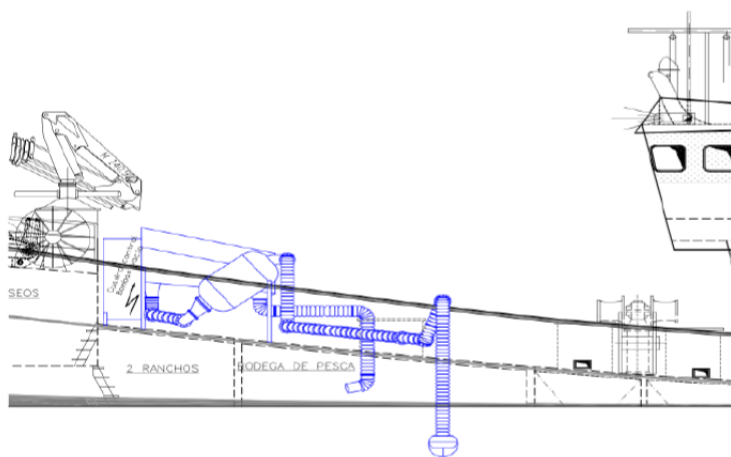
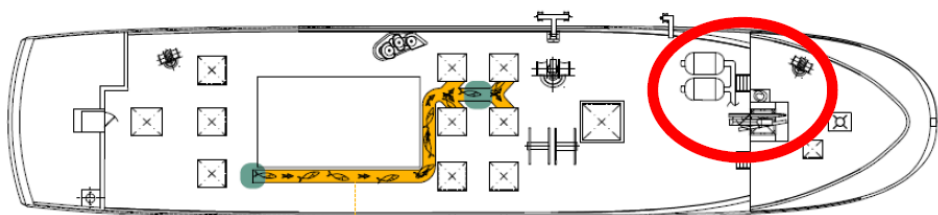
Innovative processes onboard



Survivability experiments

Improve fish welfare and quality

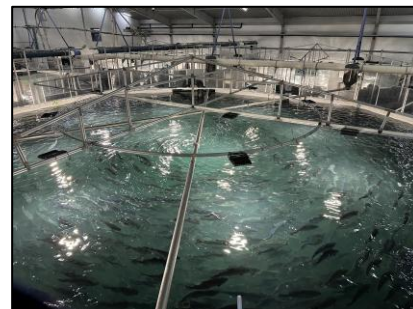
Measure stress levels of fish



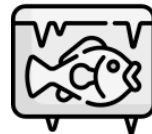
Purse seine fishery



Aquaculture farm



Innovative processes onboard



Safety and health on board

