

Is it possible to avoid deep-water sharks in the Azores hook-and-line fisheries?



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Who are the deep-water sharks?

= those whose distribution is below 200 m

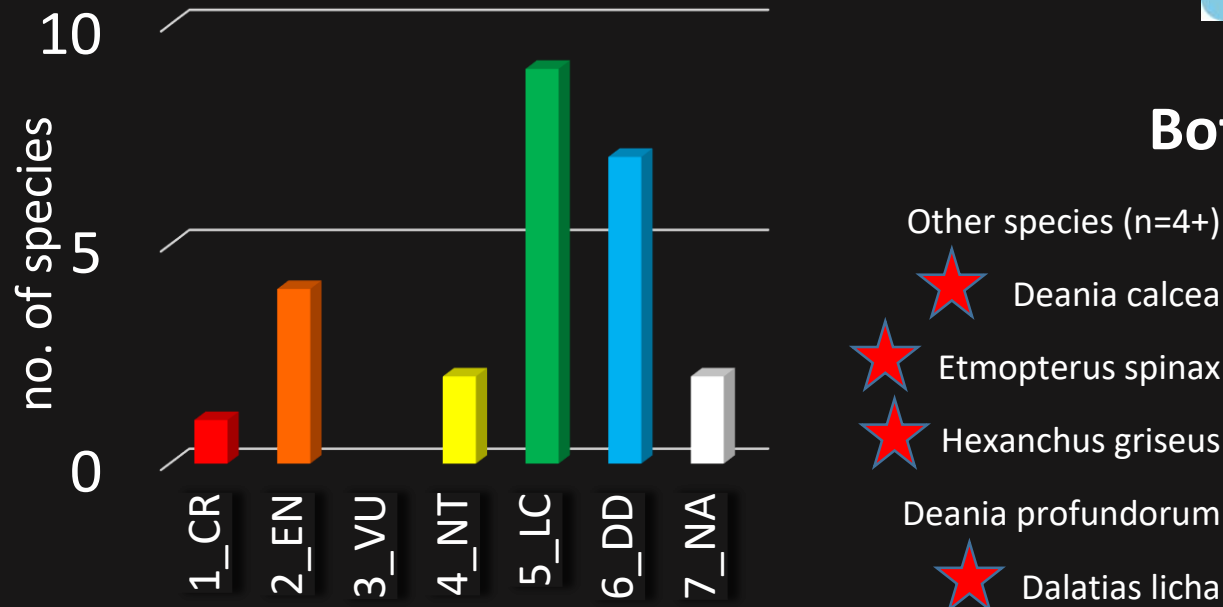


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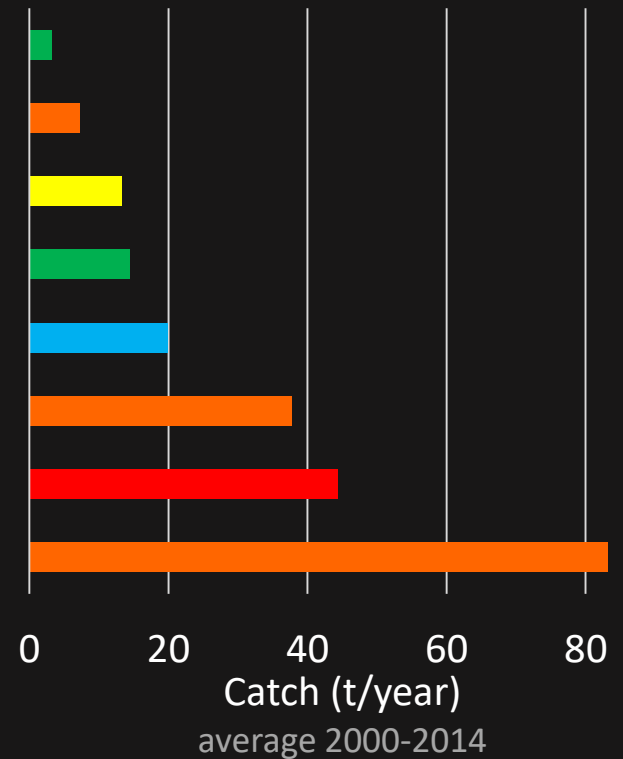
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Conservation issue + socio-economic



- Other species (n=4+)
- ★ *Deania calcea*
- ★ *Etmopterus spinax*
- ★ *Hexanchus griseus*
- Deania profundorum*
- ★ *Dalatias licha*
- ★ *Centrophorus granulosus*
- ★ *Centrophorus squamosus*

Bottom longlines



★ TAC 0 species

Objectives

➤ How can **deep-water sharks** be avoided?



➤ What can be done **for those that** cannot be avoided?



TACTICAL & TECHNICAL MITIGATION MEASURES

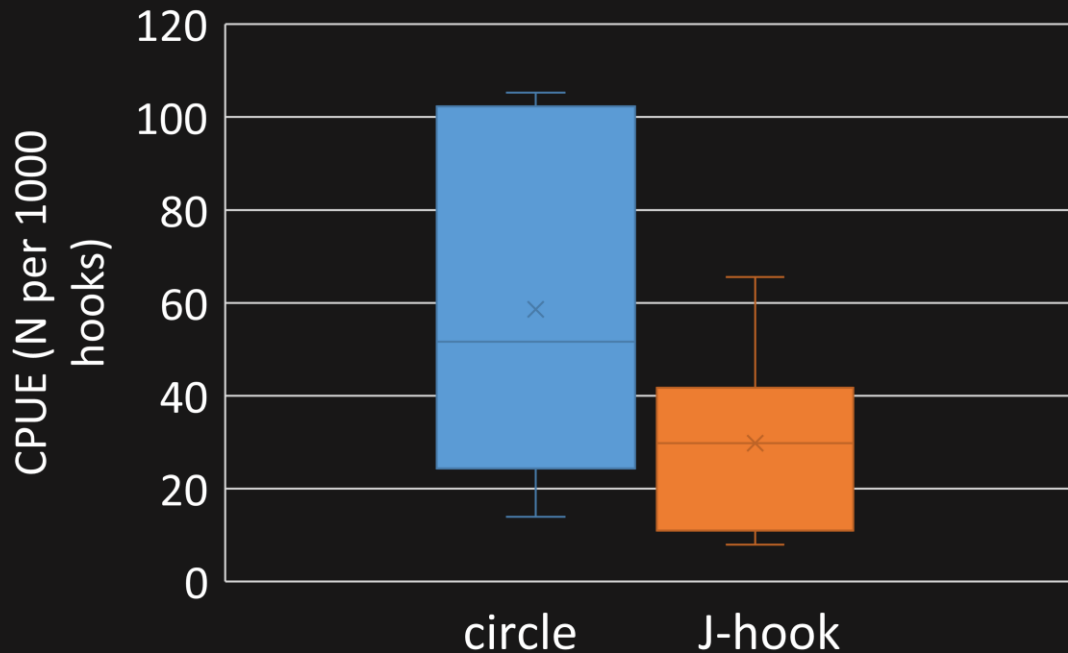
TECHNICAL

=> Circle hooks as potential mitigation measure?

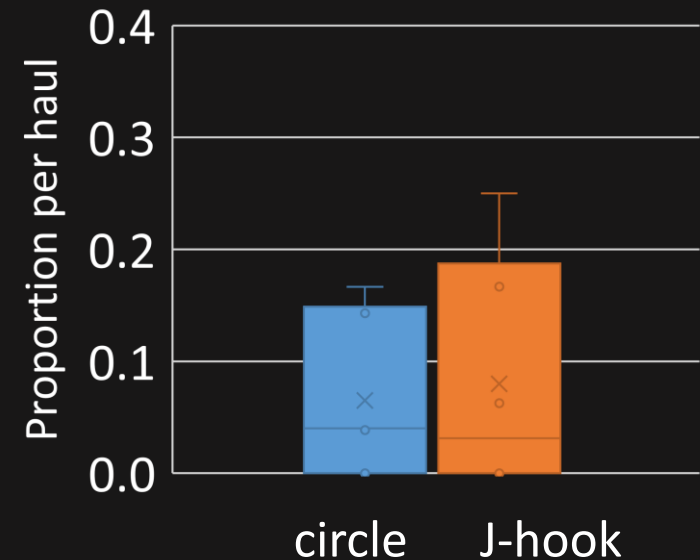


Experimental fishing => 6210 hooks (circle – J-hooks)
267 sharks caught ; 11 species

Catchability



Gut hooking



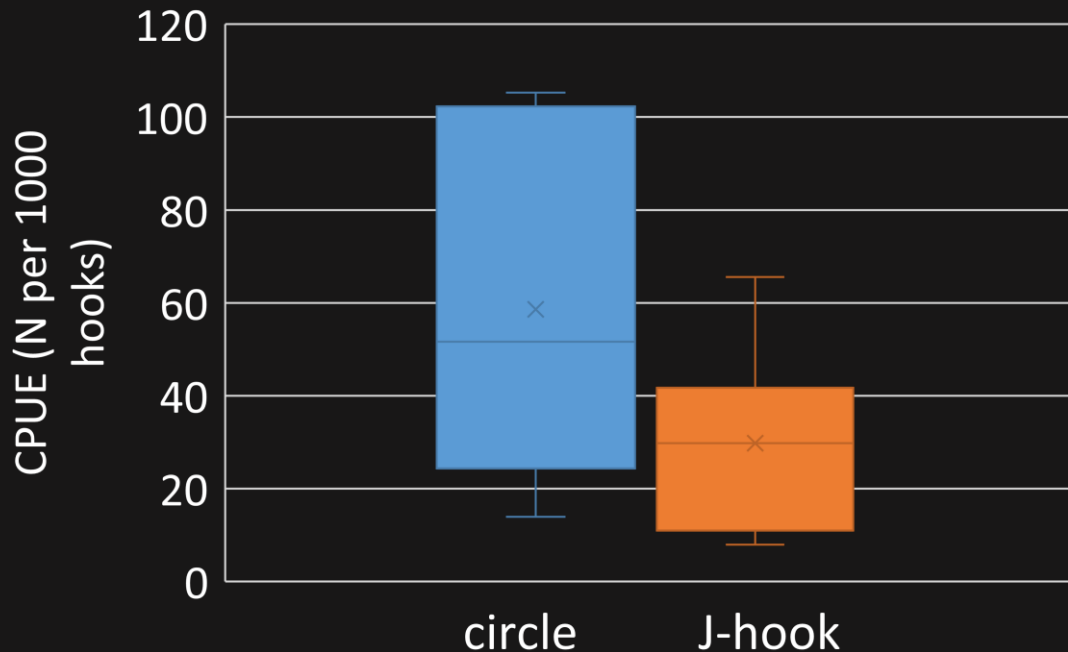
TECHNICAL

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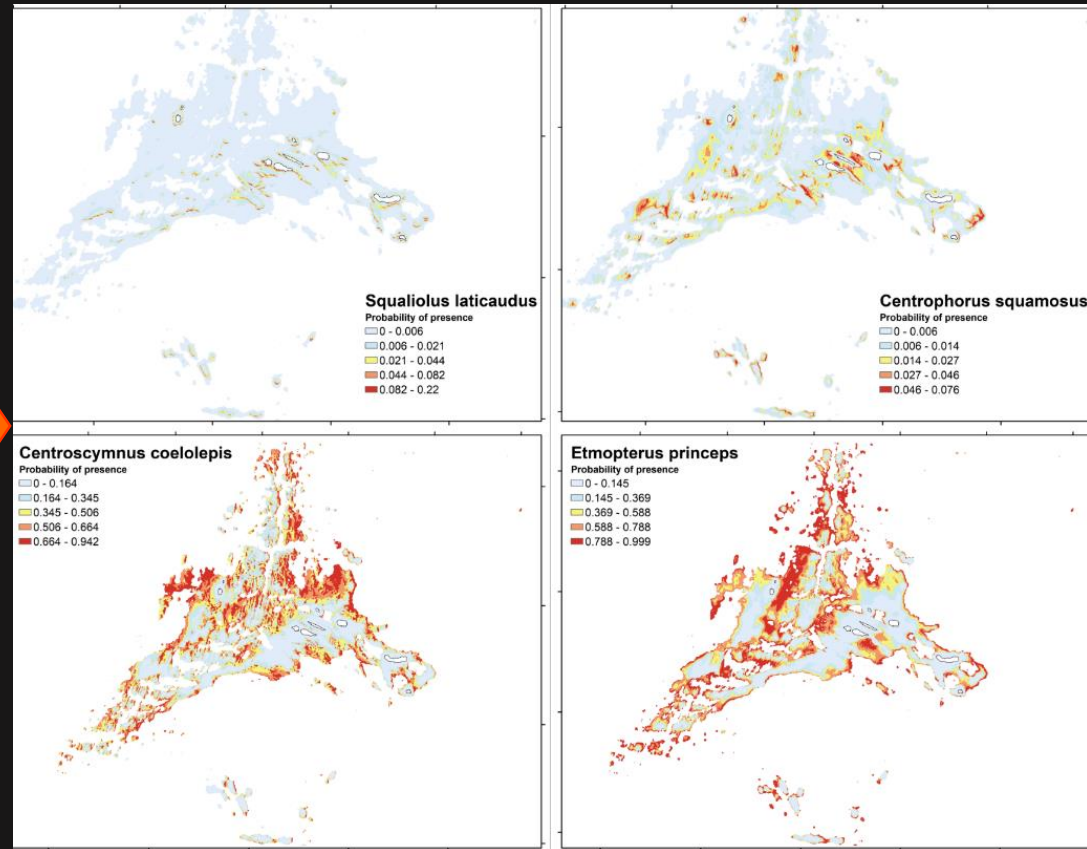
The hook type currently in use in the fishery (J-hook) is the **MOST** appropriate to limit deep-water shark bycatch

TACTICAL

=> Spatial avoidance measures

1. Species Habitat Suitability Models

- Data from demersal survey (1997-2018) + onboard observers
- Maps of **presence / absence**: 15 species of sharks and rays
- Maps of **abundance**: 6 species

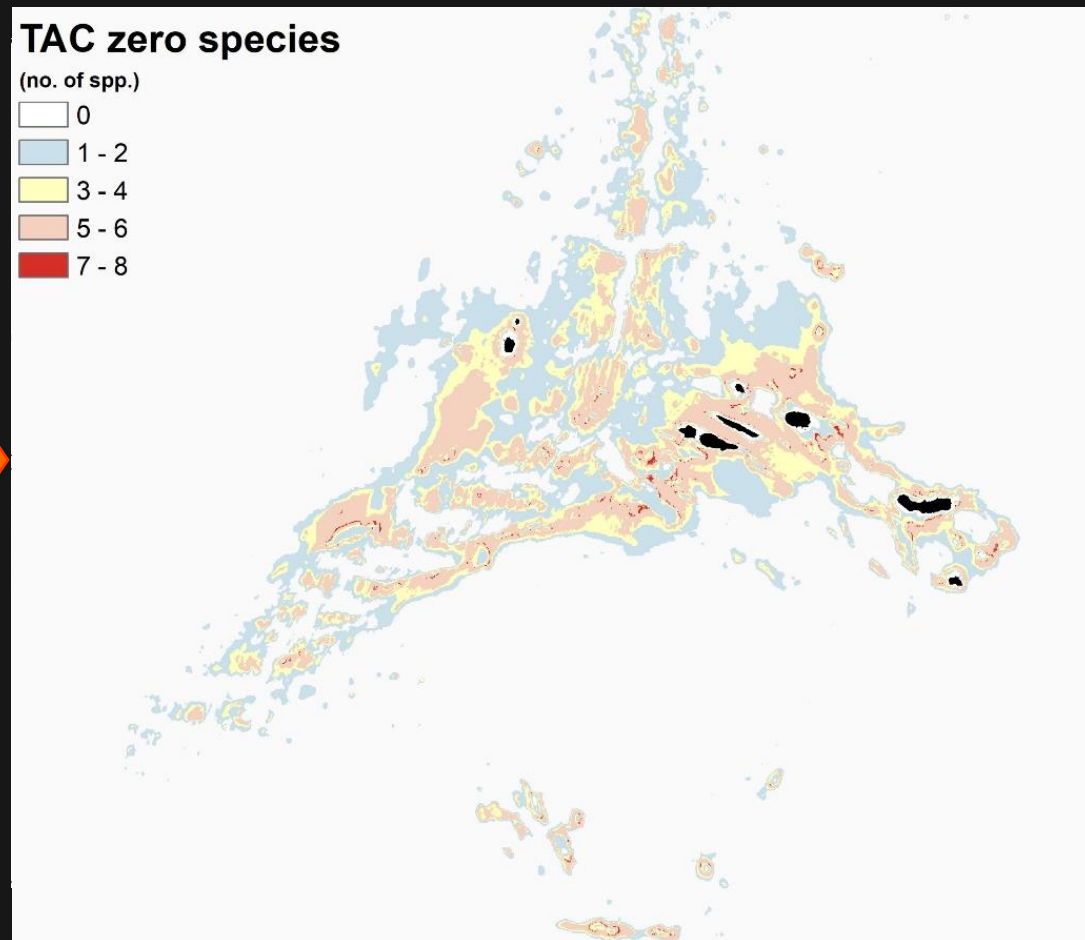


TACTICAL

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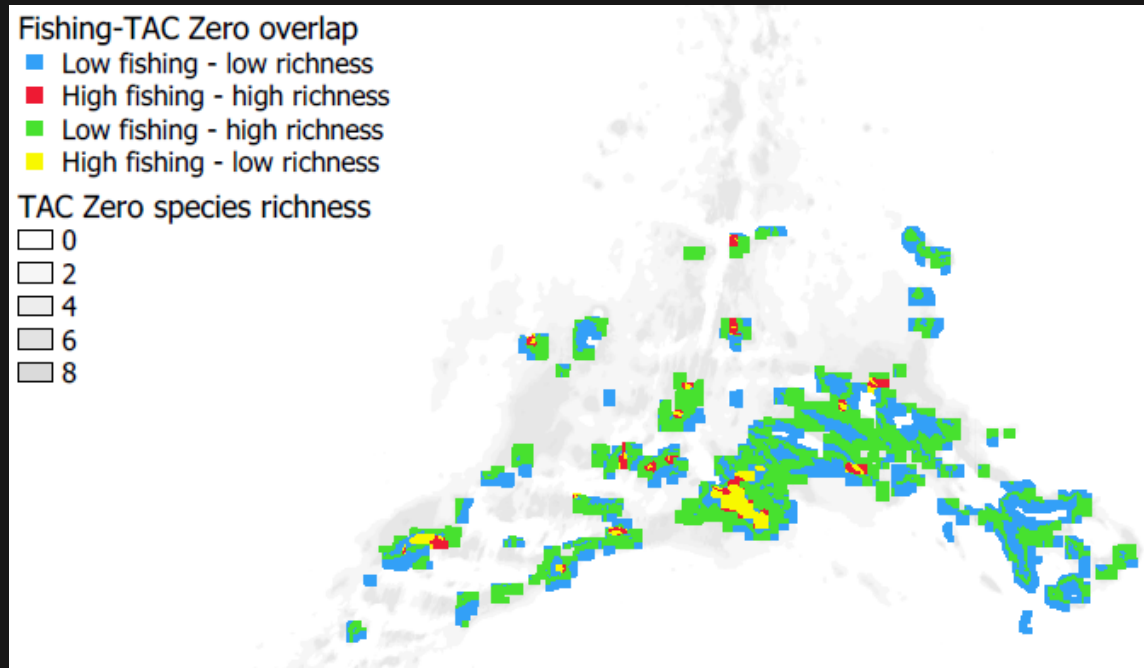
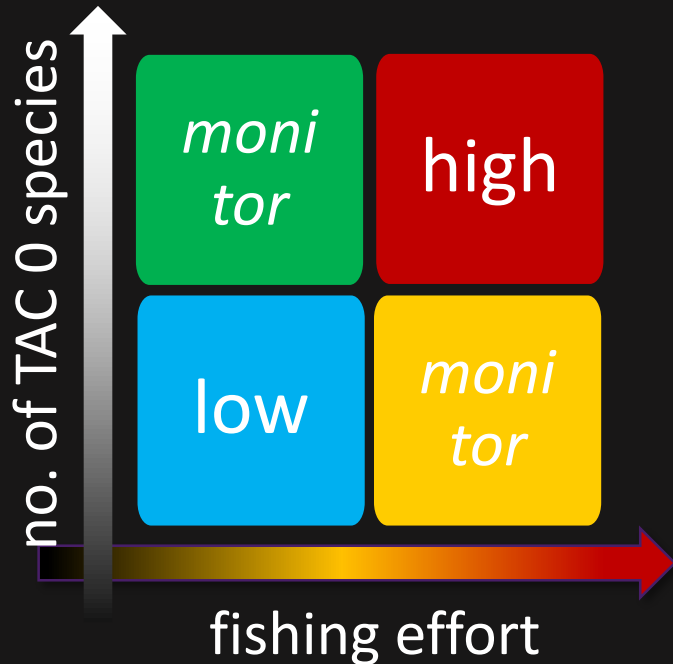


TACTICAL

=> Spatial avoidance measures (cont.)

2. Overlap with fisheries spatial distribution

Fishing effort => VMS data



DECISION SUPPORT TOOL => FISHERS

Identification of areas to avoid

VS areas of low overlap

TACTICAL

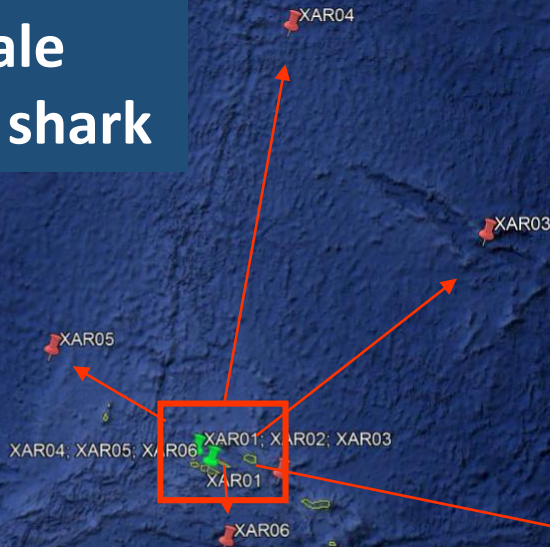
=> Spatial avoidance measures (cont.)

3. Habitat use

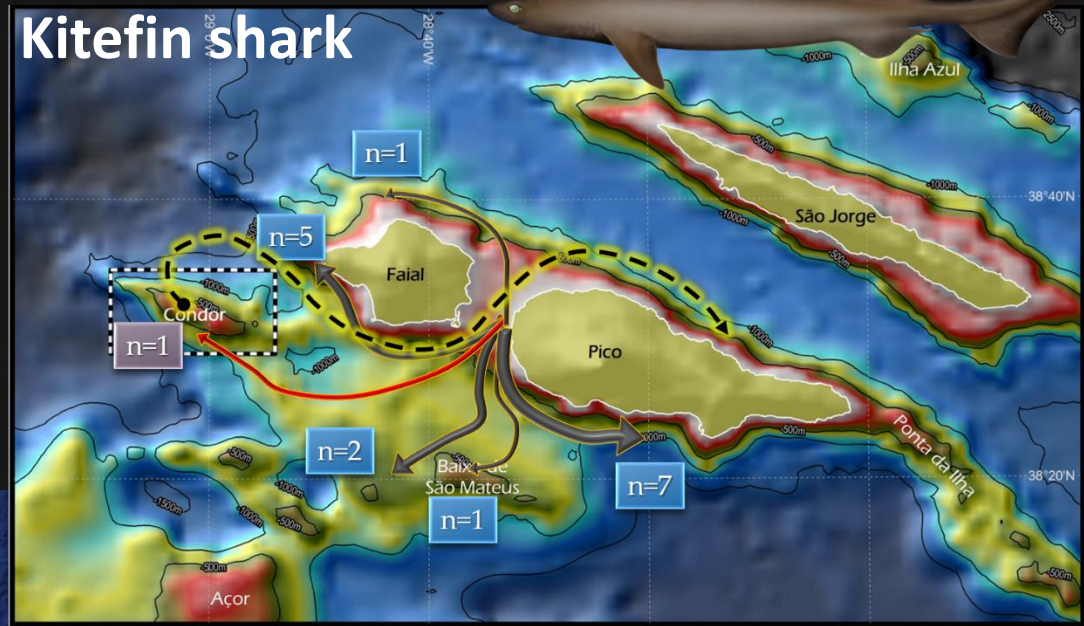
Telemetry – electronic tags

Detailed information on individuals' **movements** and **migration**

Leafscale gulper shark



Kitefin shark



Habitat range and use widely differ between species

Spatial avoidance might be an **efficient mitigation measure** for some species, but not all

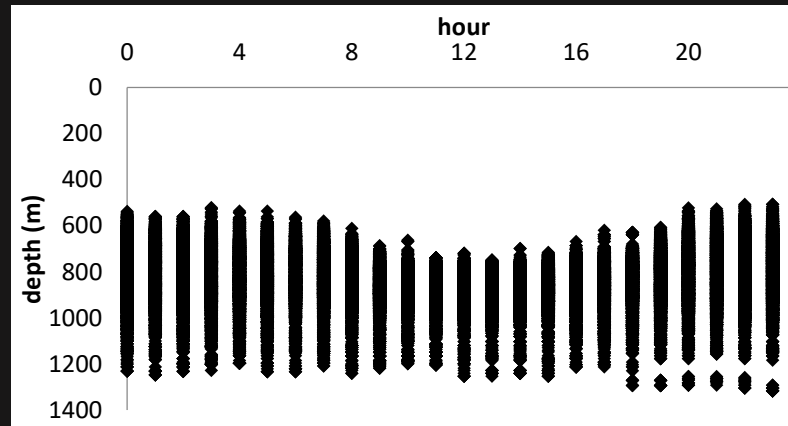
TACTICAL

=> Vertical avoidance measures

Telemetry => Detailed information on **vertical** individuals' movements

Diel

Leafscale
gulper
shark



Kitefin
shark



Depth limitations
(eg. avoid fishing **at night**
or **<500m during daytime**)
could be efficient
mitigation measures
for **some** species

Telemetry can also inform about post-release survival

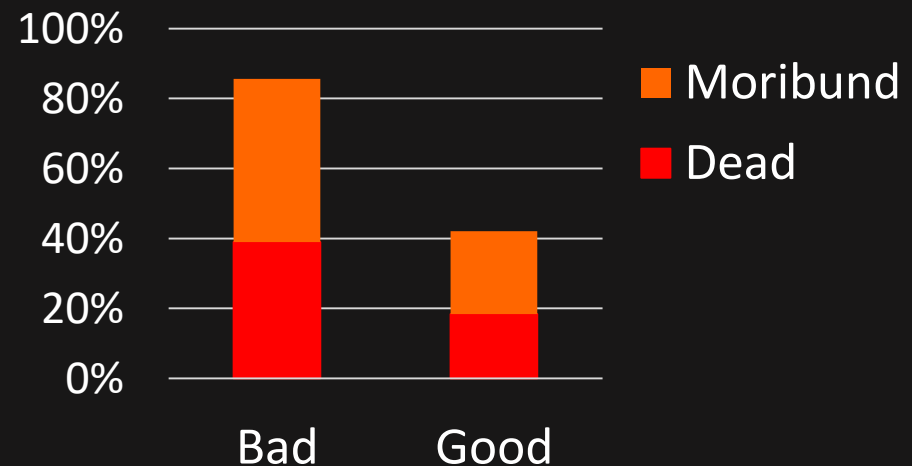


Electronic tagging

Species	Scientific name	Tagged n	'Recapture' n	'Recapture' %
Leafscale gulper shark	<i>Centrophorus squamosus</i>	6	6	100 %
Bluntnose sixgill shark	<i>Hexanchus griseus</i>	6	6	100 %
Kitefin shark	<i>Dalatias licha</i>	25	24	96 %

⇒ **Demonstrated high post-release survival of “properly” discarded sharks**

Fishers handling practices



Telemetry can also inform about post-release survival



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Manual for best handling practices
+ easy ID of deep-water sharks => fishers

Summary

- **Options to avoid deep-water sharks:**
 - **TECHNICAL =**
 - Circle instead of J-hooks **X**
 - **TACTICAL =**
 - Spatial areas ~
 - Fishing depths ~
 - **Good handling** onboard => **survival OK**
 - **Still important knowledge gaps => research and monitoring needed to be continued..**
 - Since 2019, **prohibited species** => **incentives to avoid?**
- 16 ≠ species !
=> difficulties in finding efficient solution for all

Many thanks...



=> to onboard observers and fishers who participated in observer program



=> to colleagues who helped with the fishing and telemetry experiments, and the manual



Questions ?