



Is spatial closure efficient for reducing silky shark (*Carcharhinus falciformis*) bycatch?

By

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MADE Symposium

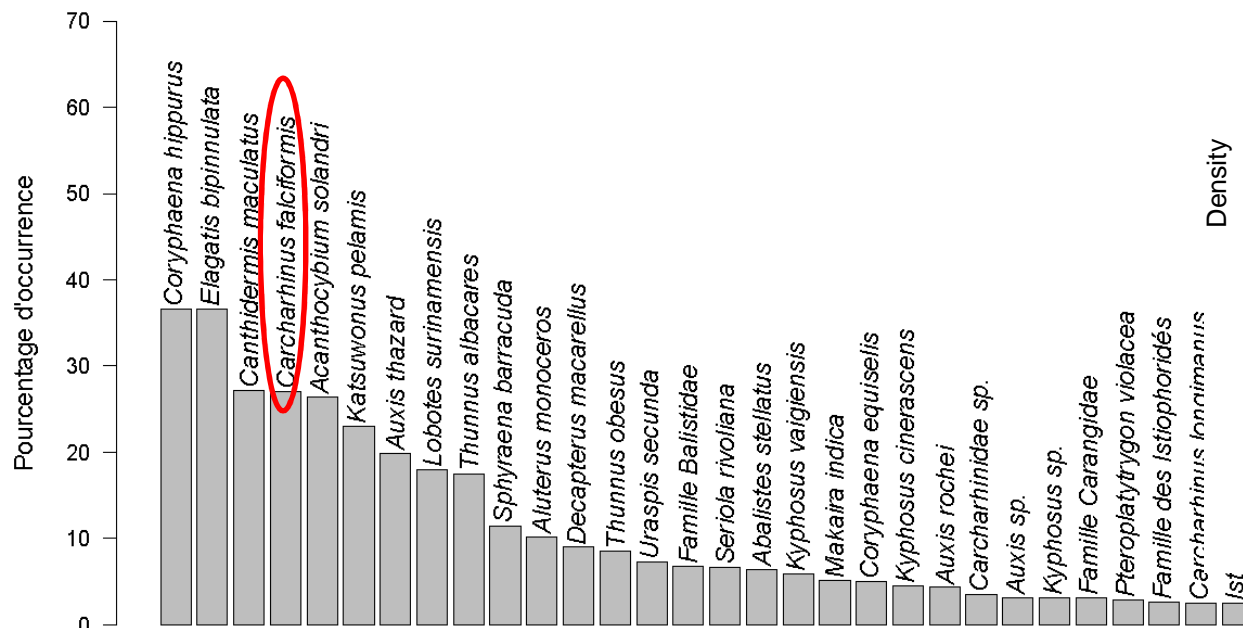
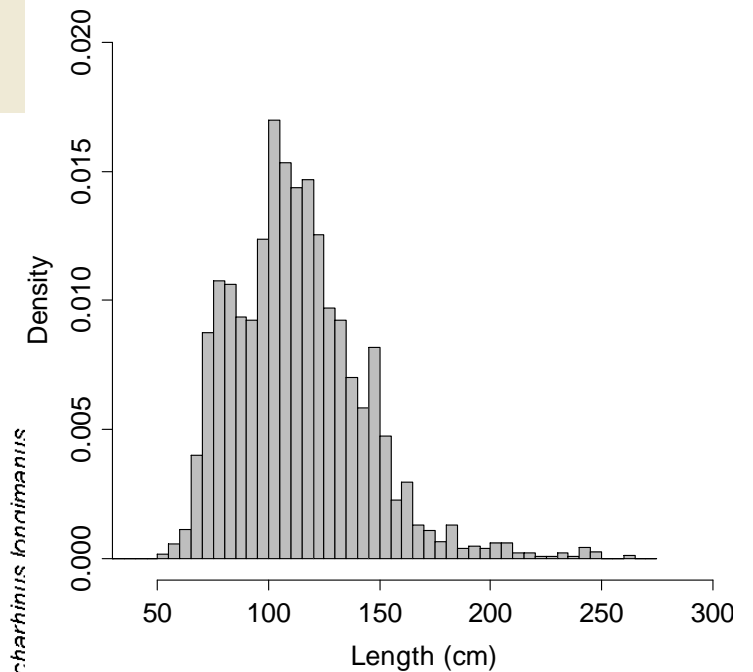
15-19 October 2012,
Montpellier France.



Silky shark (SS)

- more than 85% of all sharks caught by purse-seiners
- 90% of the total catch comes from floatings objects sets
- Immature individuals

Silky shark



- One of the most frequent species



Silky shark (SS)

- Poor biological and ecological knowledge
- Slow growth and late maturity
- High valuable fins



**Careful monitoring
&
Mitigation methods**

Need to reduce the catches of silky sharks

- Technical methods
- Time-area closures (see Watson et al. 2009)



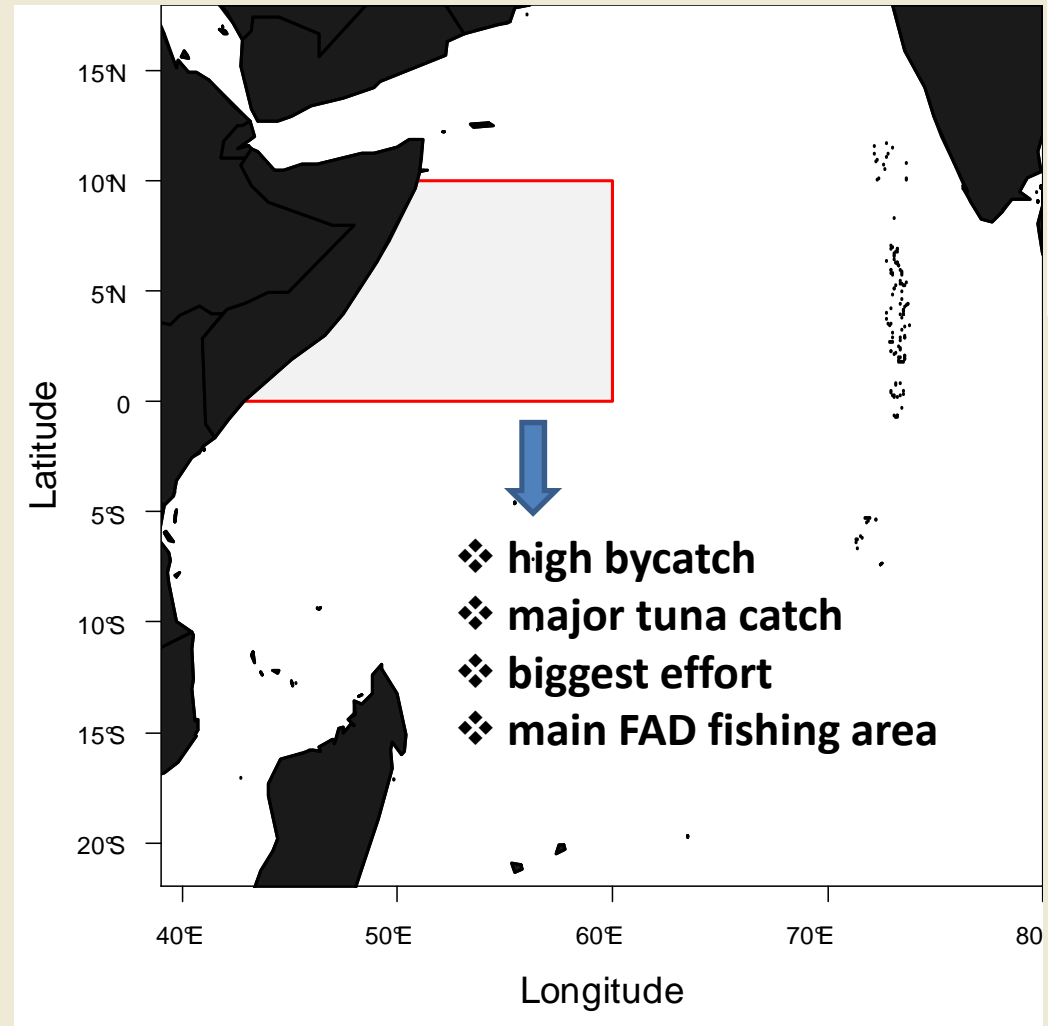


IOTC time-area closure

IOTC – 2010/October

Area closed each year in november

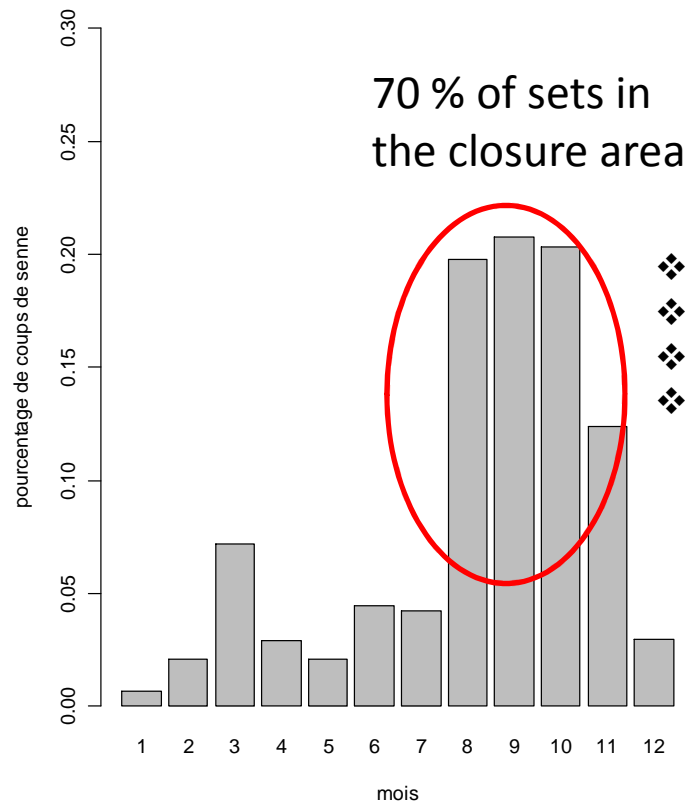
1st implementation in 11/2011





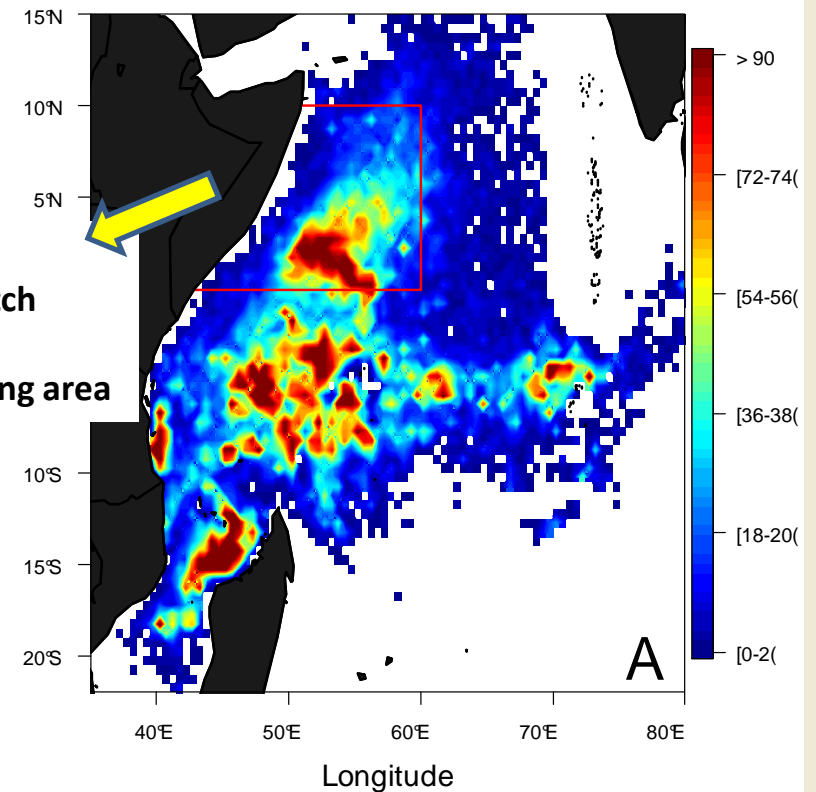
IOTC time-area closure

- ❖ Only the 17 % of the fishing area
- ❖ 23 % of the total sets
- ❖ 32% of major tuna catches (in weight)
- ❖ 37% of silky sharks (in number)



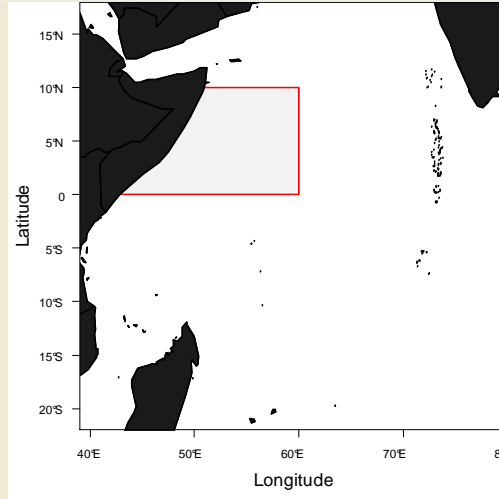
- ❖ high bycatch
- ❖ major tuna catch
- ❖ biggest effort
- ❖ main FAD fishing area

Effort - Fishing sets – 2003:2009





Objective



IRD
Institut de recherche
pour le développement

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Méditerranée



Contribution of the IOTC closure
to the reduction of catches
of silky sharks by purse seiners



METHODS



OBSERVER DATA

- Y = Silky shark bycatch (sample)
- X = Other covariates (longitude, latitude, year, etc)

Parameterizing

MODEL

Prediction

LOGBOOK DATA

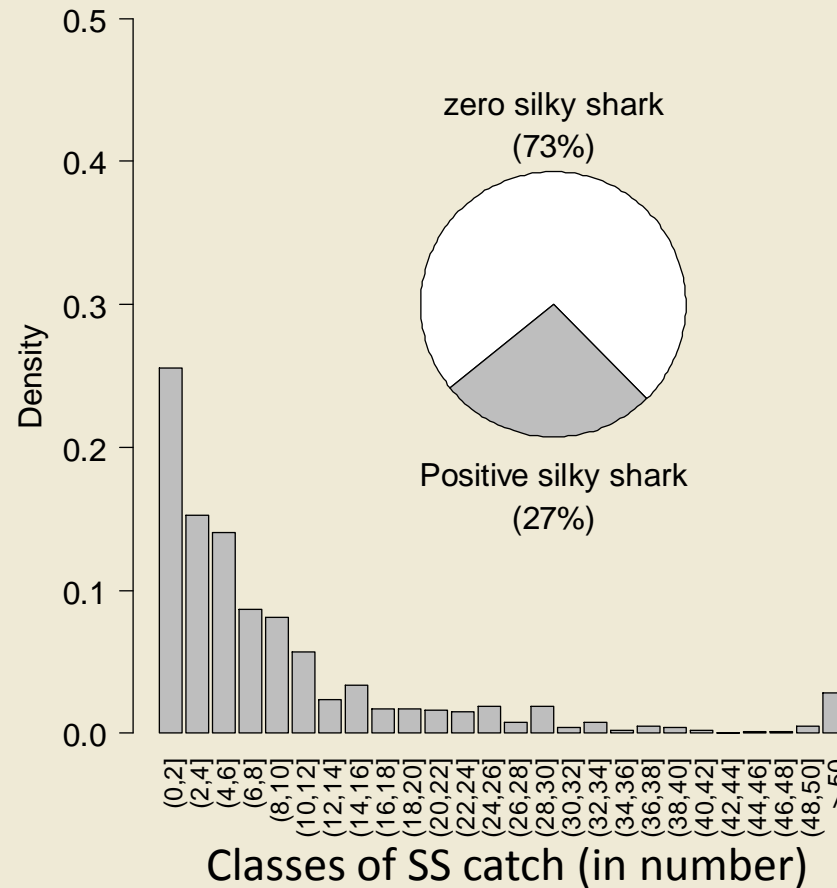
- Y = **silky shark bycatch (predicted)**
- X = Other covariates (longitude, latitude, fleet, year, etc)

Simulation
(reallocation of
fishing effort)

Assessment of
the effects of the
time-area closure



METHODS



French and Spanish purse seiners

- Observer and logbook data
- Indian Ocean from 2003 to 2009

Zero-Inflated Generalized Additive Model (ZIGAM)

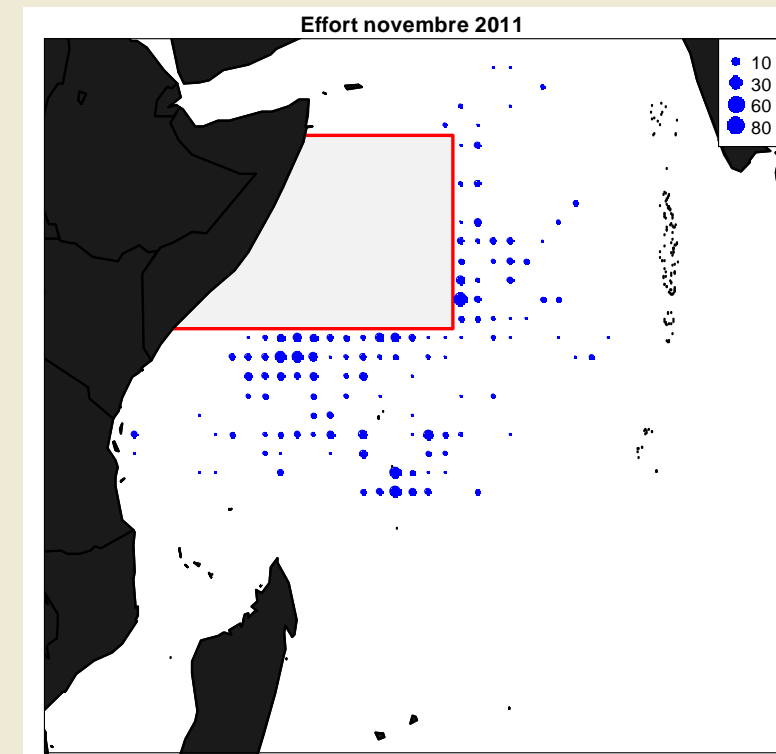
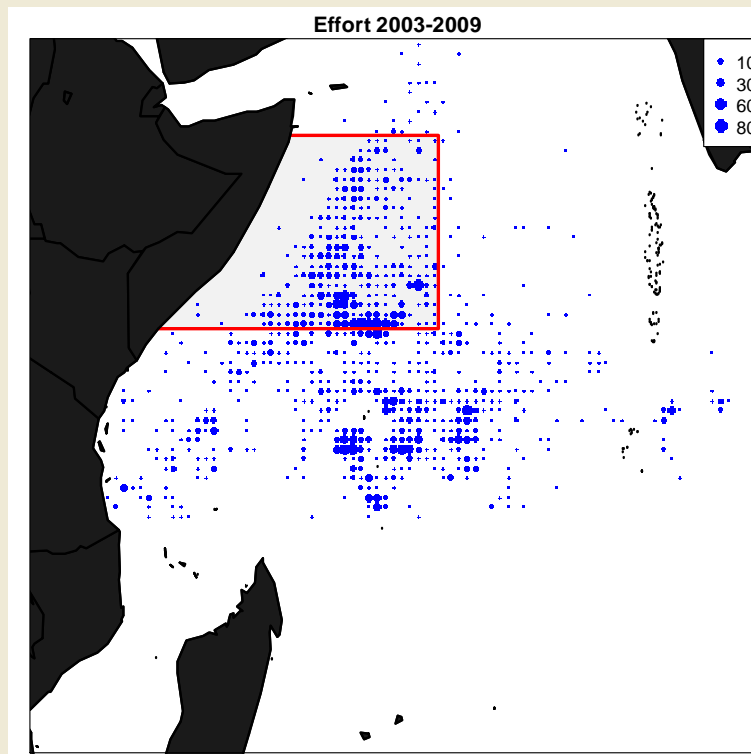
$$E[Y | X_{cat}, X_{cont}] = \frac{1}{1 + \exp^{-[\alpha_0 + X_{cat} + s(X_{cont})]}} * \exp(\beta_0 + X_{cat} + s(X_{cont}))$$



Effect of a spatio-temporal closure

1st TYPE - Historical information based allocation

2nd TYPE : Reallocation based on the behavior of fishermen during the first year (2011/11)



$$\Delta = \frac{B_{after}^k - B_{before}^k}{B_{before}}$$

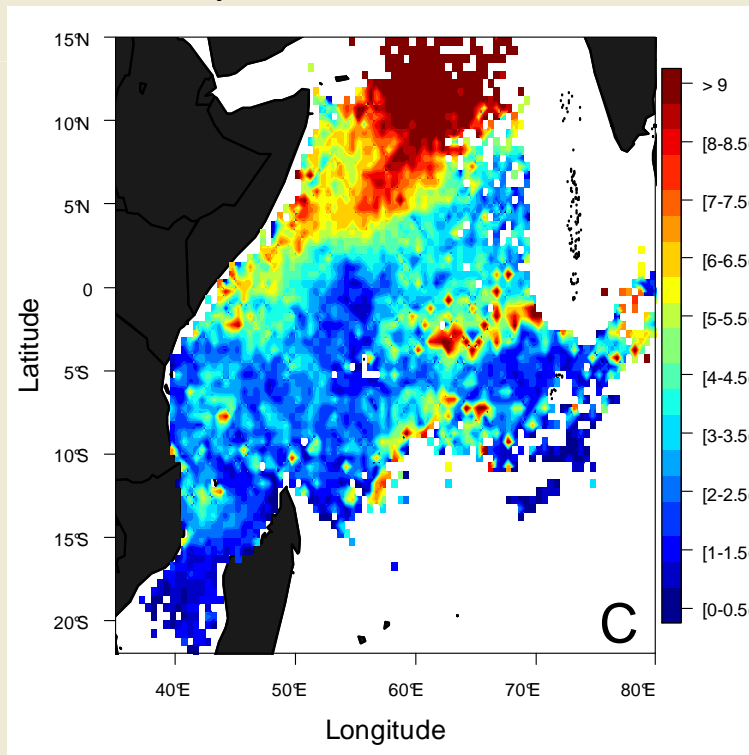


RESULTS

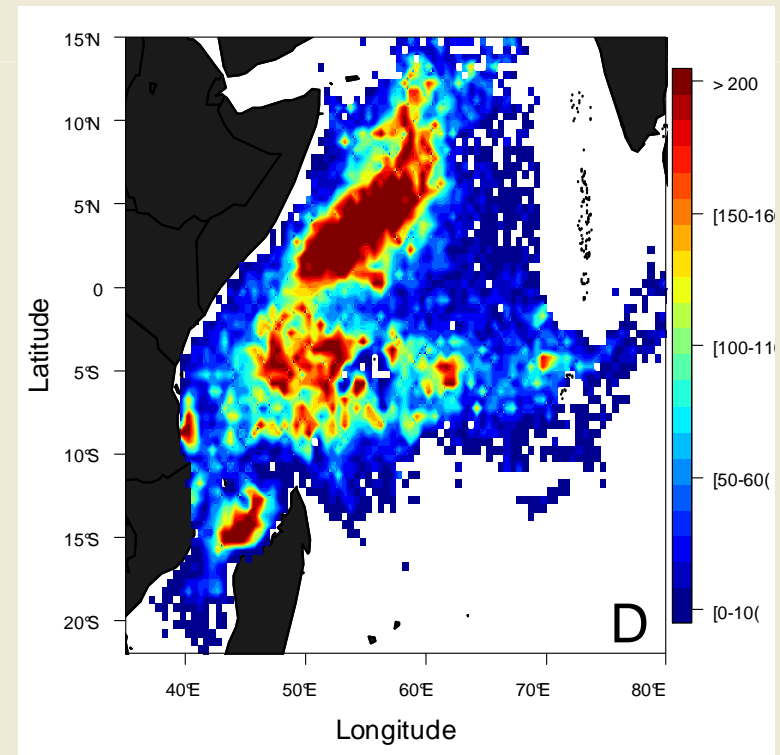
- ❑ 50% of FAD sets contain silky sharks
- ❑ 5% of FSC sets contain SS

- ❑ About **10 silky sharks** in average in sets with sharks -- both in FAD and FSC

Bycatch per unit of effort (BPUE)
of silky sharks – 2003:2009



Cumulative bycatch of silky shark – 2003:2009

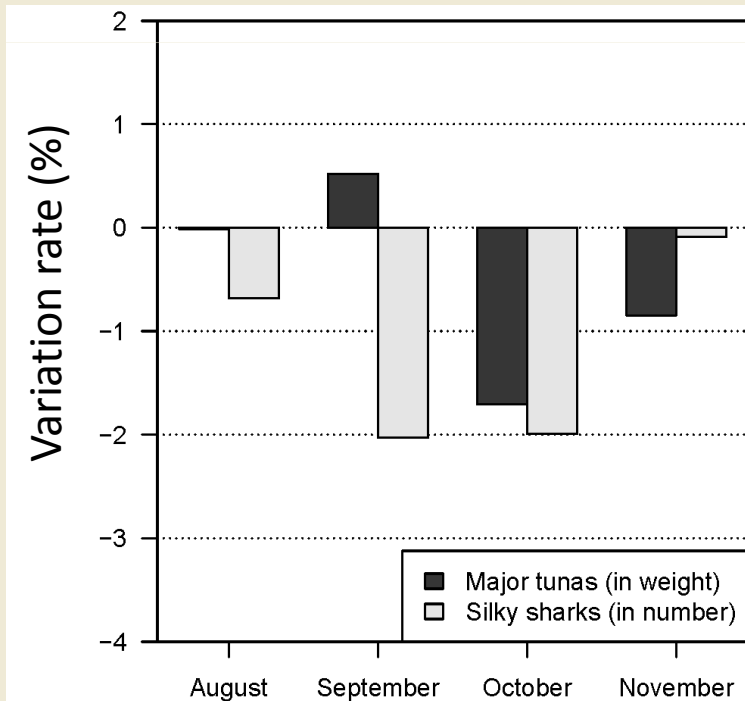




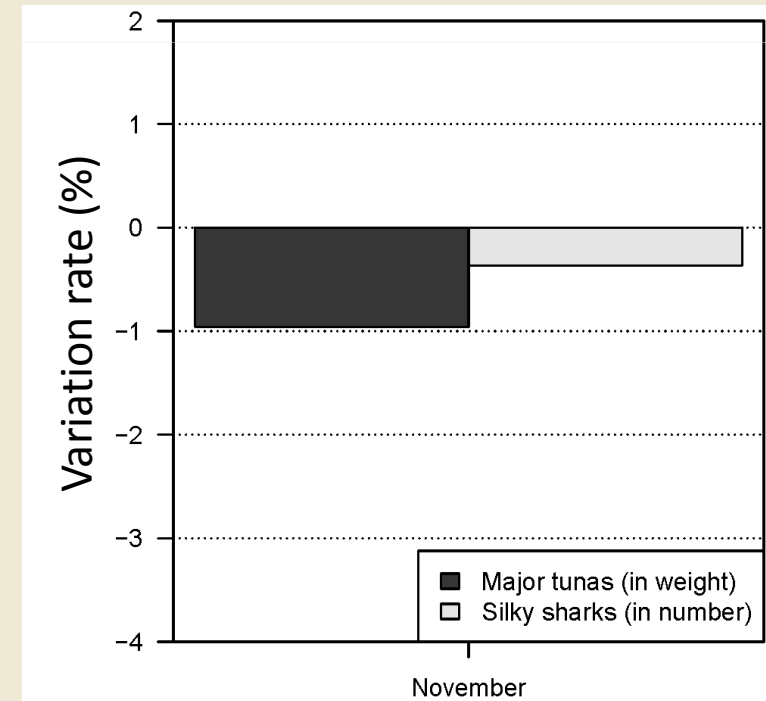
Effect of a spatio-temporal closure

- Relatively low impact of the closure (less than 1%)
- At least, the best month should be september
- Need 3 months closure to obtain about 5% difference

Historical information based allocation



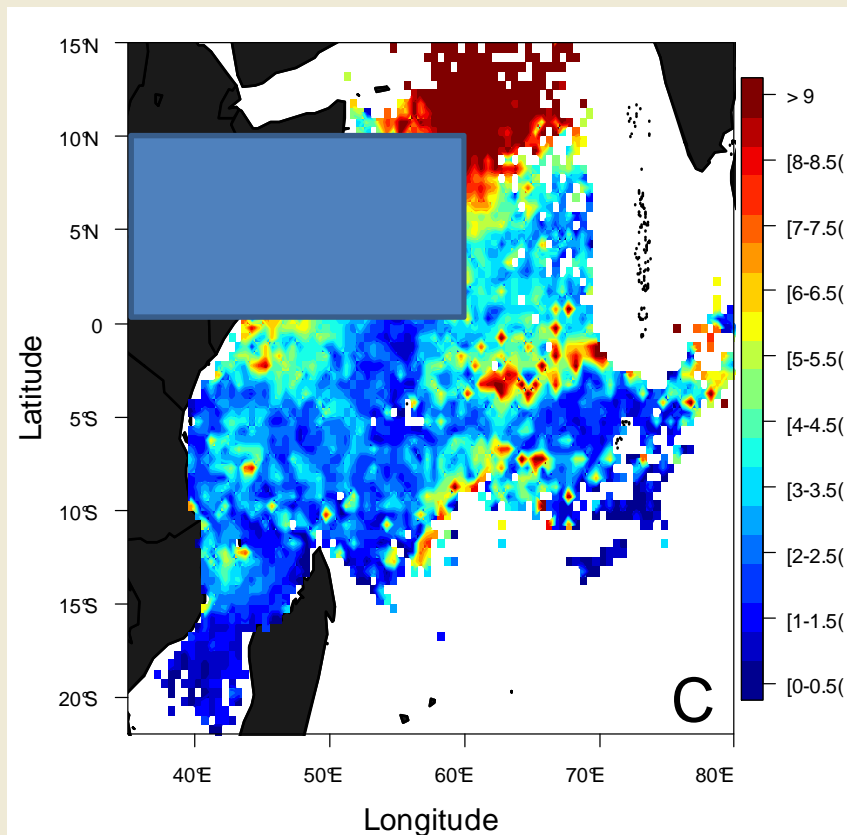
Reallocation based on the behavior of fishermen





Discussion and Conclusion

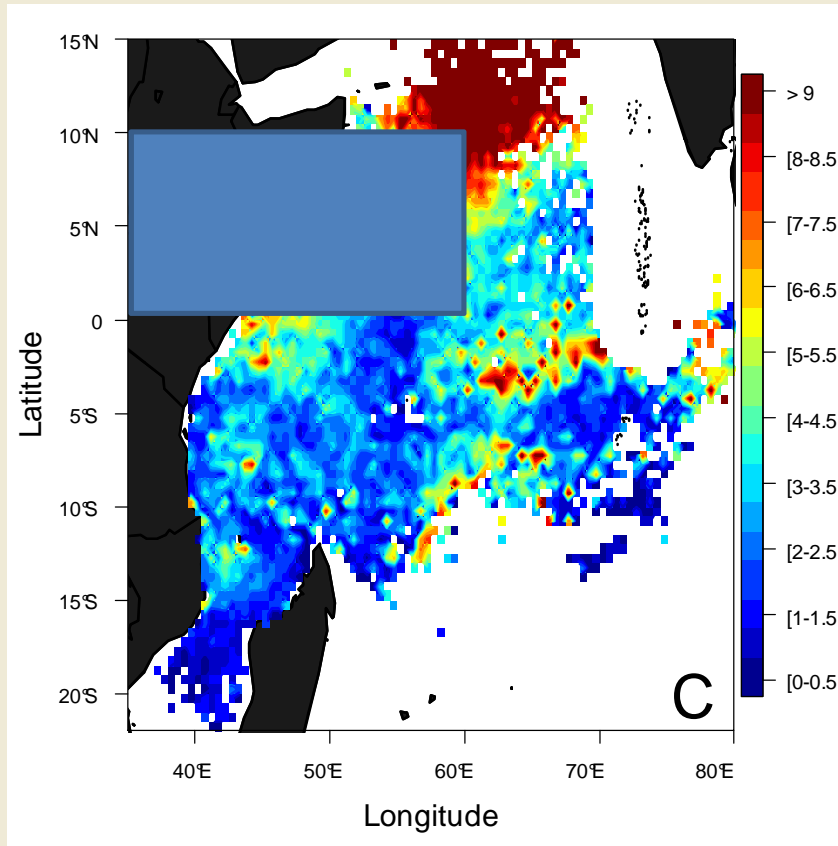
- ✓ IOTC spatial-temporal closure does not induce significant reduction of SS bycatch
 - ✓ Temporal window is too small (longer closure = better impact, but difficult to accept by fishermen)



**Avoid the north area –
latitude > 10°N (biggest BPUE)**



Discussion and Conclusion



**Avoid the north area –
latitude > 10°N (biggest BPUE)**

- ✓ Cumulative measures can help to reduce bycatch
Ex: Spatial closure + Targeting big tuna school + ecological FAD + etc..



THANK YOU

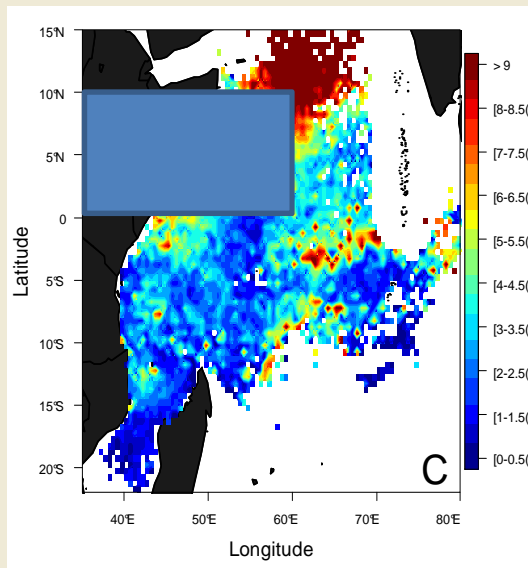
FOR YOUR ATTENTION

Mitigating adverse
ecological impacts
of open ocean fisheries



Discussion and Conclusion

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