Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division



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Mitigating odontocete depredation & by-catch in pelagic longline fisheries: physical & psychological deterrence at the hook.

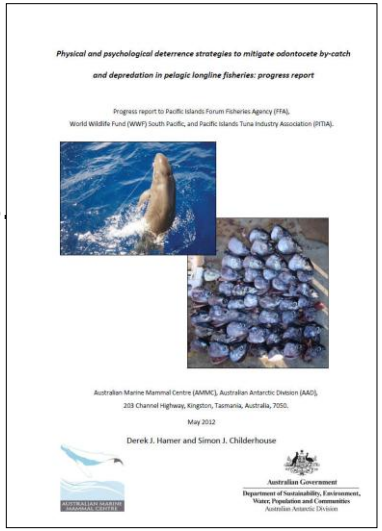




Odontocete depredation & by-catch in pelagic longline fisheries.

BACKGROUND

- **2002 workshop**: Cetacean interactions with commercial longline fisheries (Donoghue *et al.* 2003).
  - Marked increase in operational interactions over previous 20 years,
  - "*participants emphasised the need for rigorous scientific trials to demonstrate effectiveness before broad-scale adoption of any particular mitigation device or procedure*".
- **2009 this project commenced**
  - One of only a few extensive and dedicated efforts in this area to date,
  - Publication of a global review of the problem & of potential mitigation measures.
    - Hamer *et al.* 2012 : Marine Mammal Science 28(4), E345-E374.
  - Two reports...Hamer and Childerhouse 2012 , 2013.
  - Two manuscripts proposed...publish in 2014?


Physical and psychological deterrence strategies to mitigate odontocete by-catch and depredation in pelagic longline fisheries: progress report

Progress report to Pacific Islands Forum Fisheries Agency (FFA), World Wildlife Fund (WWF) South Pacific, and Pacific Islands Tuna Industry Association (PITIA).

Australian Marine Mammal Centre (AMMC), Australian Antarctic Division (AAD), 203 Channel Highway, Kingston, Tasmania, Australia, 7050.

May 2012

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Odontocete depredation & by-catch in pelagic longline fisheries.

NEED

- **Mitigate depredation**
  - Economic impact.
    - ~US$300M per annum globally...one Fiji company reported losses of ~$10M per annum.
  - Management problems.
    - Inhibits effective management of fish stocks: depredated fish unaccounted for.
- **Mitigate by-catch**
  - Conservation impact.
    - Generally unclear; size of whale populations is typically unknown.
  - Welfare issue.
    - Injury, infections, drag...inhibit effective foraging.



Odontocete depredation & by-catch in pelagic longline fisheries.

AIMS

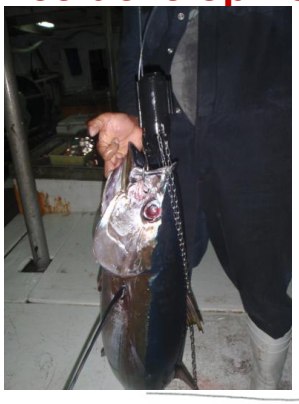
- **<u>Develop</u> devices that physically (& psychologically?) deter depredating odontocetes**
  - Acoustic deterrence strategies have proven problematic & generally lacking for pelagic gear,
  - Several reports of depredating whales avoiding gear tangles,
    - Simulation of gear tangles: device on each line, above hook.
- **<u>Assess</u> effectiveness under rigorous scientific and operational conditions**
  - Impact on:
    - Fish catch rate,
    - Incidence of depredation,
    - Incidence of by-catch,
    - Several other operational elements of fishing.

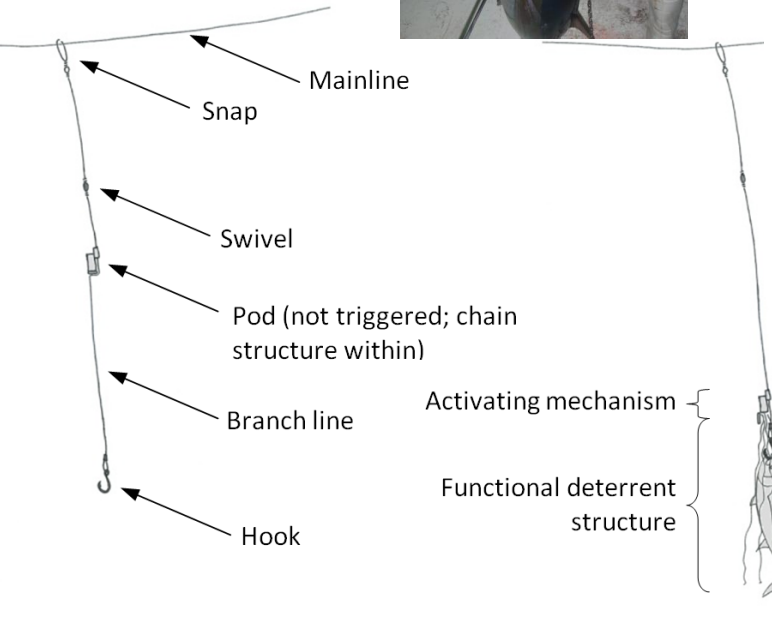


Odontocete depredation & by-catch in pelagic longline fisheries.

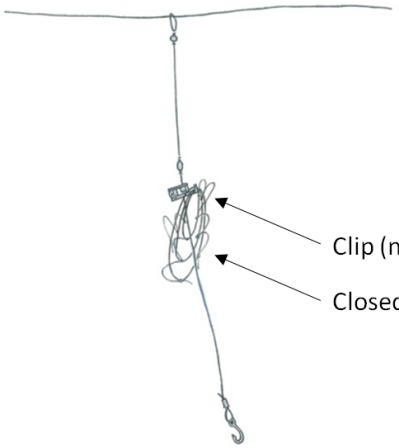
METHODS… Device development

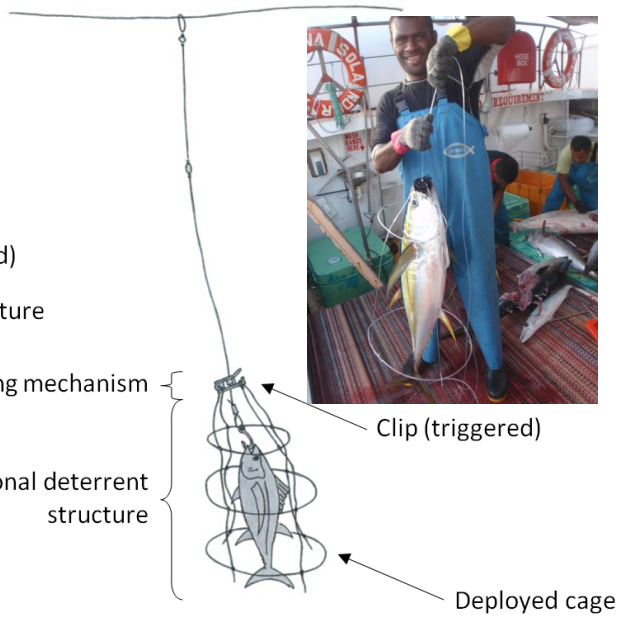
Chain device





Cage device



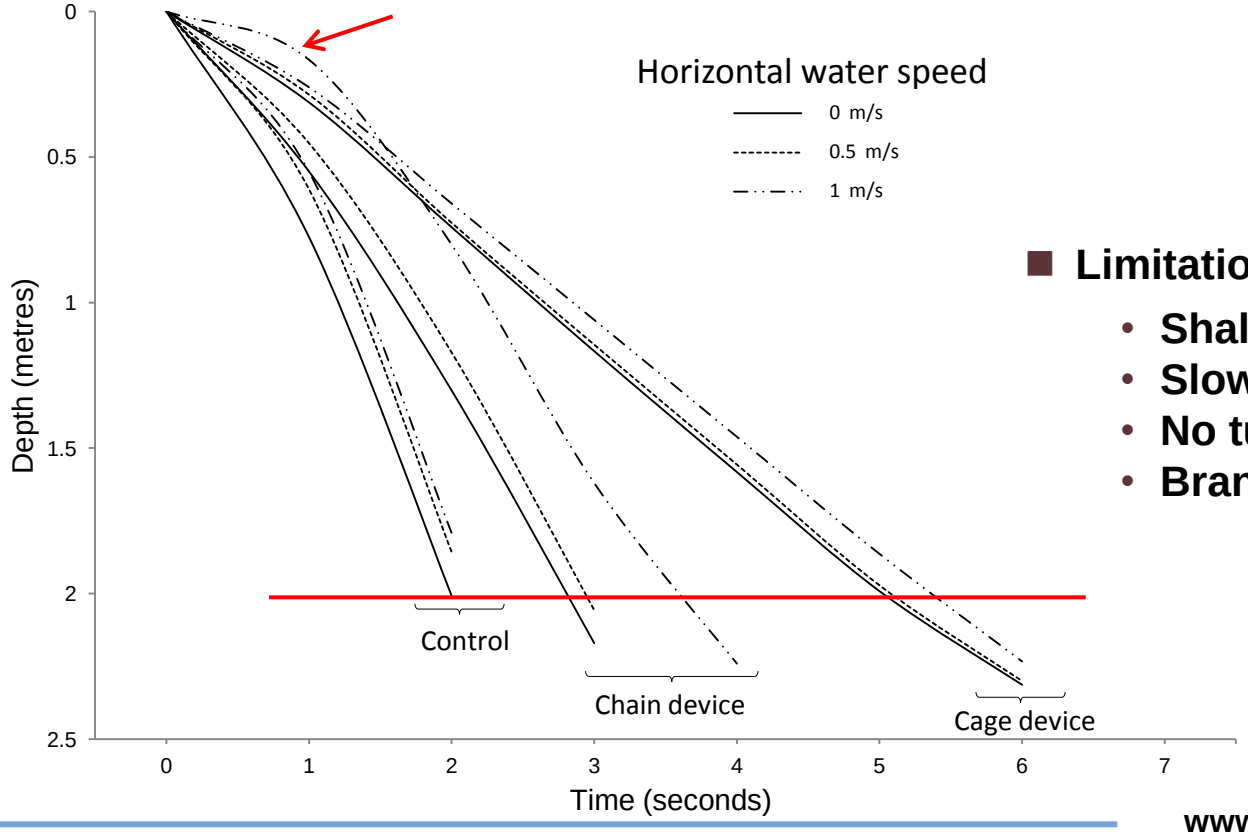




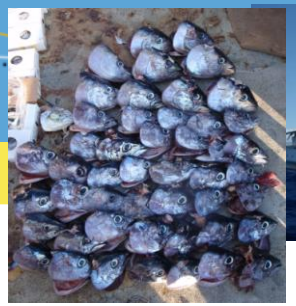
Odontocete depredation & by-catch in pelagic longline fisheries.

METHODS… Device development

- **Effect of device on sink rate**



- **Limitations**
  - **Shallow tank**
  - **Slow speed**
  - **No turbulence**
  - **Branchline only**

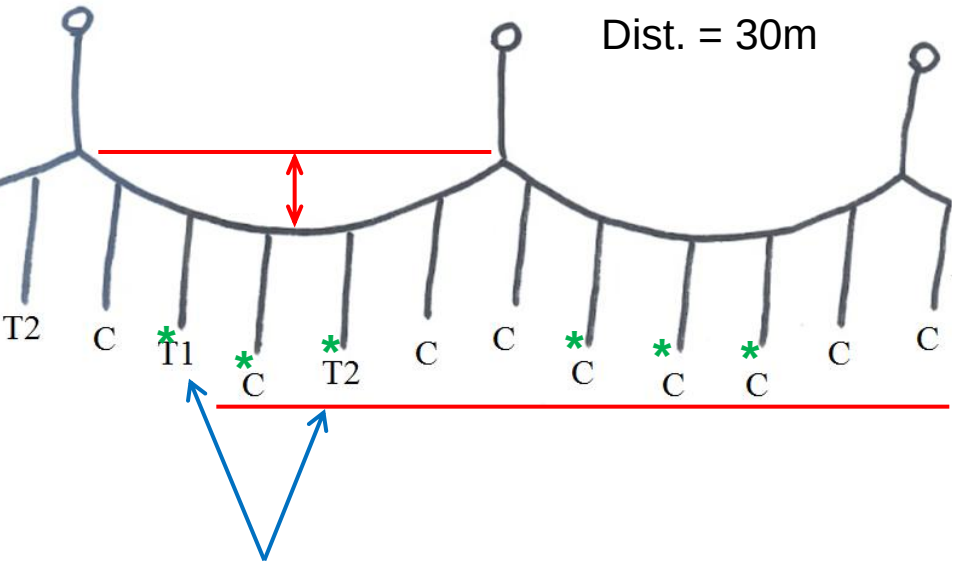


Odontocete depredation & by-catch in pelagic longline fisheries.

METHODS… Device development

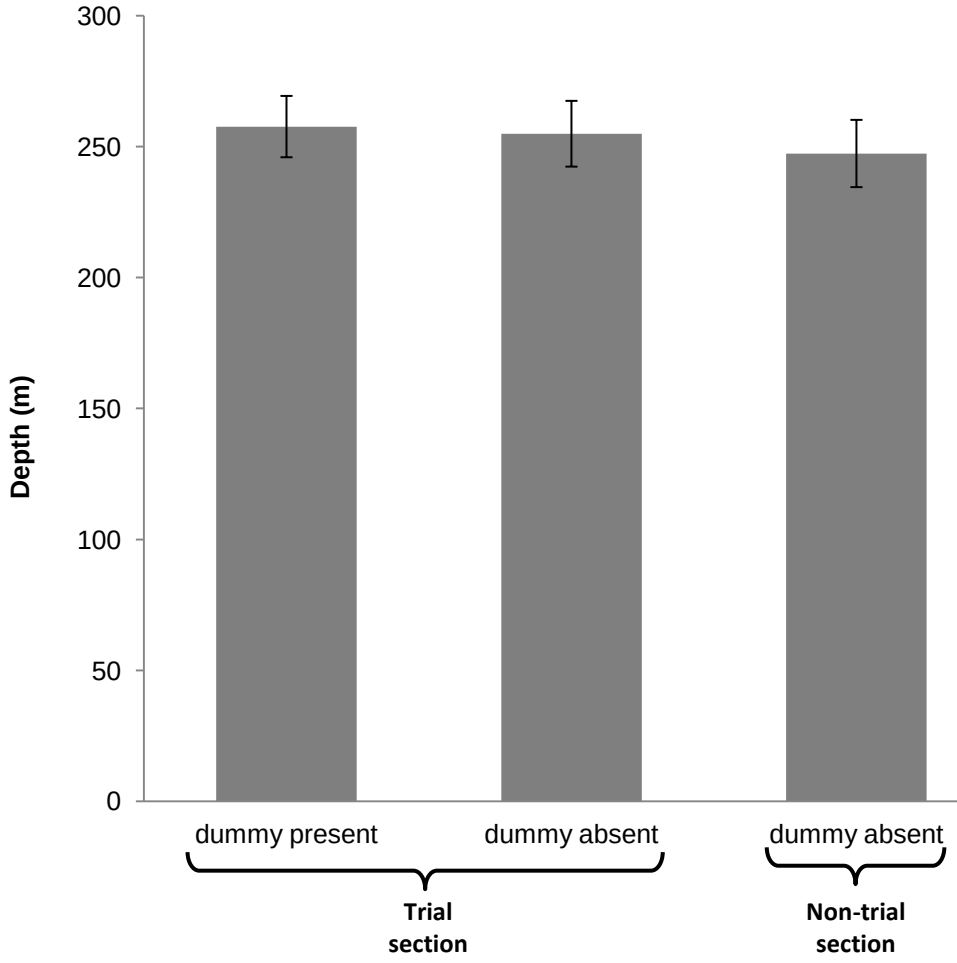
- **Effect of device on maximum depth**
  - **Exploratory trip**

Depth = 30-280m
H/set = 24
Dist. = 30m



Dummy = device (~100g)

*** = CEFAS G5 TDRs**



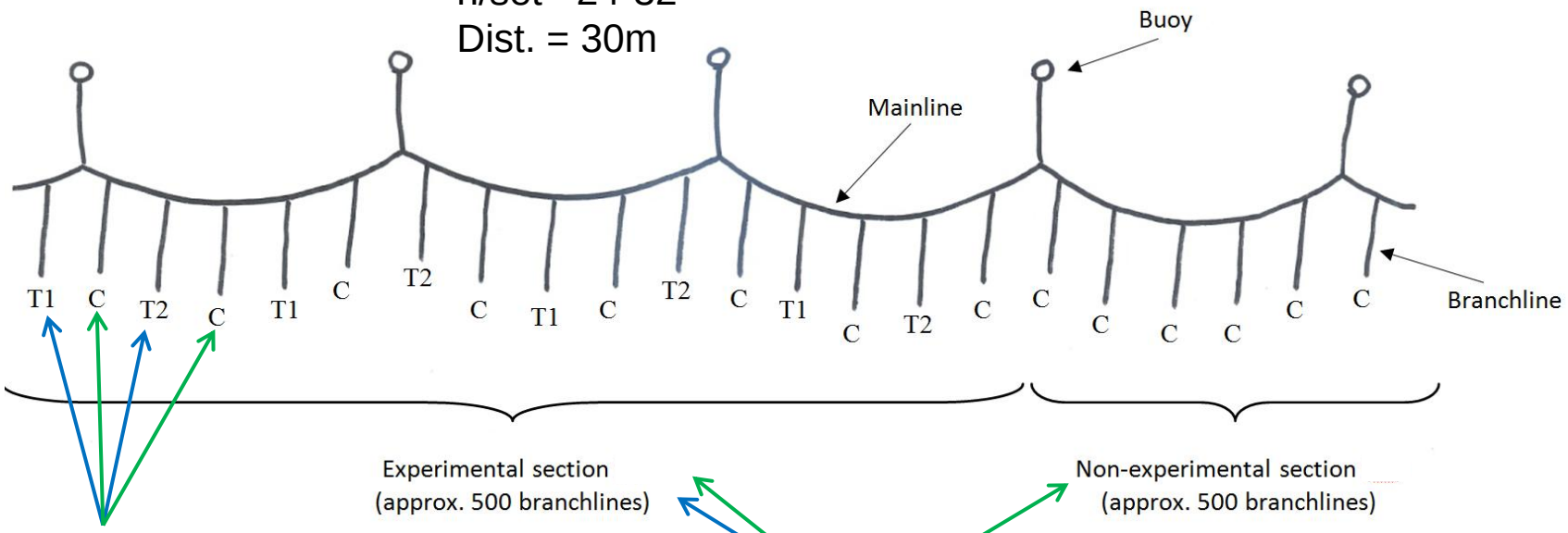


Odontocete depredation & by-catch in pelagic longline fisheries.

METHODS… Experimental design (the real thing!)

- **Treatment & Control**

Depth = 30-340m
h/set= 24-32
Dist. = 30m



T1 & T2 = devices…fish protected

C = controls…fish unprotected

Feeding choice?

Edge effects?



Odontocete depredation & by-catch in pelagic longline fisheries.

METHODS… Assessment

- **Setting** the gear

(see accompanying video file)



Odontocete depredation & by-catch in pelagic longline fisheries.

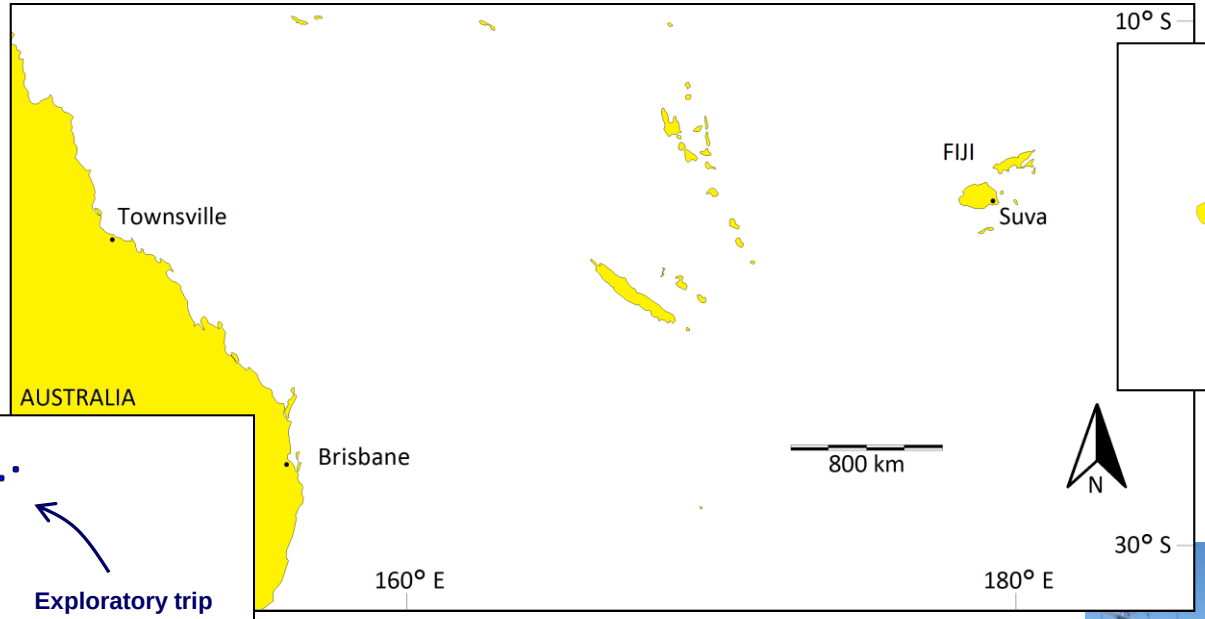
METHODS… Assessment

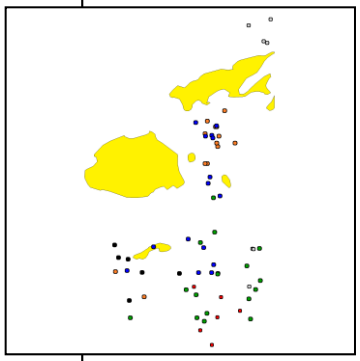
Hauling the gear (see accompanying video file)




Odontocete depredation & by-catch in pelagic longline fisheries.

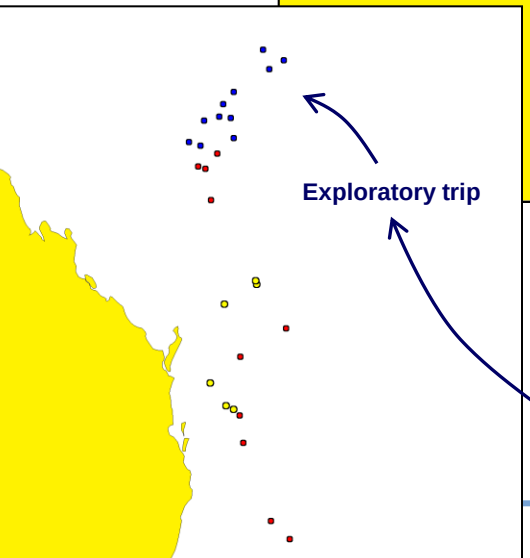
RESULTS… Effort & distribution





Fiji

- 65 sets…82,055 hooks



Australia

- 16 sets…9,959 hooks

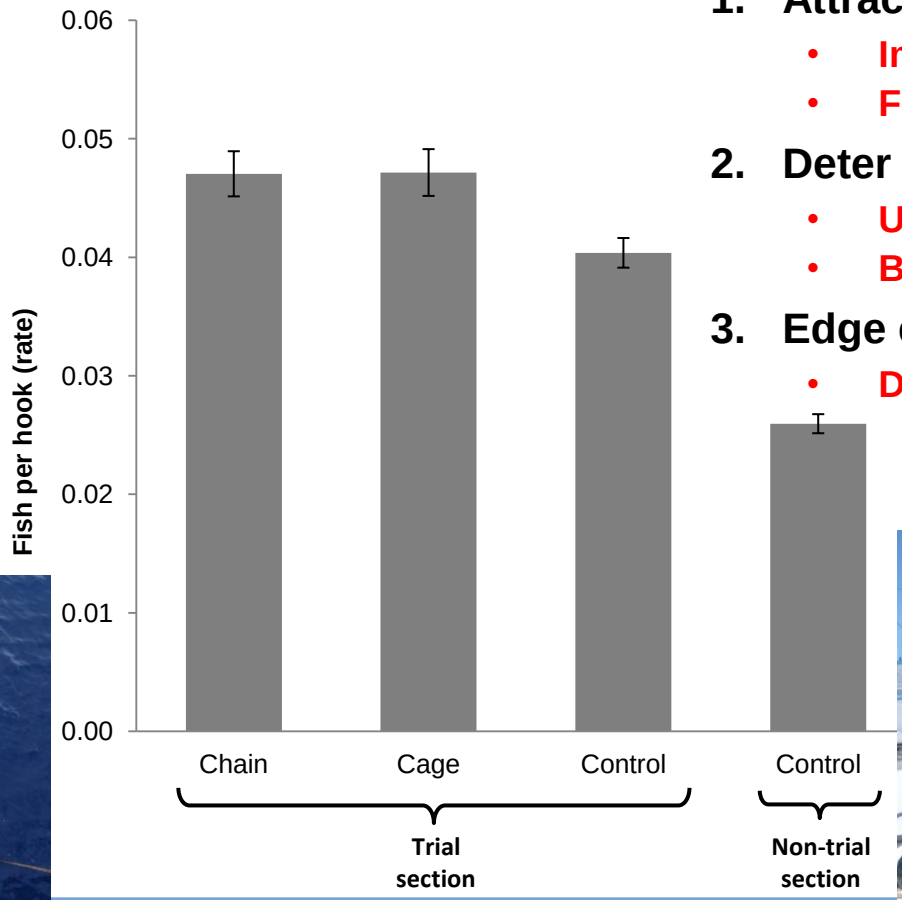
TOTOAL

- 81 sets; 92,014 hooks; 8 vessels
- (**94 sets; 119,844 hooks; 9 vessels**)



Odontocete depredation & by-catch in pelagic longline fisheries.

RESULTS… Fish catch rate



1. **Attract more fish?**
   - Improves catch
   - Fishery enhancement
2. **Deter predators?**
   - Unobserved (sharks also)
   - Better reflection of exploitation
3. **Edge effect?**
   - Deterrence beyond the device



Odontocete depredation & by-catch in pelagic longline fisheries.

RESULTS… Depredation generally

- Sharks also significant depredators
  - Underestimated problem
  - Also mitigated using these devices






Odontocete depredation & by-catch in pelagic longline fisheries.

RESULTS… Depredation by odontocetes

- **27 events** (i.e. individually damaged/depredated fish)
  - 24 on control hooks
  - 3 on treatment hooks
    - 2 on cage device
    - 1 on chain device

Structures failed to deploy
- Behaved like controls
- Fish unprotected

- **Feeding choice**
  - 7 events
    - where two fish caught consecutively
    - unprotected fish depredated

- Unable to conduct robust statistics
- However, indicates devices are a deterrent
- May reduce level of whale depredation
  - although more data needed

Odontocete depredation & by-catch in pelagic longline fisheries.

RESULTS… By-catch of odontocetes

- **4 events**
  - **All on control hooks**
  - **3 *false killer whales* and 1 *melon-headed whale***
  - **All released alive**
    - **Cutting the line, leaving hook lodged**
    - **Fate unknown**

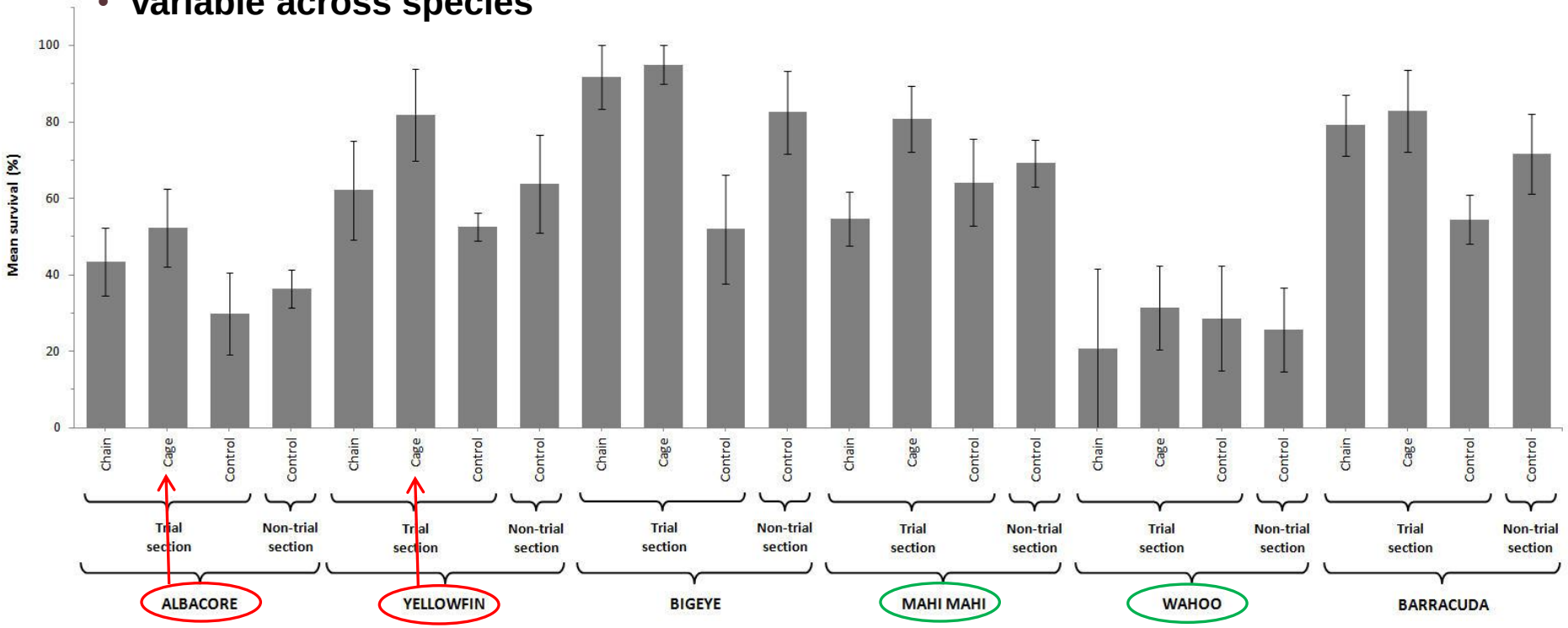
- **Again, sample size miniscule...stats not possible**
- **Devices are a deterrent?**
- **Reduce level of whale by-catch?**
- **More data needed**



Odontocete depredation & by-catch in pelagic longline fisheries.

RESULTS… Operational elements

- **Fish survival…across six most caught species**
  - variable across species

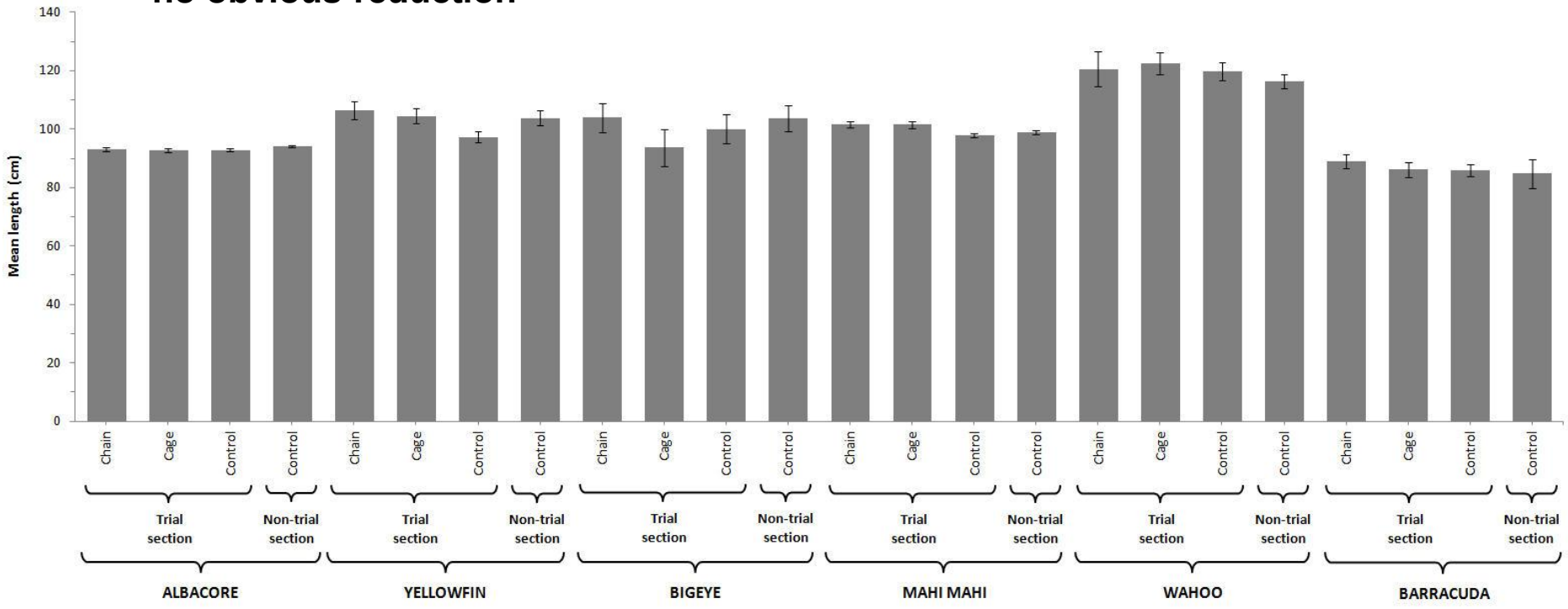




Odontocete depredation & by-catch in pelagic longline fisheries.

RESULTS… Operational elements

- **Fish size…across six most caught fish species**
  - **no obvious reduction**





Odontocete depredation & by-catch in pelagic longline fisheries.

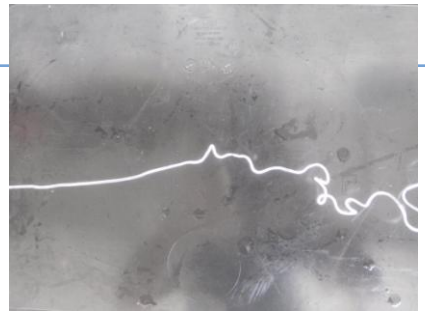
RESULTS… Operational elements

- **Speed…**
  - **Setting: no change – constrained to 6 to 8 second ‘beeps’ (one additional person in trial section)**
  - **Hauling:**
    - **Trial section = 20.57 ± 6.13 (s.d.) seconds (one additional person)**
    - **Non-trial section = 17.47 ± 5.34 (s.d.) seconds**

- **Longer hauling time may mean fewer hooks can be set**
  - **Offset by increased catch & fewer damaged fish?**



Odontocete depredation & by-catch in pelagic longline fisheries.

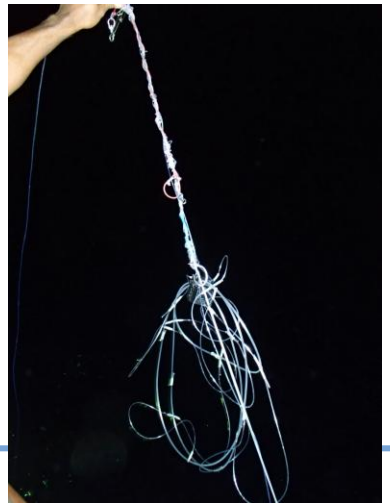


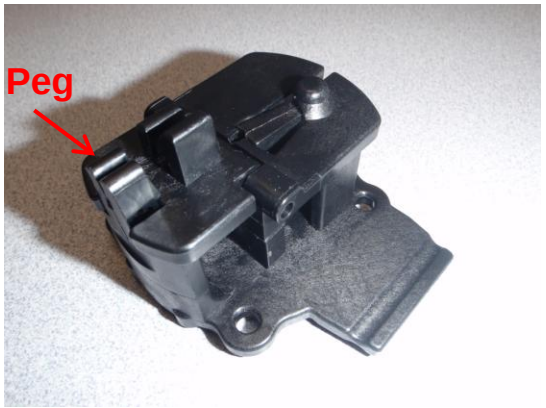
RESULTS… Operational elements

- **Functionality and durability…**
  - **Triggering success when fish caught**
    - Chain device = 78.23 ± 12.46 (s.d.) %
    - Cage device = 76.70 ± 8.54 (s.d.) %

Reasons structures failed to deploy:
- Tangled around mainline
- Poor branchline maintenance
- Fish too small
- Release threshold tension too high

Reasons for 'retiring' units:
- Damaged by caught fish
- Tension adjustment difficulty





- Increased catch value or reduced operational costs outweighs the negatives
- Could be improved, but 'fit for purpose' in this proof of concept phase



Odontocete depredation & by-catch in pelagic longline fisheries.

WHERE TO FROM HERE?

- Further development and implementation
  - Refinement and further sea trials
  - Per unit cost reduction through high volume manufacture
- Hybrid products
  - Trigger and delivery systems developed could be used to carry acoustic deterrents to the hook
- Outreach, reports and publications
  - Good foundation for future activities



Odontocete depredation & by-catch in pelagic longline fisheries.

Thank you…

- Licence holders, skippers and crews
  - Solander Pacific (Charles Hufflett & Tom Mayo)
  - Seaquest (Brett Haywood)
  - Fiji Fish (Graham Southwick & Russell Dunham)
  - DeBrett Seafood (Gary Heilmann)
- Funders
  - FFA (Hugh Walton)
  - WWF South Pacific (Seremaia Tuqiri)
  - Australian Government (FRDC and NHT)
- Support
  - Fiji Fisheries Dept. (Anare Raiwalui & staff)
- Product manufacturers
  - 3D Systems (Peter Canfield)
  - Fishtek (Pete Kibel)