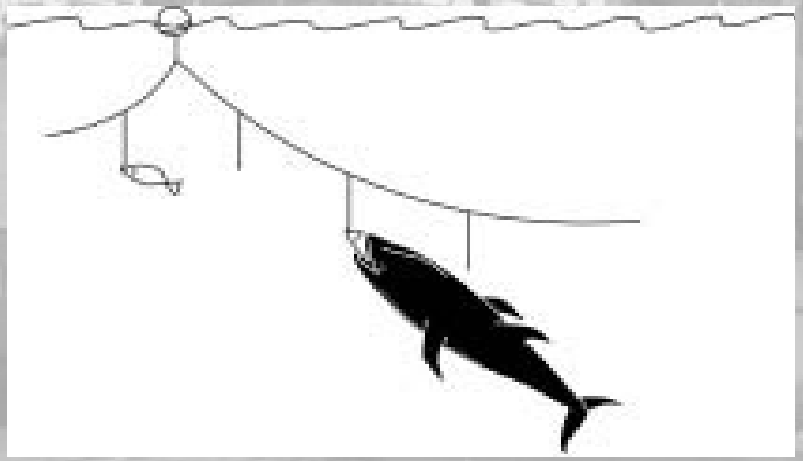
Assessment of the efficiency of the physical protection of fish as mitigation measure to depredation in pelagic longlining

N. RABEARISOA [(1)], P. BACH [(1)], V. LUCAS [(2)], F. GIROUX [(2)], M. VELY [(3)], P. TIXIER [(4)], C. GUINET [(4)]

[(1)] Institut de Recherche pour le Développement, La Réunion
[(2)] Seychelles Fishing Authority, Victoria, Seychelles
[(3)] Ministère de l'environnement et des ressources naturelles, Victoria, Seychelles
[(4)] Centre d'Etudes Biologiques de Chizé, Villiers-en-Bois

What is depredation ?



- Predation = catch of free ranging fish (by cetaceans and sharks)
- Depredation = damage or retrieval of fish caught on fishing gear

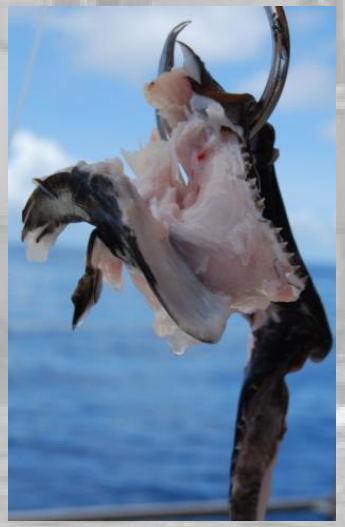
  ➡ Non natural predation behaviour

Assessment of depredation by sharks or cetaceans

Shark damages:

- Large bites
- Clean cuts
- Involves only part of the fish

Assessment of depredation by sharks or cetaceans



Cetacean damages:

- Tooth puncture marks widely spaced
- Tearing of the fish
- Often only the head is left on the hook

Species involved

Short-finned pilot whale (*G. macrorhyncus*)

False killer-whale (*P. crassidens)*

Pelagic sharks

Depredation consequences

Economic consequences:

- Fish loss
- Damage to the fishing gear
- Extra spending on fuel

Environmental consequences:

- Increased fishing effort
- Fish loss not accounted in stock assessment

Biological consequences:

- Diet shift
- Change cetacean and shark foraging behavior and distribution
- Injury and mortality of cetaceans and sharks, deliberate (by fishers) or accidental (hooked or entangled)

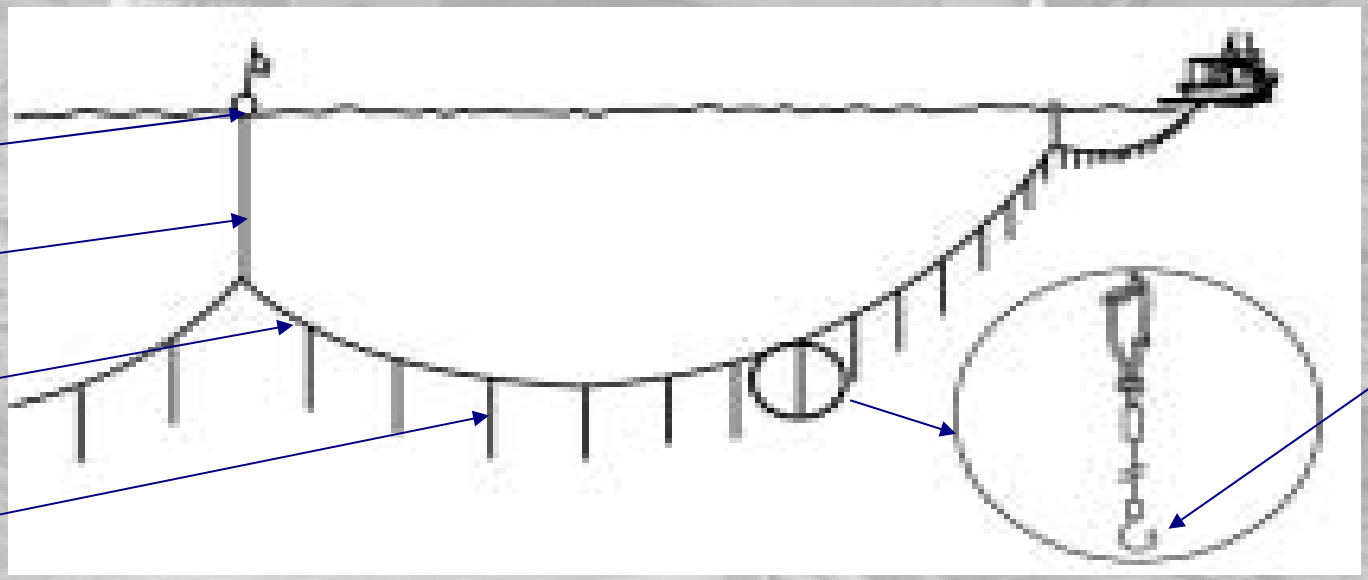
Mitigation measures

- Acoustic
  - ADD (Acoustic Deterrent Device)
  - AHD (Acoustic Harassment Device)
- Shift in fishing techniques
- Stop fishing or change fishing zone
- …

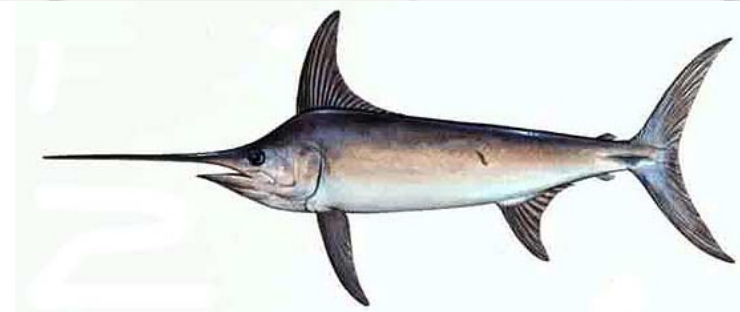
Principle of the pelagic longline fishing

FV Albacore

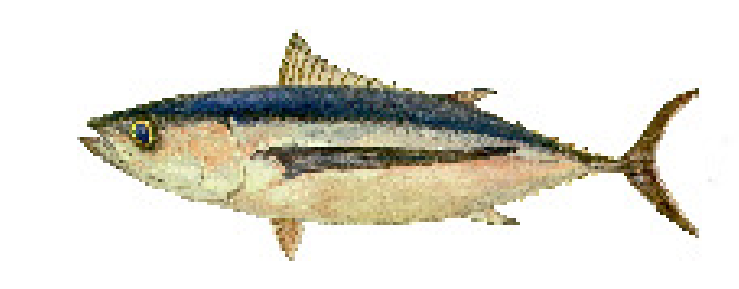
Principle of the pelagic longline fishing



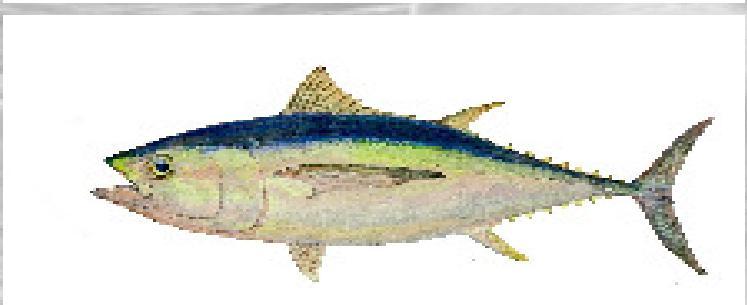
Species targeted



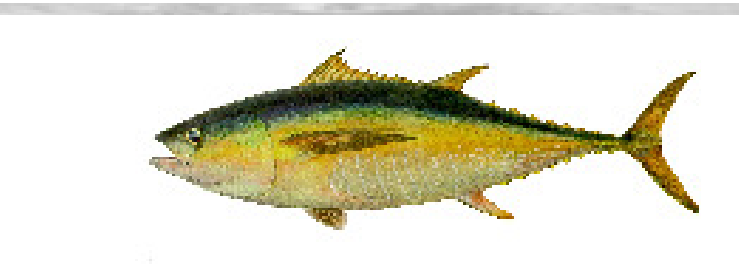
Swordfish (*X. gladius*)



Yellowfin (*T. albacares*)



Albacore (*T. alalunga*)



Bigeye (*T. obesus*)

Seychelles depredation

In 2007 an Action Plan to mitigate depredation was produced

Collaborators :

- Seychelles Fishing Authority
- French embassy
- French scientists
- Owner and crew of FV Albacore
- MENRT (Ministry of National Education, Research and Technology)

Objectives:

- Identify the cetacean species involved — Nov 2006
- Quantify depredation
- Identify fishing practices at risk (if any)
- Better understand the depredation processes
- Design and test the efficiency of mitigation measures

Research cruises

- 1st trip (November 2006) :
  - Study the fishing operation (suitable design of mitigation devices)
  - Identify marine mammals involved in depredation
  - Record acoustic signal generated by the vessel
  - Attempt to detect acoustic signal of marine mammals

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Jan-June 2007

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Depredation extent in Seychelles

Reported since 1995 through a logbook data collection system

More lines depredated by sharks (41%) than by cetacean (16%)

More fish lost per line due to cetaceans (60% of the catch) than to sharks (18%)

Global depredation rate : 21% (12% cetaceans and 9% shark)

4.2 fish lost/1000 hooks

Estimated economic loss: 340 €/1000 hooks set

- 150.000 € for the 2004-2006 period
- 1.000.000 € for the 1995-2006 period

The highest mean depredation rate reported for longliners

Rabearisoa et al, 2007

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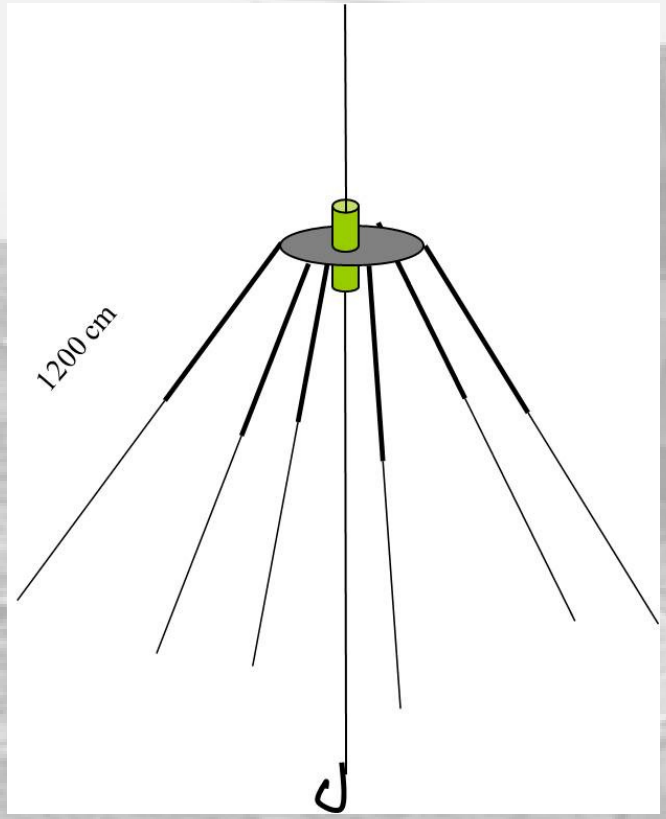
Nov 2007
Nov 2008

Goal of the study

- Investigate an empirical technical mitigation measure designed to physically protect the hooked fish by hiding them to predators

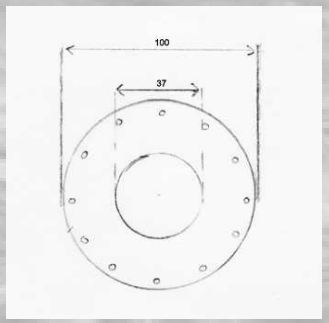
- 2nd and 3rd trips (November 2007 and November 2008):
  - Check if those systems prevent cetaceans from consuming targeted catches
  - Assess whether they fit the fishing gear and fishing techniques parameters

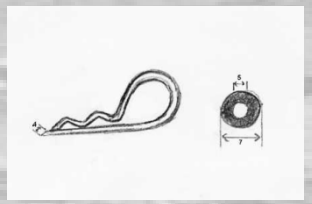
Survey 2: November 2007

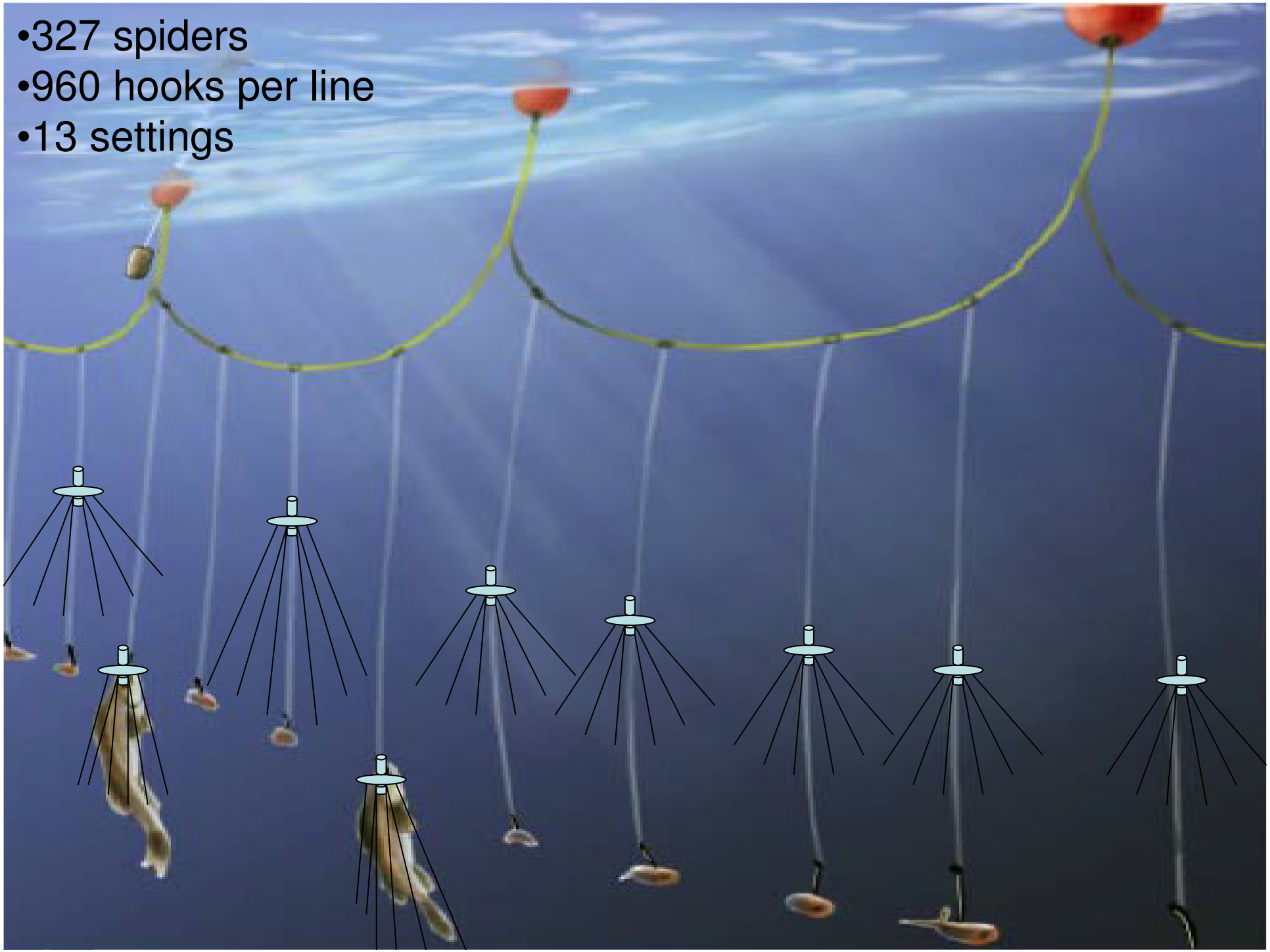


Dissuasive device made up of:

- a 10 mm thick plactic disk (radius 100 mm) with 16 evenly spaced holes on its outer range
- a triggering system
- four 2400 mm polyester strands inserted and hung to make eight 1200 mm hanging legs






•327 spiders
•960 hooks per line
•13 settings

Results

- Efficiency
  - 87% of the time, when a catch was present on the line, the device was triggered
  - 9% of the time, it was triggered when there was no catch
  - When triggered, in 80% of the cases, it provided adequate protection for the captured fish (all species)
  - Swordfish received less protection (long bill)

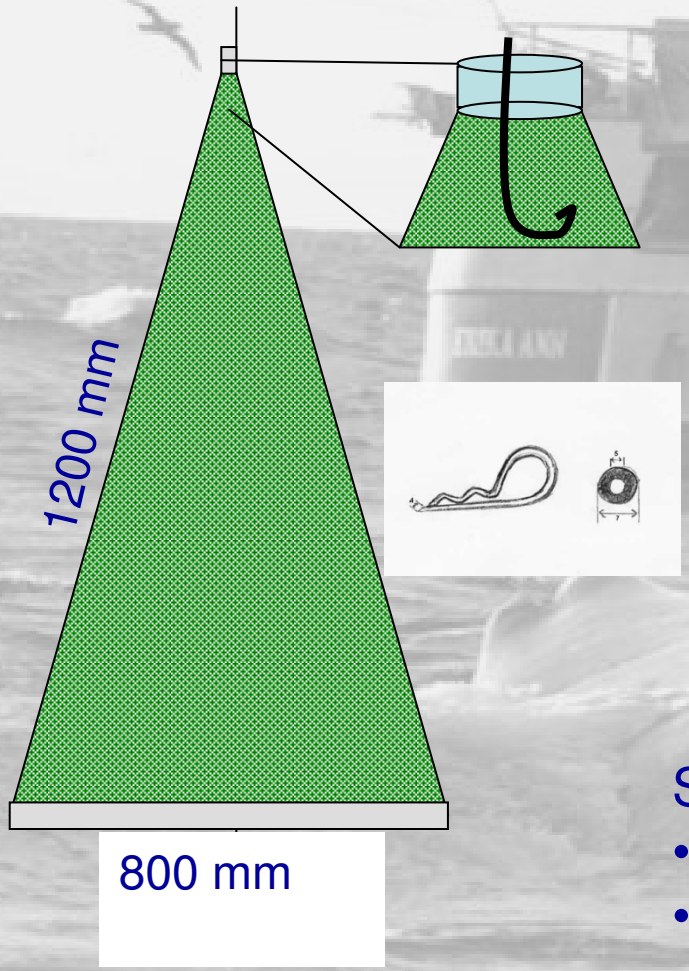
Results

- Operational
  - Attaching the spider is time consuming
  - Triggering mechanism needed significant effort to be put in place (spiders deployed only every 4 hooks)
  - Entanglement during hauling

Conclusion

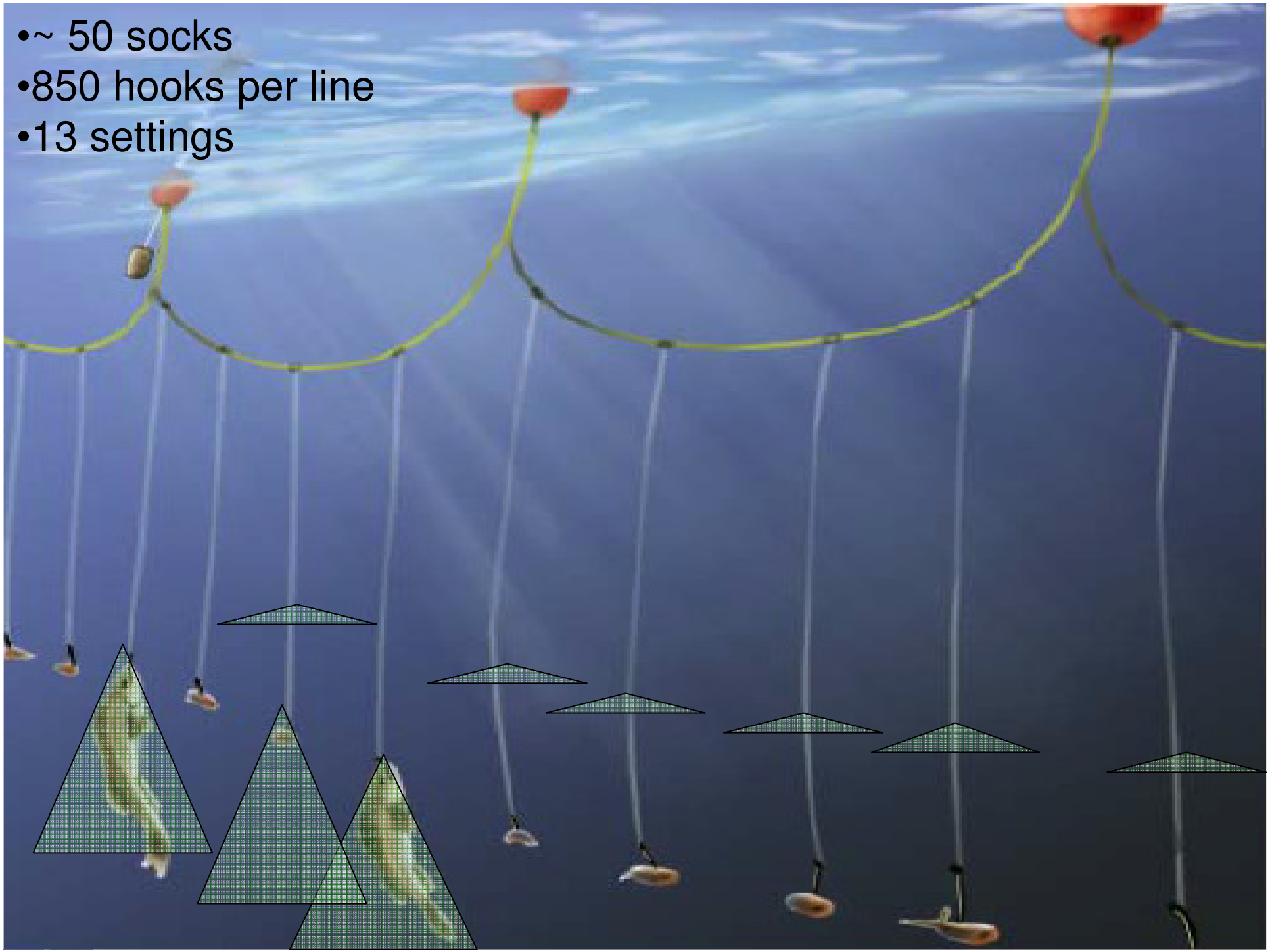
- The triggering system was validated
- The polyester strands (legs) system failed in its dissuasive purpose
- Total physical protection will therefore be required
- A conical shaped net system was developed and tested in november 2008

Survey 3: November 2008



Sock made up of:

- fiberglass mosquito netting or propylene fiber net
- metallic or plastic hook
- small lead weights


•~ 50 socks
•850 hooks per line
•13 settings

Results

- Efficiency
  - 68.9% of the time, when a catch was present on the line, the device was triggered
  - When triggered, in 14% of the case, it provided adequate protection for the captured fish (all species)
  - 21% of the time, it was trig when there was no catch
  - Swordfish received less protection
  - 1 swordfish covered by a sock was shark depredated

Results

- Operational
  - Attaching and taking down the sock is time consuming
  - One person have to be dedicated to this task
  - Triggering mechanism needed significant effort to be put in place (socks deployed every 2 hooks)
  - Entanglement during hauling
  - 13 devices were lost

Conclusion

- Spider and sock were not very effective depredation mitigation devices and they both failed in their dissuasive purpose
- Because of their low number, those systems were more meant to be tested regarding their compatibility with fishing parameters and their technical behavior than regarding their efficiency towards depredation
- Setting up the devices on the branchline took too long and required considerable force
- Tests were not a total failure as they allowed the designers to better understand the technical parameters and constraints of this fishery for the future surveys

Thanks for your attention.