Is FAD fishing an economic trap?

Effects of a seasonal closure on the IO purse-seine tuna fishery

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IOTC FAD WG online meeting, 4-6 October 2023

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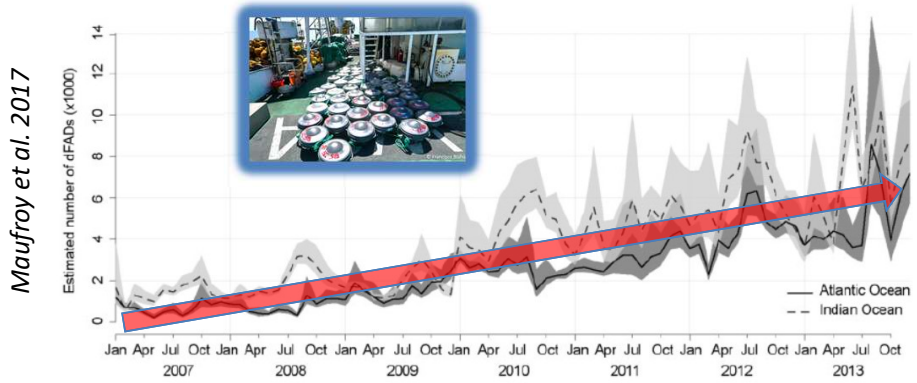
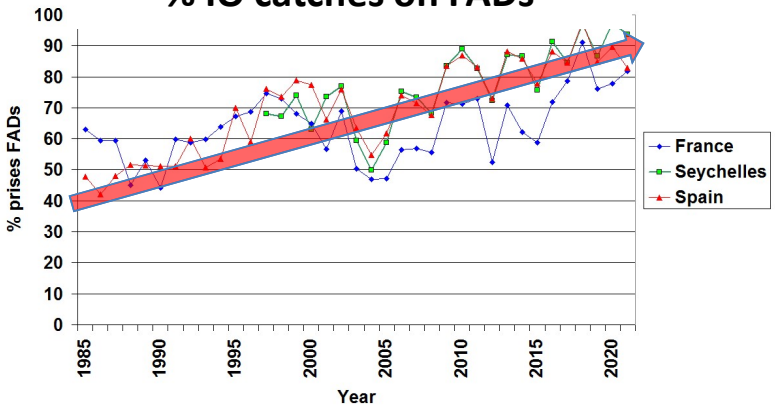
1) Issue, context and literature

Increasing number and use of dFADs in all oceans (> 100,000)



% IO catches on FADs



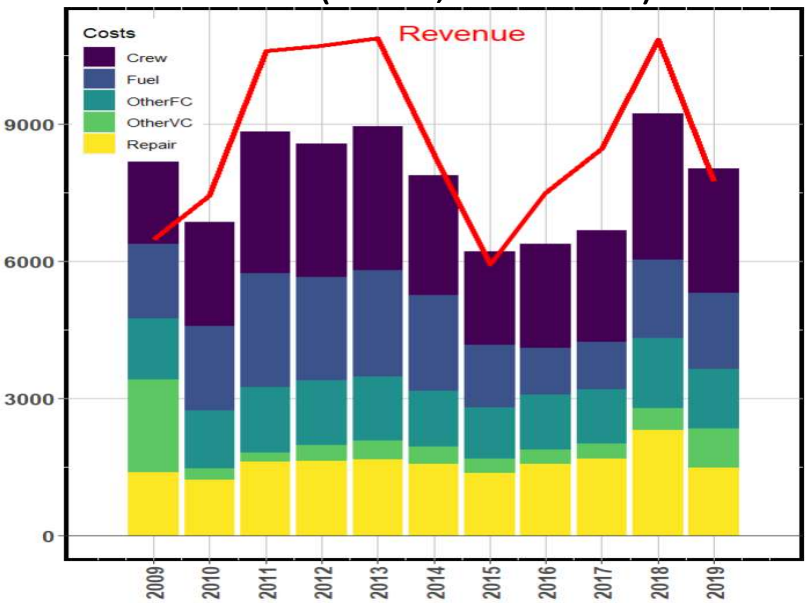
Fonteneau 2023

Context: IOTC Res. 23/02 setting a 72-day moratorium on FADs from 2024

- Is it profitable for the PS fleet fishing in the IO?
- What are the economic consequences for some tuna-dependent CPCs?

→ **'Economic trap hypothesis'** for both PS fleets and tuna-dependent CPCs

French PS vessel account
('000 €, A.E.R 2022)

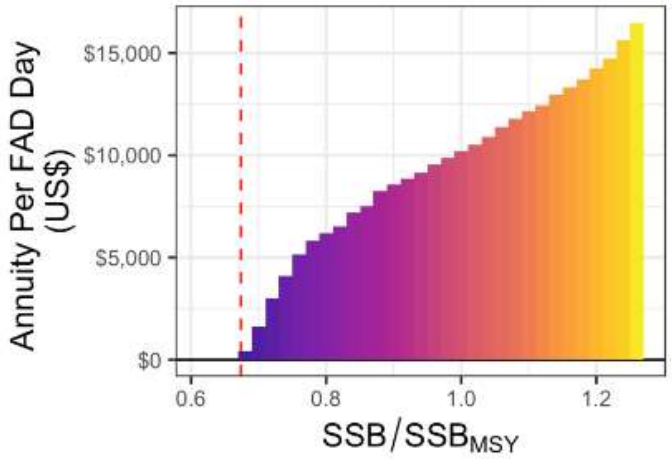


Economic effects of dFAD limitations

- *Escalle et al. 2017*: 6-month FAD moratorium EU_PS fleet/AO+IO = -600/-1,800 t per boat per year (-12%/-37% of yearly catches)

- *Holmes et al. 2019*: 3-month closure in WCPO EEZ = -$ 250,000 per trip + lower revenues (-15%) for SIDS (e.g. 85% of public revenue in Tokelau, *Bell et al. 2021*)

- *Ovando et al. 2021*: only limited FAD removal (-15%) could produce benefits greater than costs (MSY Bigeye → 2/3 of dFADs removed → +$ 1.9 bn for LL profit, -$3.3 bn from PS SKJ)

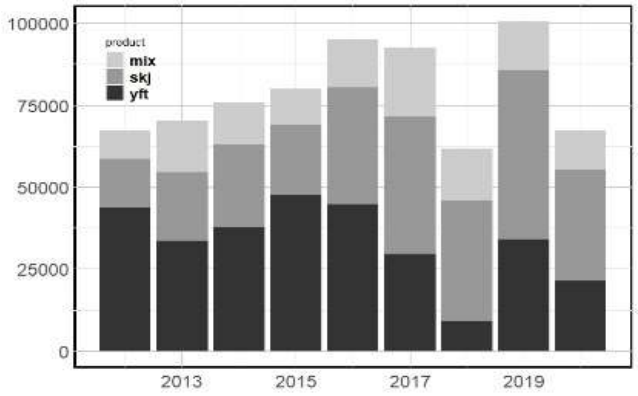


Ovando et al. 2021

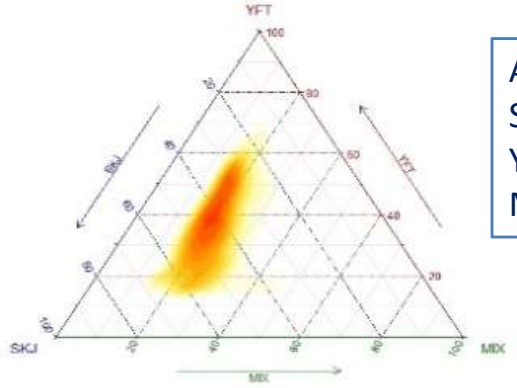
2) Data and empirical approach

French PS fleet fishing in IO 2012-20 → Catch & effort data by fishing trip + economic data (# 1,217 obs.)

1) Catch PS French fleet (tonnes)

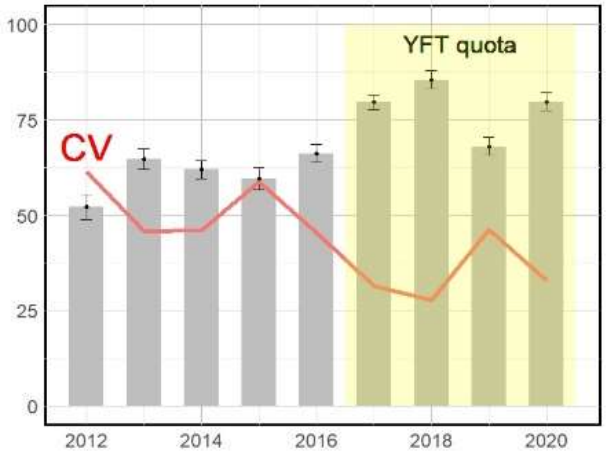


2) Distribution 2012-20 of catch by species (t)

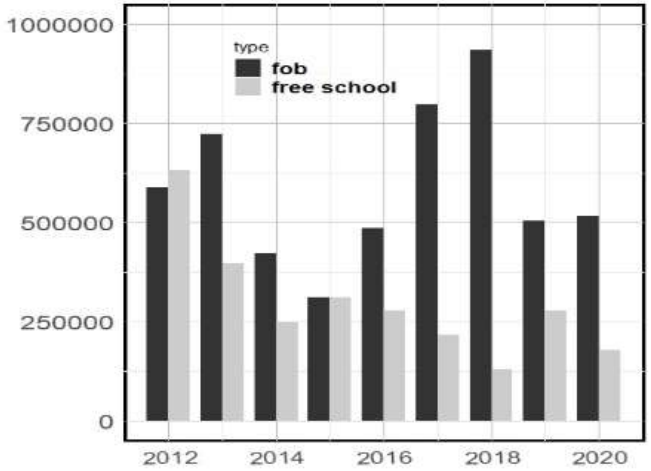


Avg.
SKJ 46%
YFT 33%
MIX 21%

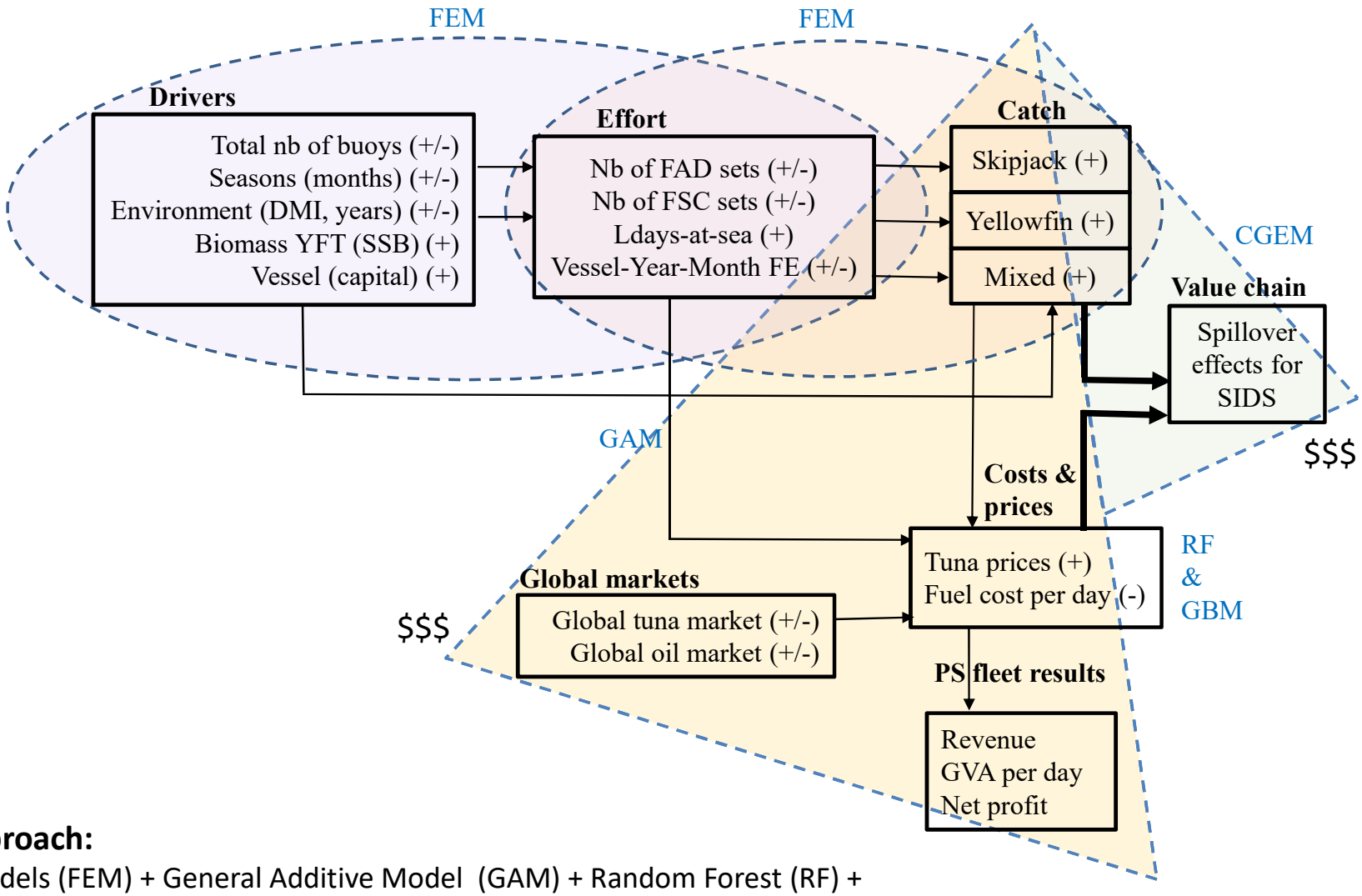
3) Proportion of FAD sets (%)



4) GVA by fishing technique (constant USD)



2) Data and empirical approach



Empirical approach:

Fixed Effect Models (FEM) + General Additive Model (GAM) + Random Forest (RF) + Gradient Boosting Model (GBM) + dynamic Computable General Equilibrium Model (CGEM)

3) Results and discussion

FE models estimated by S.U.R.

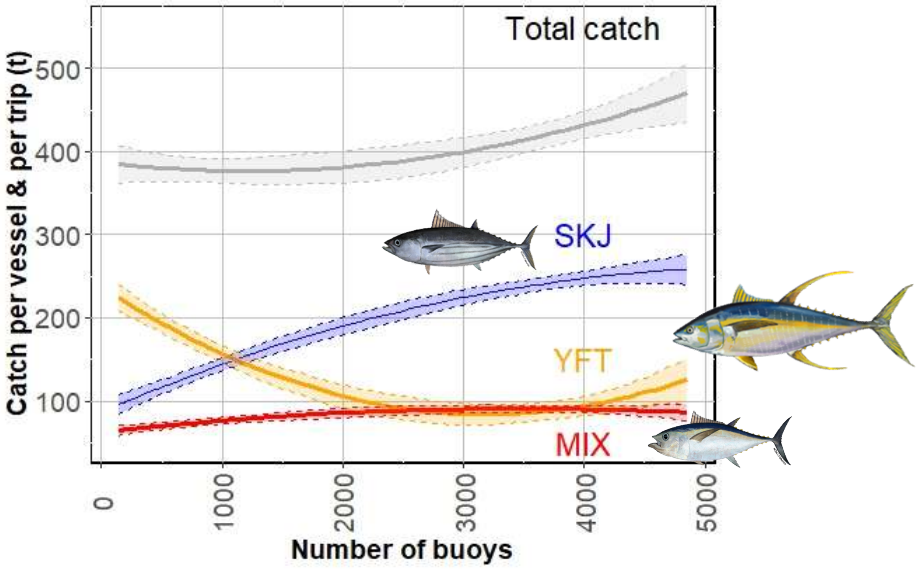
	(1)	(2)	(3)	(4)	(5)
	FAD sets	FSC sets	SKJ catch	YFT catch	MIX catch
Number of buoys	5.07***	-5.58***			
	(1.287)	(1.536)			
Squared nb of buoys	-0.25***	0.32***			
	(0.075)	(0.091)			
SSB	1.29	0.95			
	(0.991)	(1.230)			
DMI	0.26*	0.04	-0.22*	-0.43**	0.01
	(0.139)	(0.171)	(0.121)	(0.179)	(0.113)
Number of FAD sets			1.02***	-0.31**	1.14***
			(0.179)	(0.152)	(0.162)
Squared Nb FAD sets			-0.08**	0.11***	-0.09**
			(0.039)	(0.036)	(0.037)
Number of FSC sets			-0.01	0.40***	-0.04
			(0.027)	(0.106)	(0.027)
Squared Nb FSC sets				0.07**	
				(0.033)	
Nb of days at sea			-0.01	1.86**	-0.12
			(0.098)	(0.780)	(0.088)
Squared days at sea				-0.30**	
				(0.128)	
Constant	-39.25***	12.20	2.65***	1.57	2.17***
	(14.810)	(18.537)	(0.282)	(1.162)	(0.313)
Fixed-effects					
Year	X	X	X	X	X
Month	X	X	X	X	X
Vessel	X	X	X	X	X
Cov	-0.10***				
	(0.025)				
Pseudo-R^2	0.23	0.26	0.47	0.34	0.50
Pseudo-likelihood			-1697.18	-5490.33	-1661.17
Observations			1,217	1,217	1,217

*Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

3) Results and discussion

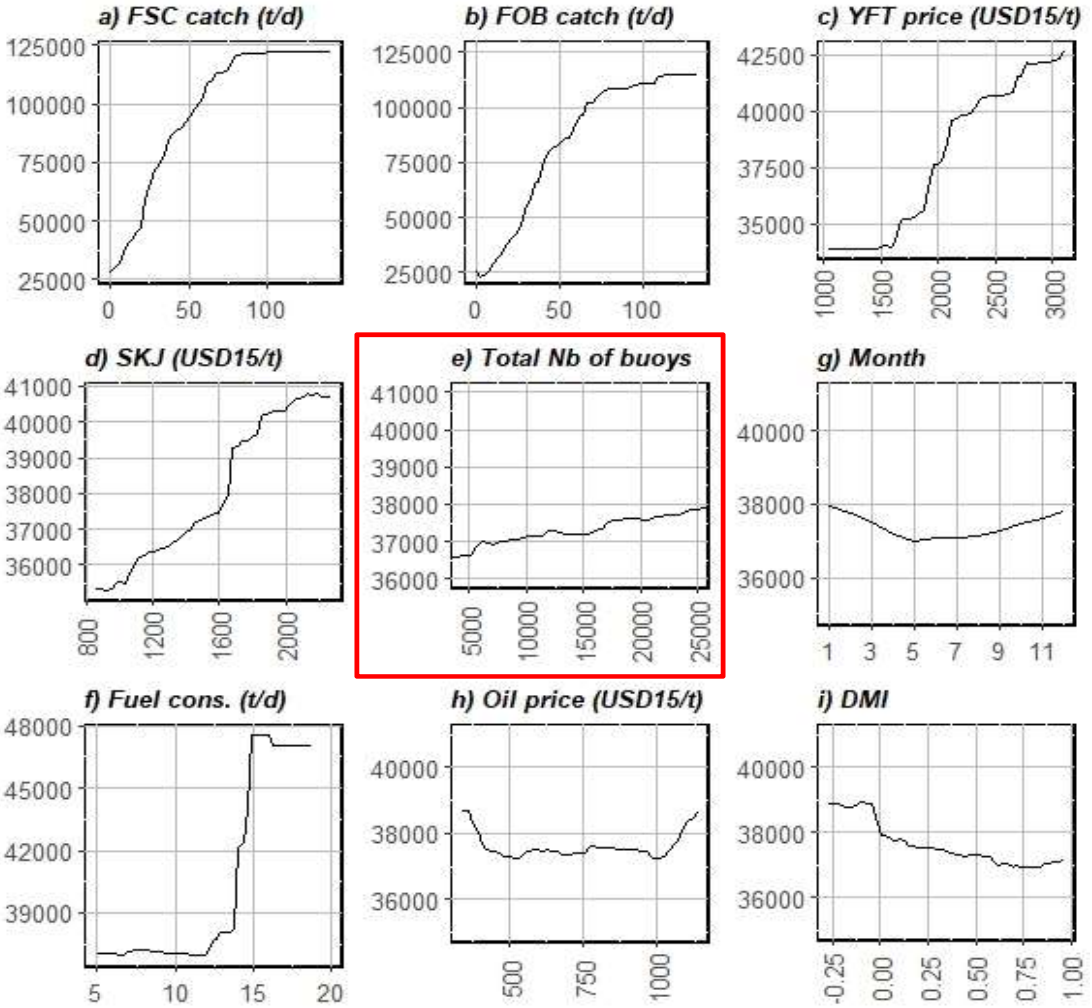
Causal link (though weak)

#FAD buoys → FAD use → Catch



***3,000 buoys for 15 PS vessels**: Is 200 FAD buoys per vessel an optimal number to minimize YFT catch?*

Marginal effects on GVA per day (y-axis) in USD15



Random forest of 500 trees, max-depth=4, accuracy rate on test data set= 0.87

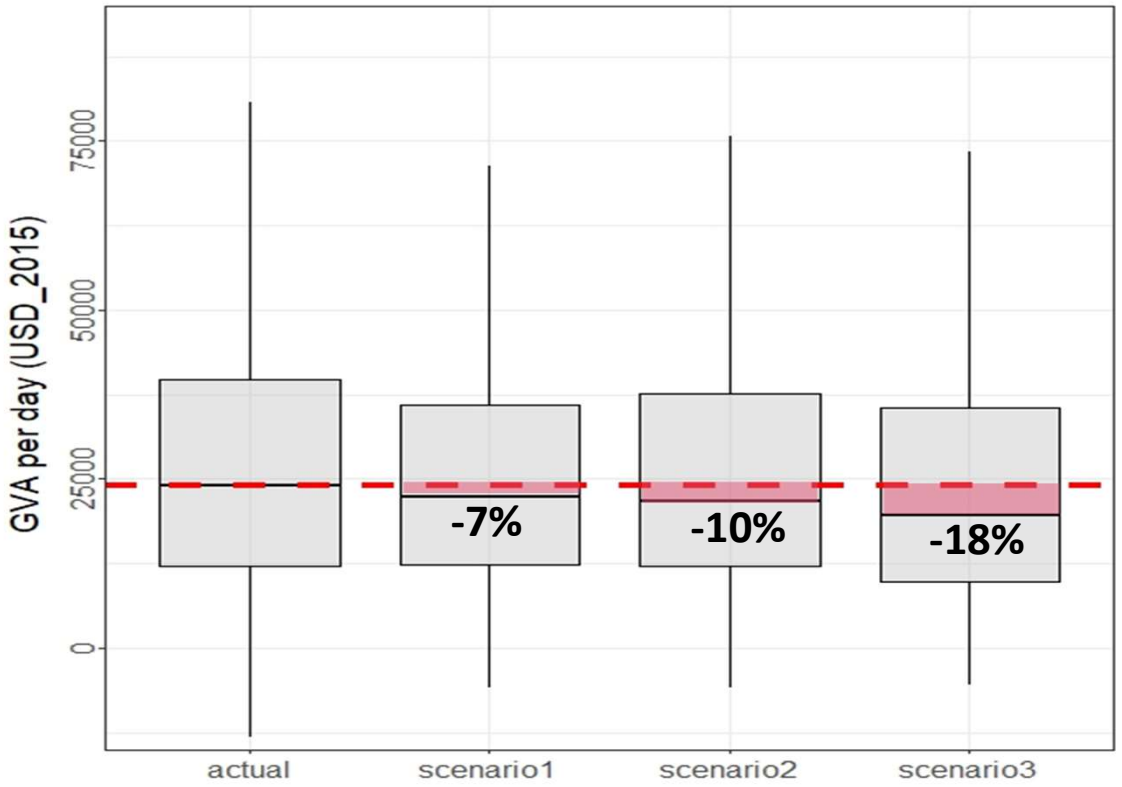
Impact of 3 FAD management scenarios on the PS French fleet profit (GVA per day)
(values predicted by the FE and RF models)

***REF**: BAU case*

***S1**: Nb buoys /2*

***S2**: 72-day FAD ban <u>with</u> reallocation of effort on FSC*

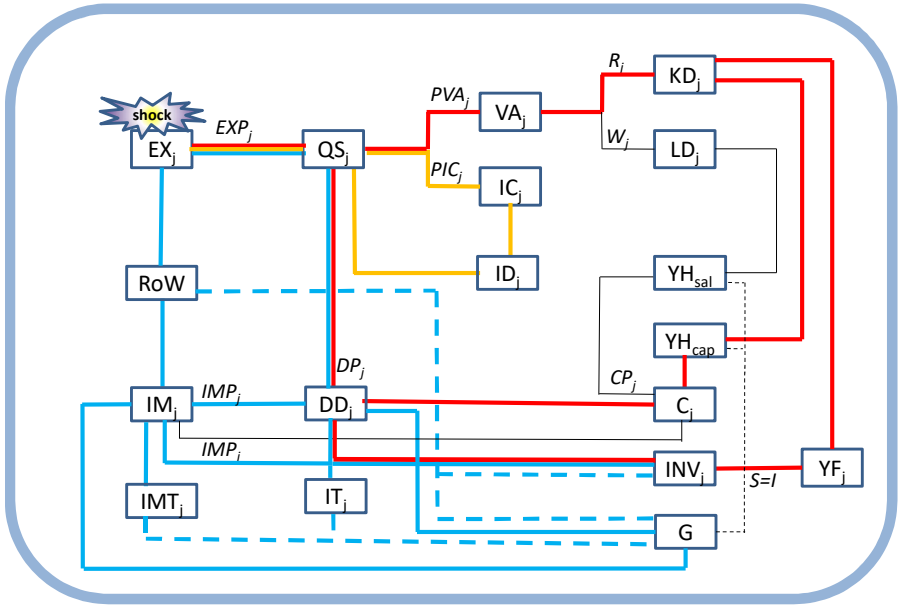
***S3**: 72-day ban <u>without</u> reallocation of effort on FSC*



3) Results and discussion

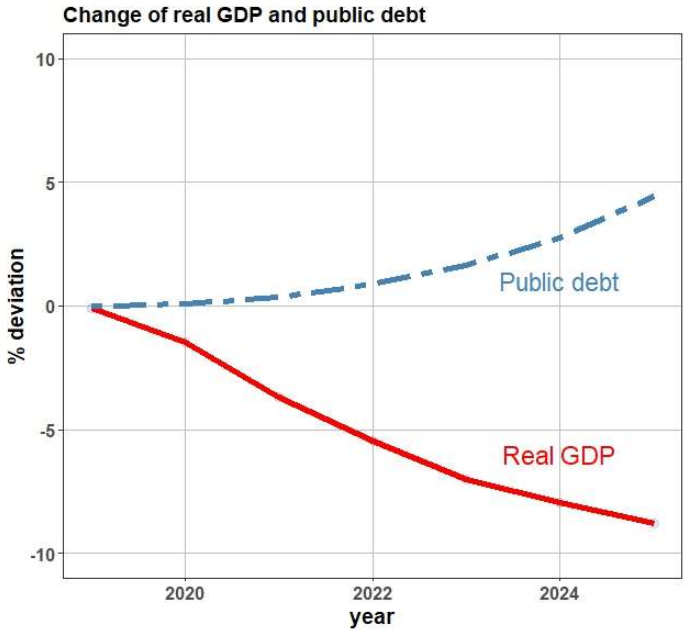
Scenario 3: **-12%** tuna supply & exports for the Seychelles cannery *(IOT Ltd, Thai Union Group, ~2,000 jobs)*

Dynamic CGEM



Many impacts along the supply chain: *Fishing, stevedoring , bunkering, shipchandling, air travels (crew), communication, port dues, fishing rights fees, canning plant, etc.*

All the demand drivers (C,G,I,X) are impacted:
Keynesian multiplier, *Leontief multiplier*, *Twin deficit*...



Increasing public debt (+4.4% after 7 years)

-8.8.% deviation from the real GDP trend

4) Conclusion and next steps

- Any seasonal closure of dFAD fishing would decrease the catch of skipjack and mixed tunas and may increase the catch of large yellowfin on free schools

- Economic trap of PS fleet between greater efficiency of dFADs, economies of scale and the overfished yellowfin tuna in the Indian Ocean (trade-off constrained by a quota limit of yellowfin)

- Entangled interests between DWFN fleets and some tuna-dependent SIDS (cannery supply, port activities, fishing rights, fish exports, etc.), but Seychelles case ≠ Maldives, Indonesia or Iran

NEXT STEPS

- Operating model showing the interactions between fleets (PS, LL, P&L, other artisanal gears): **who wins, who loses?...** Competition between PS and P&L tuna on EU tuna markets (MSC label). Is there any **optimal number** of FADs?...

- Other benefits of restricting FAD use on marine ecosystems: **environmental valuation** of avoided costs (bycatch of silky sharks, costs of beaching, ghost fishing, etc.)

- Multi-Criteria Analysis of conservation measures for more sustainable fisheries

THANK YOU FOR YOUR ATTENTION