



MADE Symposium, 15 – 19 octobre 2012, Montpellier

Session 6: MITIGATION TECHNIQUES IN LONGLINE FISHERIES

Is the fishing time an appropriate bycatch mitigation measure in swordfish-targeting longline fisheries?

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Fishing experiments carried out in the frame of projects CAPPES , SWIOFP, MADE & PROSPER



1 - RATIONALE



Longliner boat

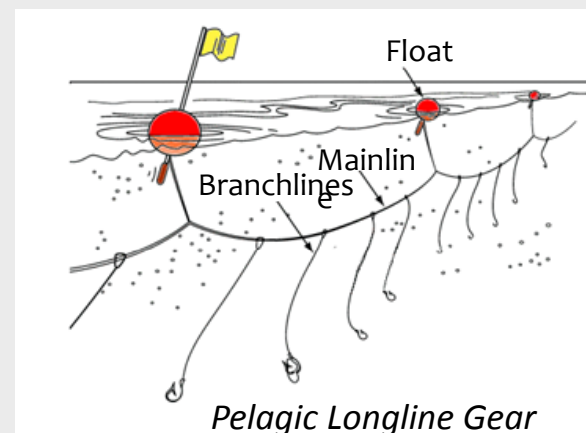
- ✓ Impacts of **fisheries bycatch is a major concern of the ecosystem perspective while** the ecological implications of discarding practices of fisheries are not well understood (Harris & Ward, 1999).
- ✓ Discarding practices are perceived by resource managers and the general public as wasteful (Hinman, 1998; Dobrzynski et al., . 2002) and solutions to mitigate bycatch leading to discards must be proposed.



1 - RATIONALE

- ✓ Pelagic longline = fishing gear exploiting the 2/3 of the global ocean to target mainly swordfish, tropical tunas (YFT, BET) and temperate tunas (ALB, BFT, SBT)

- ✓ The pelagic longline is a **simple gear** but **complex** in terms of fishing practices (material, bait, fishing time, fishing depth) depending on target species, fishing grounds and seasons.



- ✓ For each fishing practices, the level of incidental catches ~ 50% including ~ 100 species of fish, elasmobranchs, seabirds, sea turtles, marine mammals.



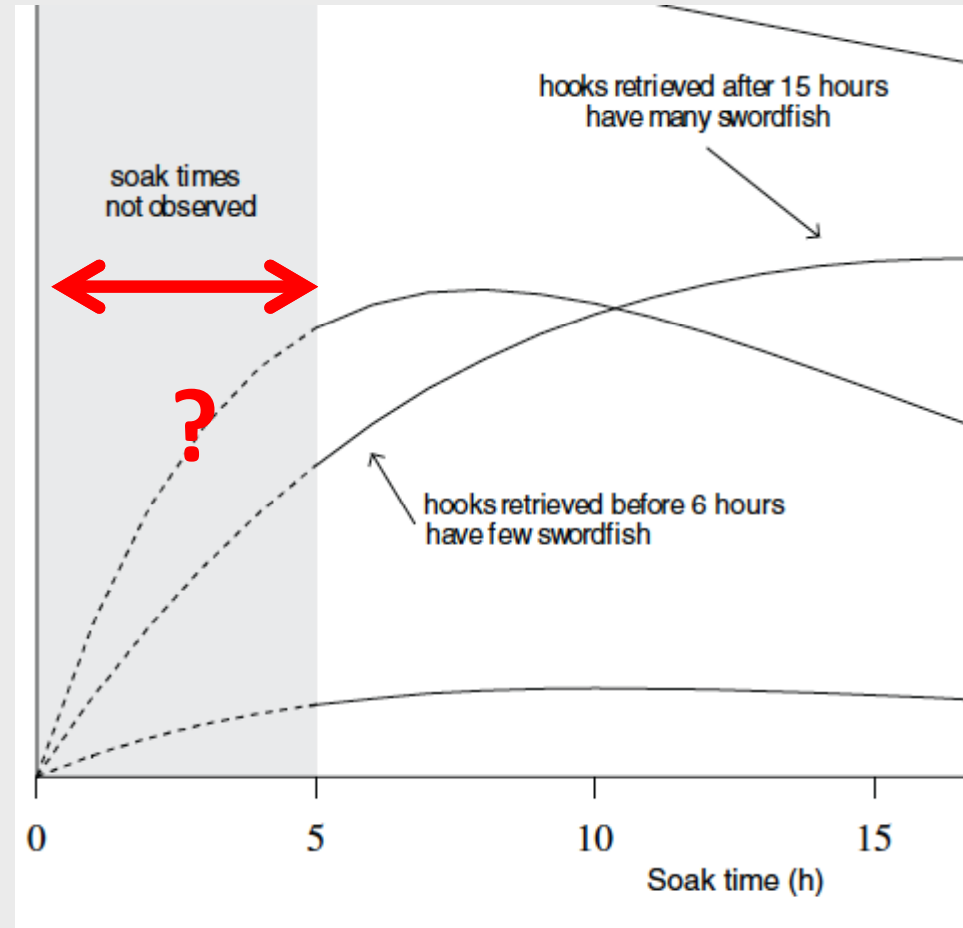
1 - RATIONALE

- ✓ Some **general fishing practices** were proposed to reduce seabirds and sea turtles **in pelagic longlining** (tori line, underwater setting, dumping of offal, night setting, side setting, blue-dyed bait, hooks out of shallow waters (Boggs, 2001; Gilman et al, 2007; Cocking et al, 2008; Beverly et al., 2009; Løkkegorg, 2011),
- ✓ The **longline fishing time** (setting, soak time and hauling) was not really investigated as bycatch mitigation measure so far (except the positive effect of the reduction of both soak time and daytime hauling to reduce sea turtles bycatch (Watson et al., 2005)).



1 - RATIONALE

- ✓ Studies investigating the fishing time in pelagic longlining started observations of the capture at the beginning of the hauling (i.e. after 5 or 6 hours after the start of the fishing operation).



(from Ward et al., 2004)



2 - OBJECTIVE

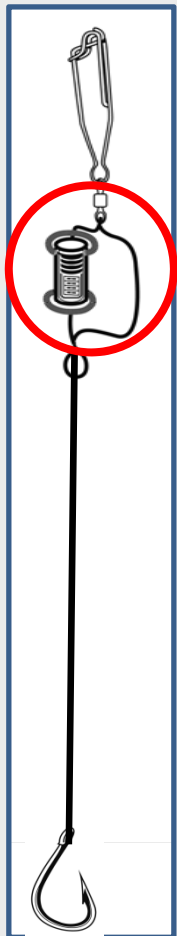
- ✓ To investigate **the fishing time** as a mitigation measure to reduce bycatch for pelagic longlining targeting swordfish during nighttime in the South West Indian Ocean by observing interactions between the fishing gear and the pelagic resource during **all the soak time**



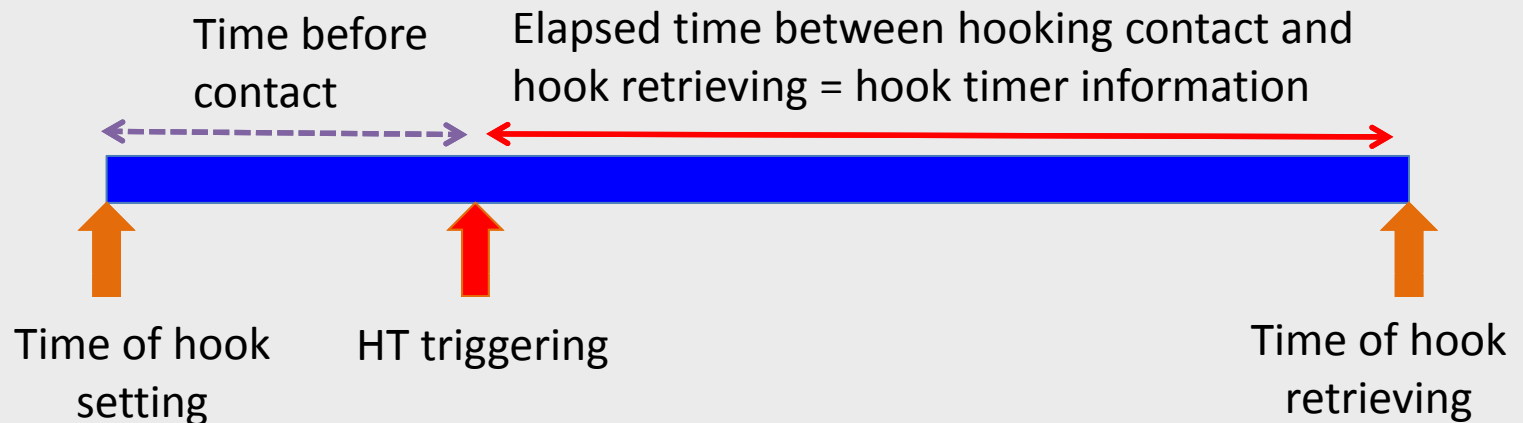


3 – MATERIAL & METHODS

Fishing experiments with an instrumented longline



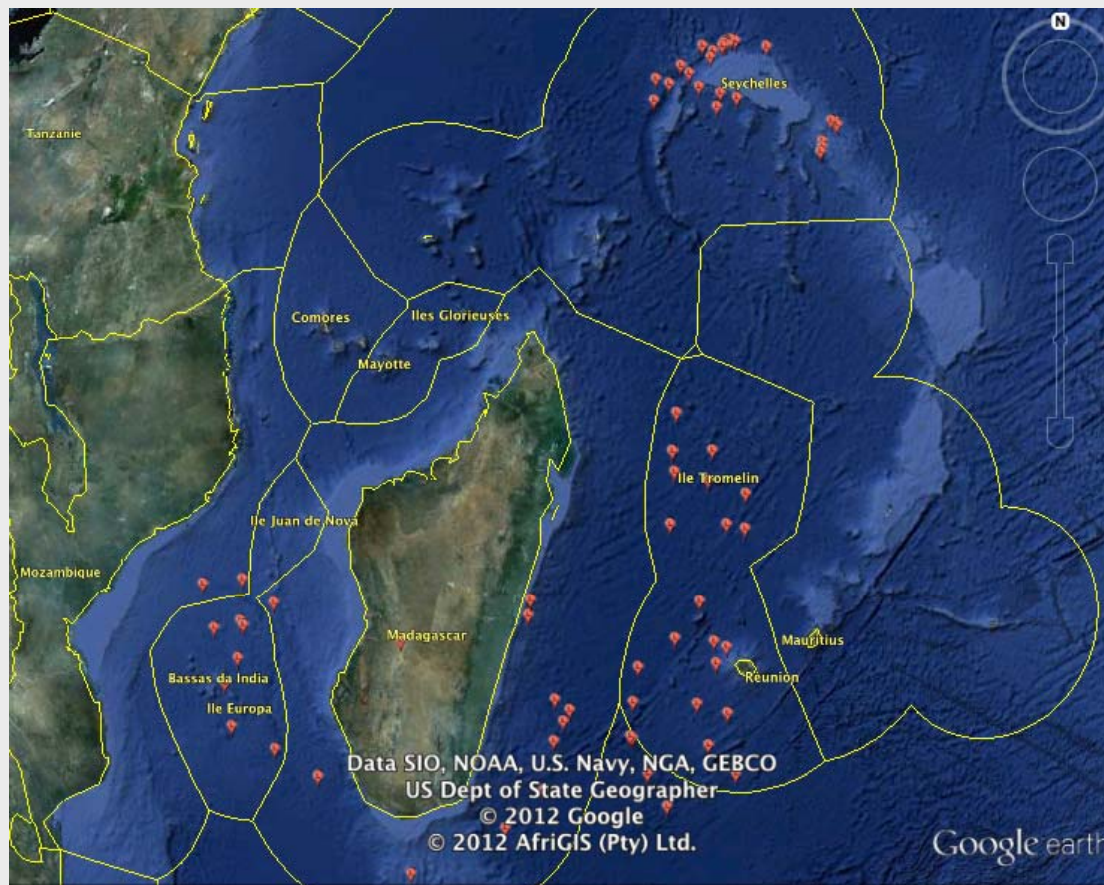
Developped by Somerton et al. (1988), hook timer (HT) is attached at the top of each branchline. HT is triggered by the attack of the bait by a predator and indicates elapsed time between the hooking contact of the hook retrieving.





3 – MATERIAL & METHODS

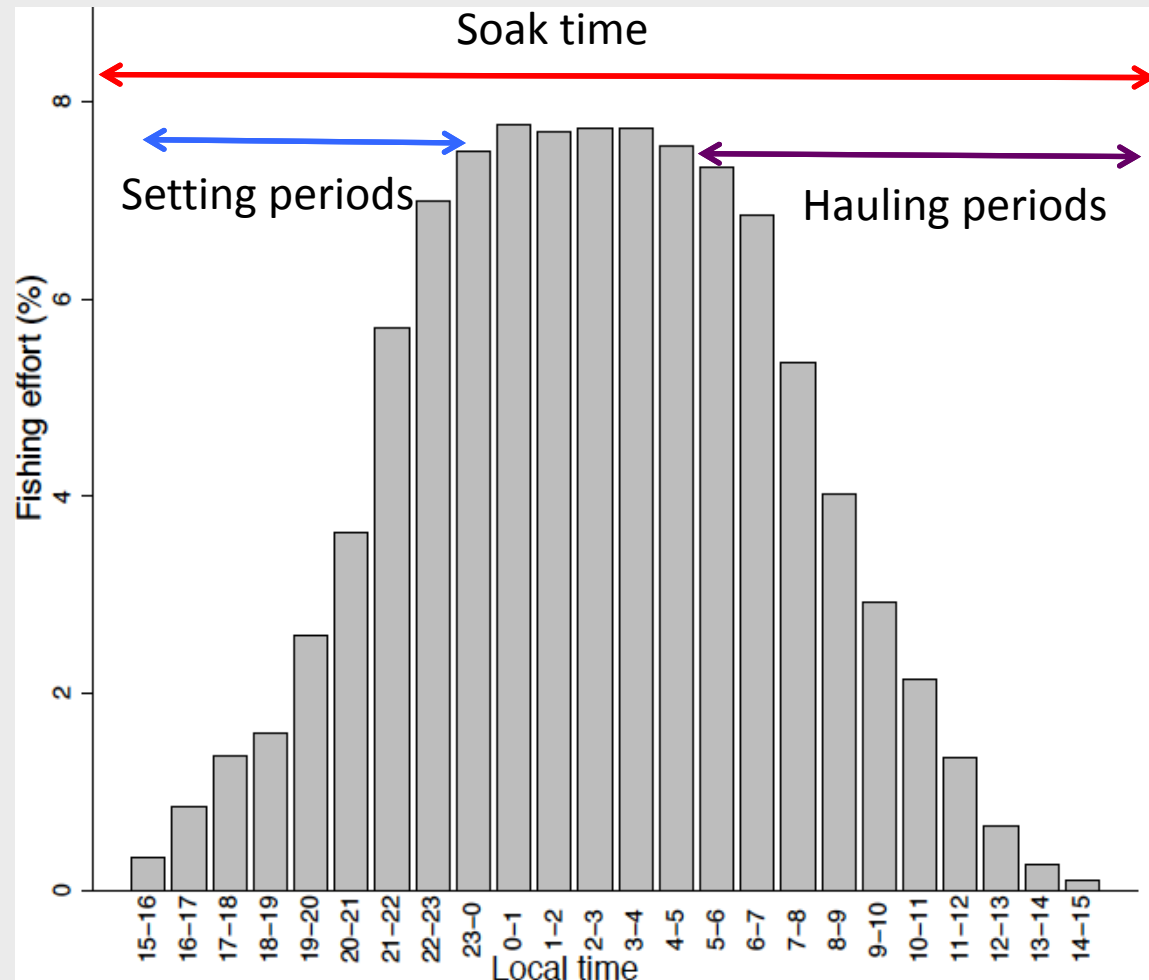
- ✓ 56 instrumented longline fishing experiments carried out in 2005, 2008, 2010 and 2011 in the SWIO
- ✓ 22304 hook timers deployed (from 156 to 544 HTs per fishing operation, average = 400 HTs)





3 – MATERIAL & METHODS

- ✓ All fishing sets explore a period of fishing of 24 hours of duration starting at 15:00 local time.
- ✓ Setting periods of 2 or 3 hours started from 3 p.m. to 8 p.m
- ✓ Hauling periods of 3 to 6 hours started from 4 a.m. to 8 a.m.





3 – MATERIAL & METHODS

Analysis of cumulated distributions of CPUE per hour for :

- Hooking contact (triggered hook timers with or without capture)
- Hooking success (triggerred hook timers with capture)
- Swordfish
- All bycatch
- Sharks

Local time

	H1	H2	H3	-----	Total
N° Longline set	LL1	$\frac{\Sigma CPUE_{1,h}}{CPUE_{tot1}}$	$\frac{\Sigma CPUE_{1,h}}{CPUE_{tot1}}$	$\frac{\Sigma CPUE_{1,h}}{CPUE_{tot1}}$	CPUE _{tot1}
	LL2	$\frac{\Sigma CPUE_{2,h}}{CPUE_{tot2}}$	$\frac{\Sigma CPUE_{2,h}}{CPUE_{tot2}}$	$\frac{\Sigma CPUE_{2,h}}{CPUE_{tot2}}$	CPUE _{tot2}
	-----	-----	-----	-----	-----
	LLn	$\frac{\Sigma CPUE_{n,h}}{CPUE_{totn}}$	$\frac{\Sigma CPUE_{n,h}}{CPUE_{totn}}$	$\frac{\Sigma CPUE_{n,h}}{CPUE_{totn}}$	CPUE _{tot3}



Bootstrap

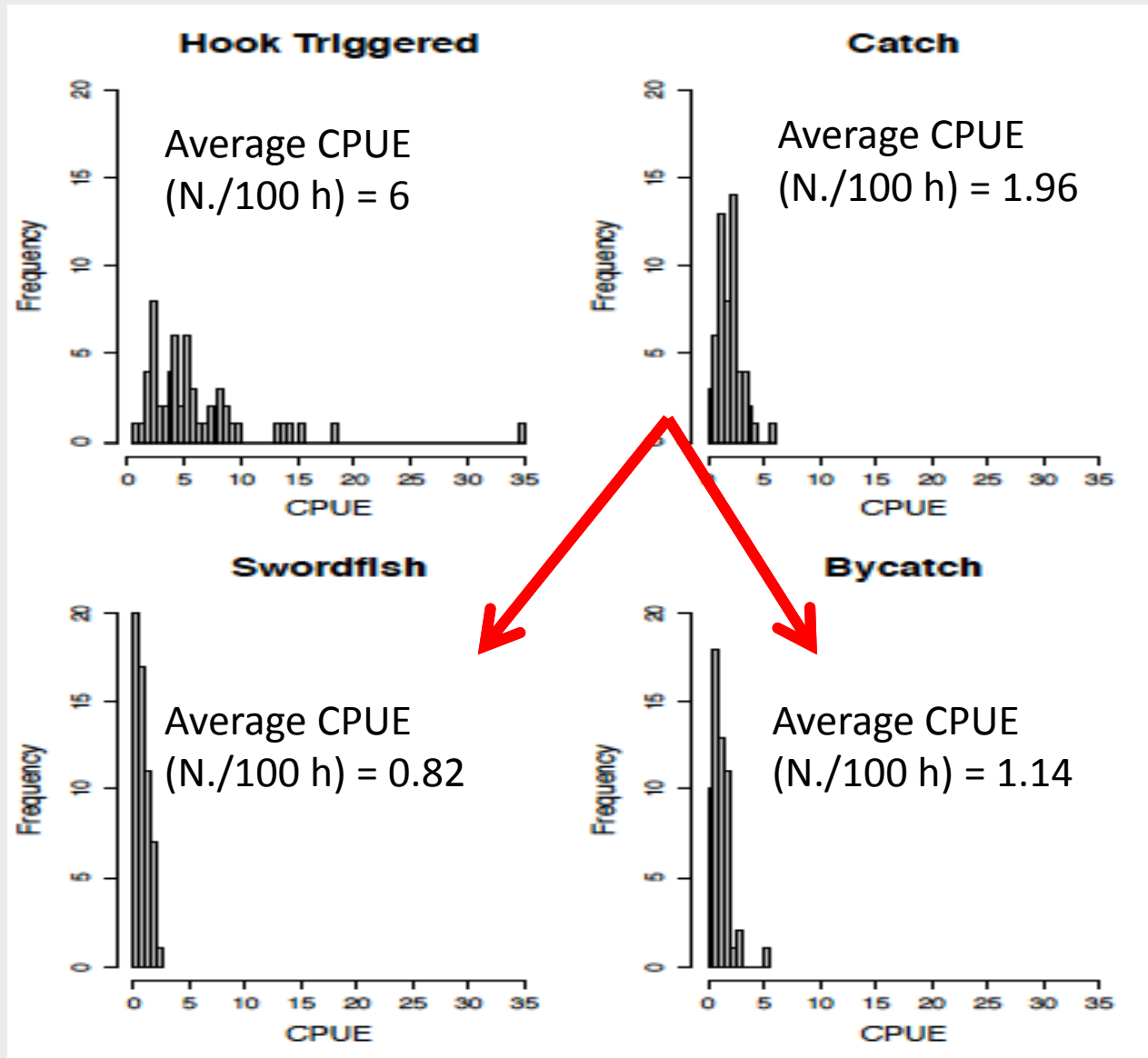
Bootstrap

Bootstrap



4 – RESULTS

- ✓ Average level of interactions = 6%
- ✓ Capture = 33% of total interactions
- ✓ Bycatch = 58 % of catches

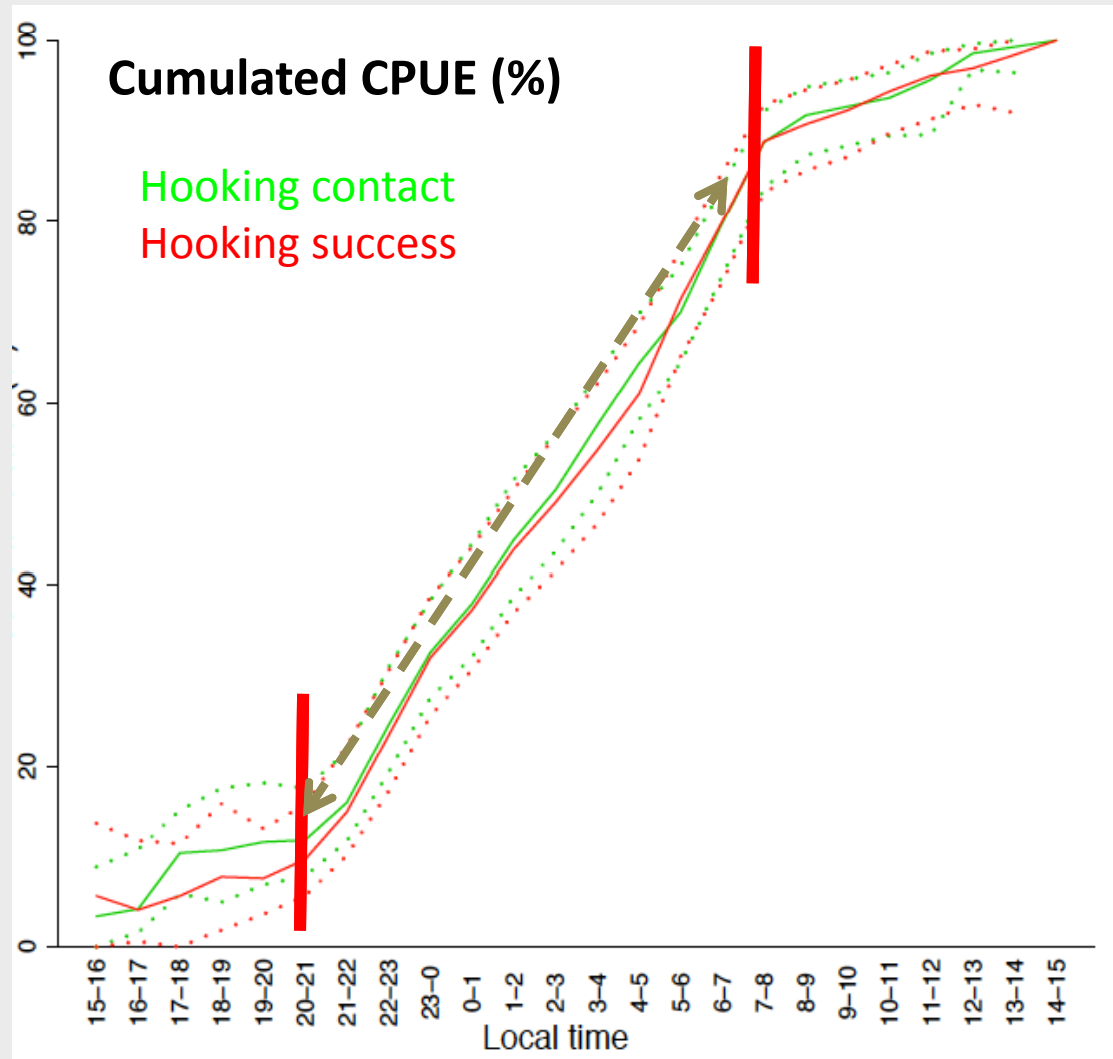




4 – RESULTS

Hooking contacts and hooking success

- ✓ ~ 80% of contacts and success from 8 p.m. to 8 a.m.local time
- ✓ Similar linear increase of ~ **7%** per hour of the rate of both hooking contacts and capture during nighttime

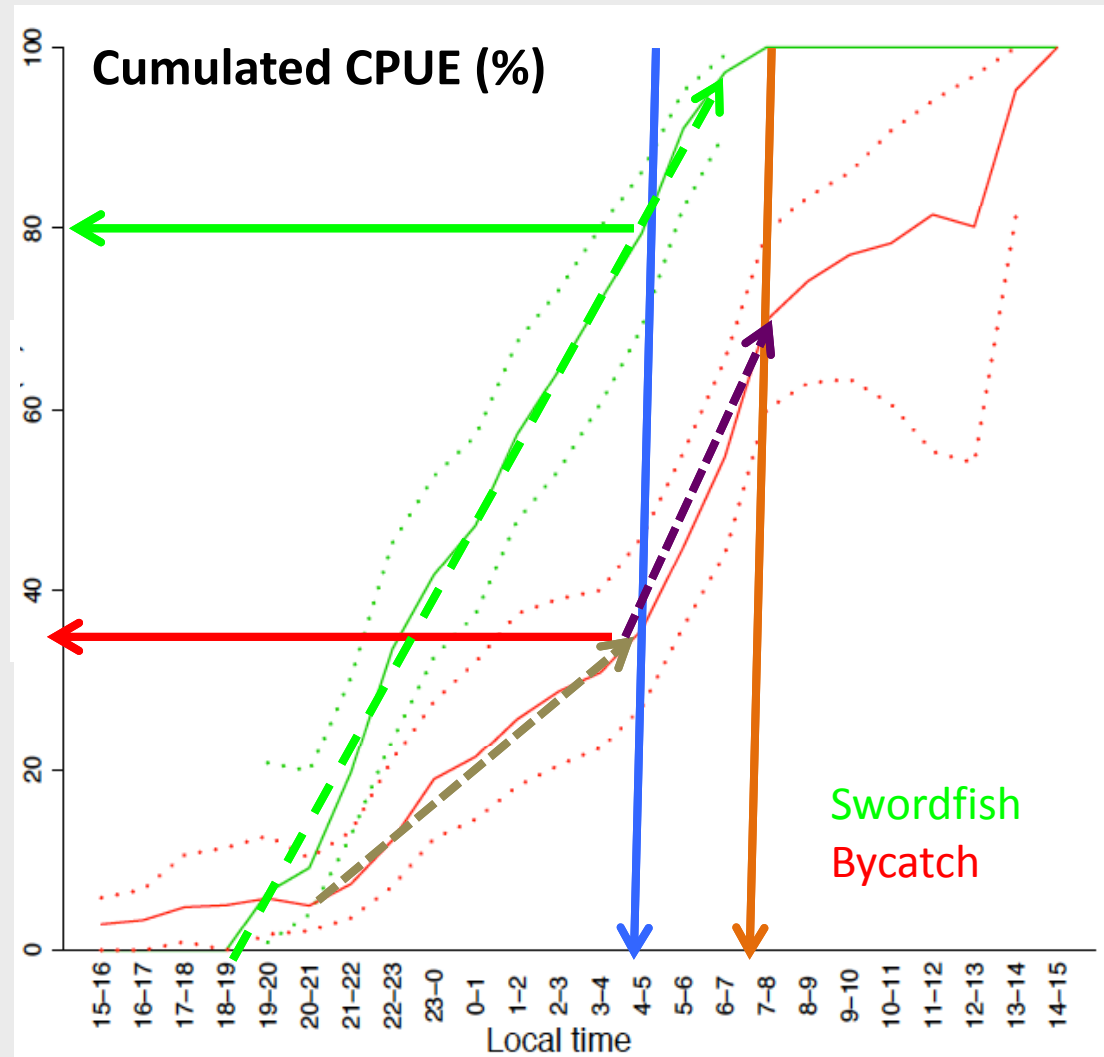




4 – RESULTS

Swordfish VS Bycatch

- ✓ Swordfish capture occurred after sunset while bycatch occurred earlier and stop after sunrise when bycatch = 68%
- ✓ Linear temporal catch trend for swordfish from 7 p.m. to 7 a.m (8.5 % per hour)
- ✓ Highest increase of bycatch catch rate (8.5 %) from 4 a.m to 8 a.m (3.6% before)
- ✓ At 5 a.m. 80% of swordfish caught compared to 35% for bycatch

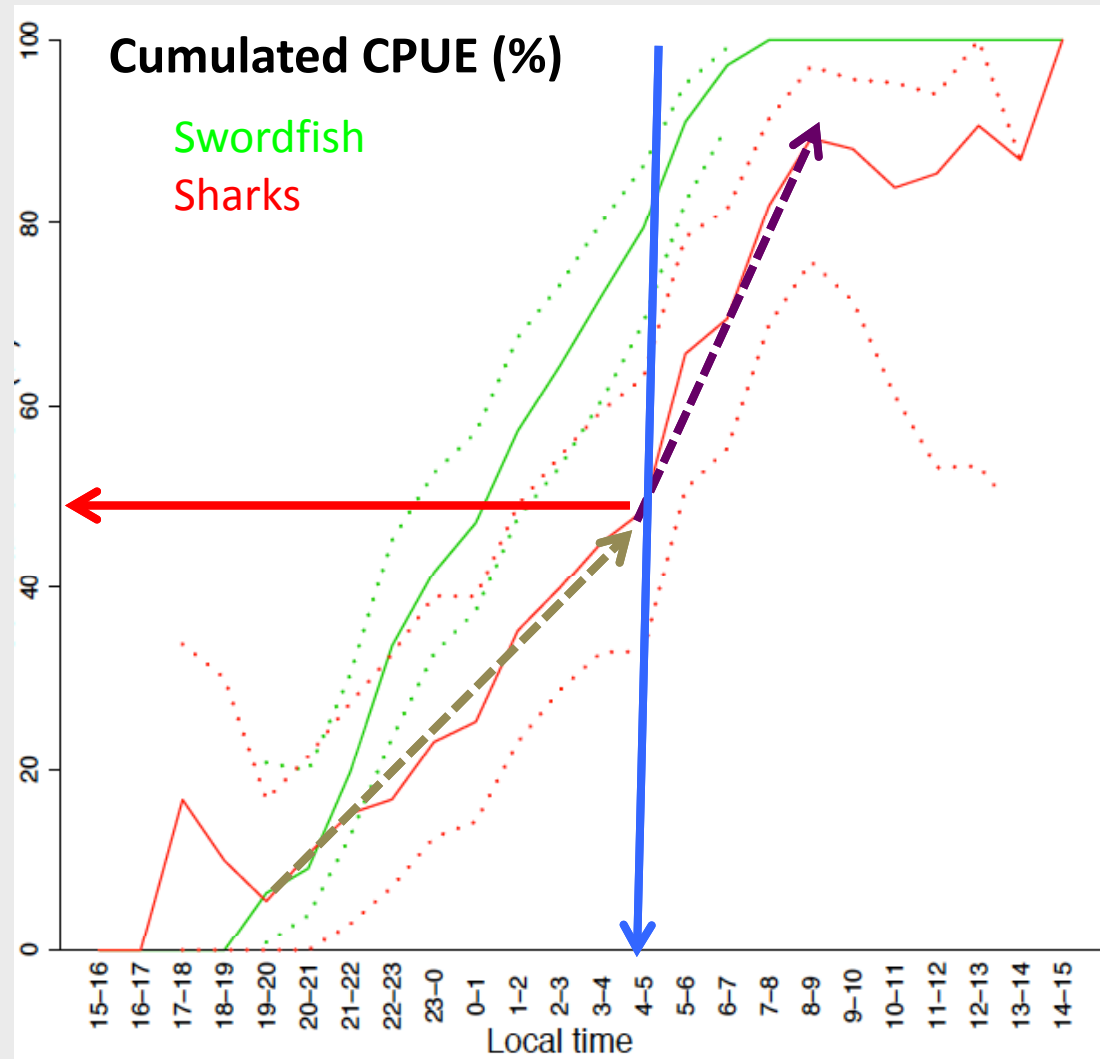




4 – RESULTS

Swordfish VS Sharks

- ✓ Highest increase of shark catch rate (8.2% per hour) from 5 a.m. to 9 a.m compare to those observed from 7 p.m. to 5 a.m (4.75% per hour)
- ✓ 5 p.m. (80% of swordfish capture compared to 49% for sharks)





5 – CONCLUSIONS

- ✓ 80% of interactions (contacts and capture) between the pelagic resource and the longline observed during nighttime (linear trend suggesting (i) constant catchability for fish interacted with the gear and (ii) no saturation effect at the longline scale for this level of resource abundance).
- ✓ 100% of swordfish capture occurred during nighttime while bycatch capture are observed before dusk and after dawn.
- ✓ Total bycatch and bycatch of sharks showed a highest increase of their catch rate after 5 p.m.
- ✓ At this time limit, the level of swordfish capture reaches 80% of the total when 35% and 49% of capture are observed for total bycatch and sharks, respectively



5 – CONCLUSIONS

- ✓ The fishing time might be an appropriate mitigation measure for bycatch in pelagic longlining targeting swordfish in the SWIO.
- ✓ Limiting the fishing period between dusk (beginning of the setting) and 5 p.m. would allow to reduce significantly bycatch in general, bycatch of sharks without impacting significantly the capture level of the target species.
- ✓ In the same time, this approach would be benefic for sea turtles as it proposes both to reduce the soak time and to avoid fishing during nighttime.



5 – CONCLUSIONS



Longliner boat


- ✓ The application of this fishing tactic limited to small scale longline fisheries with boats deploying between 500 and 1200 hooks per set
- ✓ More experiments must be undertaken in other regions in order to analyse how the pelagic resource abundance could impacted the temporal trend of their interactions with the fishing gear and the differences between CPUEs of the target species compared to bycatch in general and particularly species on concern (sharks, sea turtles)



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