

Coastal & Marine Conservation

By-Catch

What is By-catch?

- Incidental capture of non-target species
- Approx 23% of the global fisheries catch
- Globally, in excess of 300,000 cetaceans p.a. (University of St Andrews)
- 2,700 Harbour Porpoises in Celtic Sea every year; 15,000 in the North Sea (ICES, 2014)
- Tens of thousands of Southern Ocean seabirds
- Fisheries pose gravest threat

(IWC, 2008; MCS, 2009)



Porpoises washed ashore in Swansea





21st June 2009: young porpoise at Broughton, Gower

(Thomas, 2009)

Seabird Mortality

- Late to mature; slow to reproduce
- Natural adult mortality low
- Human-induced mortality potentially population threatening
- Albatross – 15 out of the 22 species threatened with extinction
- Up to 60 miles long with 30,000 baited hooks
- Albatrosses, shearwaters and petrels vulnerable – ability to dive beneath surface; ocean wanderers
- 1997-2000 333,000 seabirds



UK Turtle Mortality

- Entanglement in ropes used by pot fisheries for crustaceans
- Driftnet, pelagic and demersal trawls, purse seine and long line fishing
- High mortality in West Wales between 1995-1997 linked to expansion of pot fisheries for whelks (Godley *et al.*, 1998)
- Limitations of bycatch data available – only 3 of the 17 turtles stranded in Carmarthen Bay since 1995 are recorded as bycatch – entangled in rope



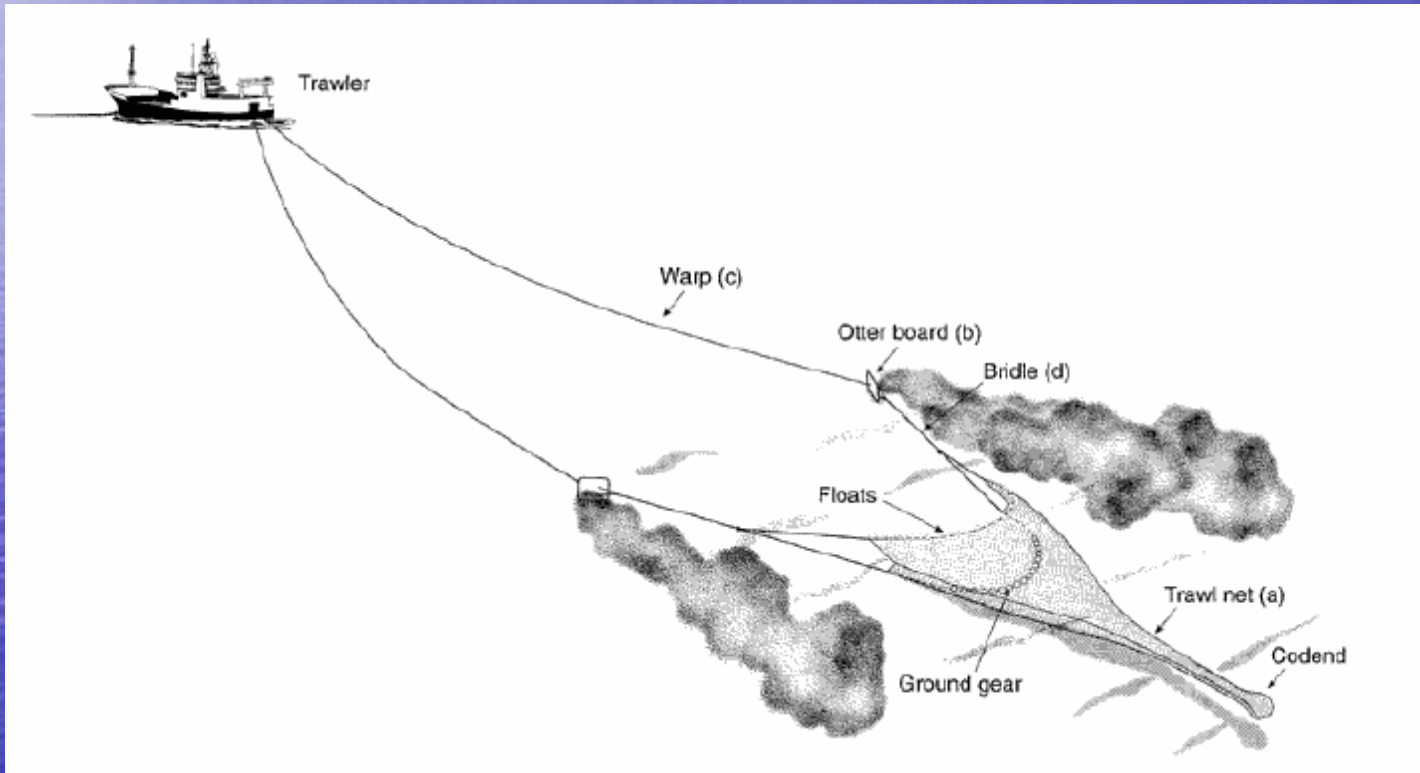
Sharks

- Vulnerability- growing demand for shark products since 1990s
- 33% of all landed shark statistics – from bycatch fisheries (Bonfil, 1994)
- Stevens *et al.* (2000) – sharks taken as bycatch could account for 50% all shark landings.
- Atlantic Ocean – Spanish swordfish longline fishery – 70.3% catch (total landing) are large pelagic sharks
- Often shark fins removed (income) and fish discarded dying or dead

Fisheries Associated with Bycatch

- Almost any fishing gear
- Cetaceans - Pelagic trawls; demersal trawls; bottom-set gillnets; driftnets; trap fisheries (herring weirs); hook and line fisheries and ghost netting
- Turtles – set nets; demersal and pelagic trawls; driftnets; pot-based fisheries
- Seabirds & Sharks – long-line fisheries

Fishing Techniques: Pelagic trawl



Pelagic trawl

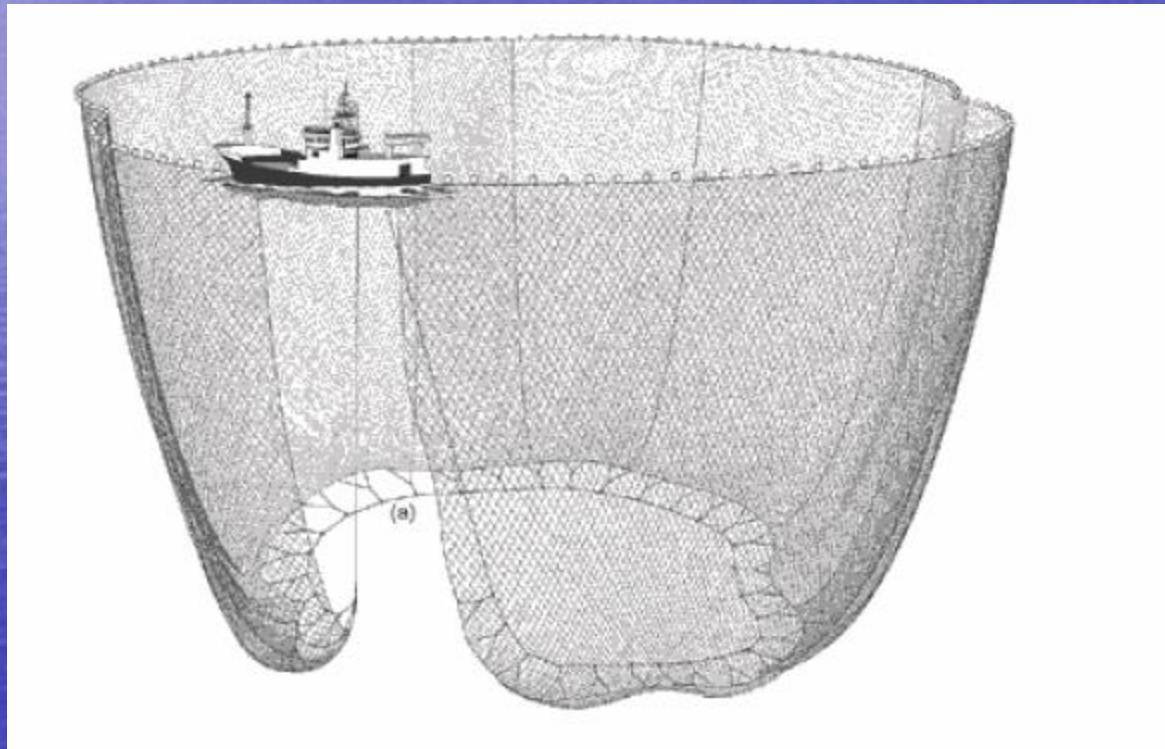
- Towing of a trawl net by a single or two vessels
- Mid water trawls most problematic with cetaceans
- Herring, mackerel, whiting, sea bass, hake and albacore tuna- fisheries known to catch cetaceans in North East Atlantic
- In 2002/3, 310 pelagic tows observed in the sea bass fishery (English Channel) – 91 Common Dolphin were recorded

Bottom Set Gillnets

- Nets suspended vertically
- Fish gills wedged within the mesh opening
- Target species – cod, turbot, haddock, dogfish
- Tangle nets – a variation on the theme – crustaceans/flatfish
- Driftnets are also gillnets – left to drift at or near the surface
- Durability of nylon gillnets – ghost fishing



Fishing Techniques: Purse seine



Why Cetaceans Get Caught?

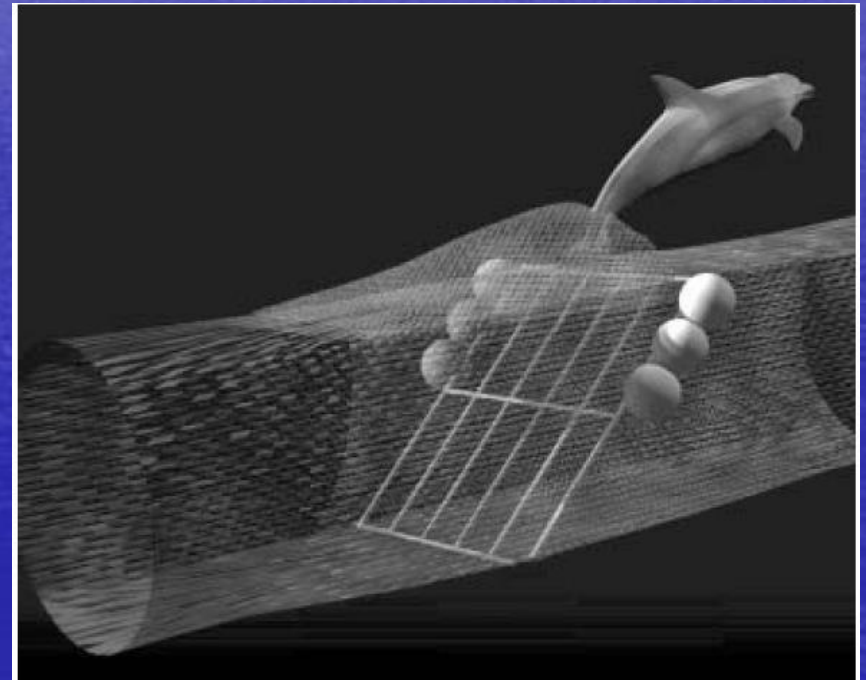
Mitigation

- Nets have limited acoustic detectability (Kaschner, 2003)
- Pelagic trawls are very noisy underwater – unlikely animals cannot detect the nets (Gosselin, 2001)
- Most mitigation looks at exclusion techniques – physical or acoustic
- Also net modifications and management of fisheries involved



Mitigation Measures: Exclusion devices

- Selection grids also used in shrimp fisheries where turtle bycatch is a problem
- Widely spaced metal grid allows fish through, but angle deflects larger species upwards to an escape hatch
- Successful trials in 2003 – more ongoing
- Concerns have been raised about possible injuries sustained by passage through the grid



Mitigation Measures: Acoustic devices

- 'Pingers'
- Initially a success story during trials
- Unpopular— expensive, prone to failure and interfere with setting and hauling.
- Habituation (*Cox et al., 2001*)
- Exclusion from critical habitats with widespread use



Mitigation Measures: Net Modifications

- Increasing acoustic detectability—impregnating barium sulphate
- Trials in Bay of Fundy were positive
- Danish observers — reduced fish catches — stiffness of net
- Unpopular — bulkier, heavier nets with reduced fish catches



Mitigation Measures: Management

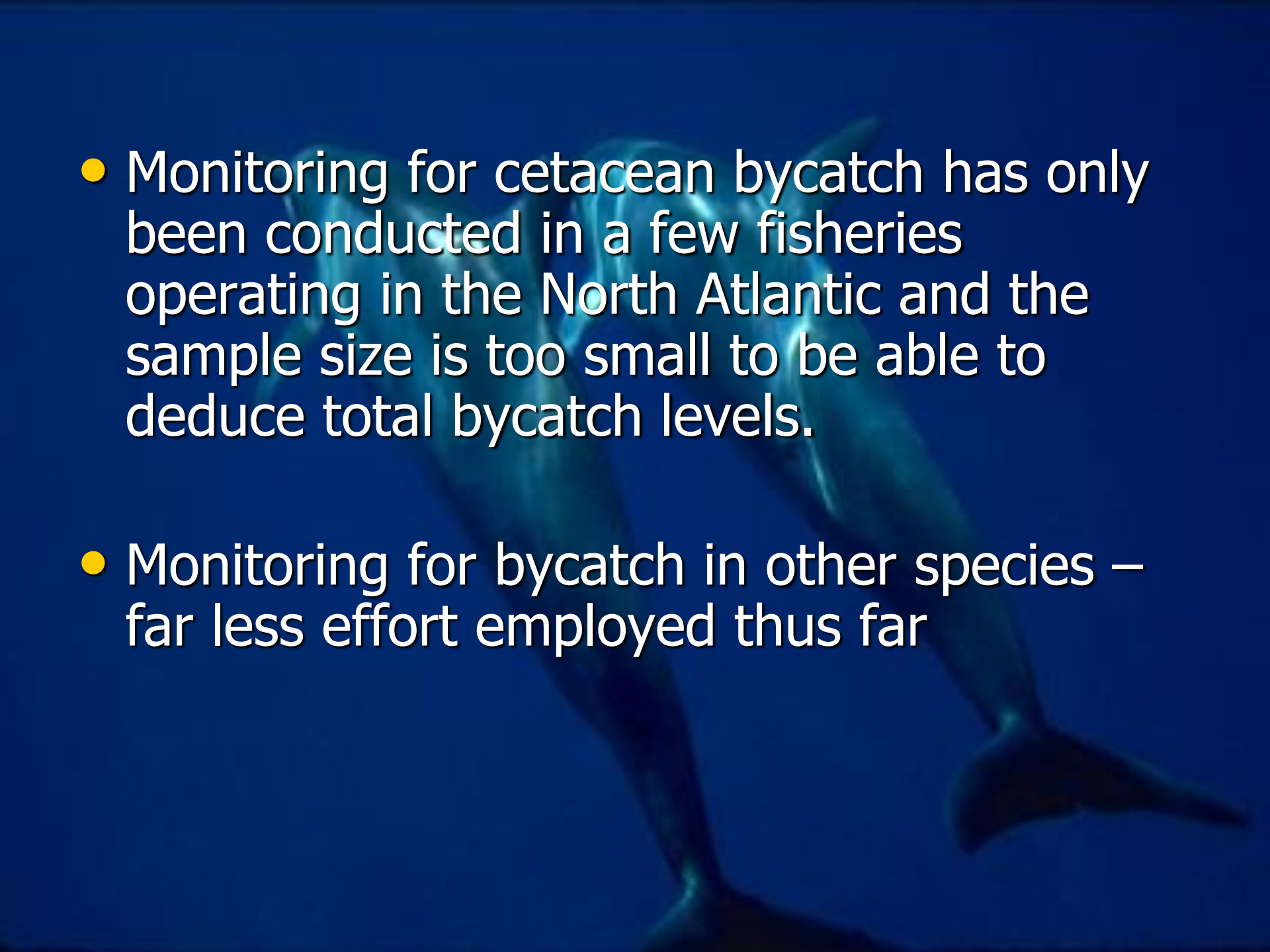


- Reduce amount of fishing effort
- Time and area restrictions
- Alternative gear types
- Emergency measures
- International treaties and agreements

Mitigation Measures: Management



- EC – summer 2005 pingers mandatory on bottom-set gillnets and entanglement nets in North Sea
- Western English Channel and Western approaches – Jan 2006
- Monitoring trawl fisheries from Jan 2005 – English Channel, Irish sea, western Britain and from Jan 2006 in North Sea and west Scotland
- But regs. only apply to vessels >10m

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- A background image showing two dolphins swimming underwater. The dolphins are dark in color, and the water is a deep blue. The dolphins are positioned diagonally across the frame, with one in the foreground and one slightly behind it.
- Monitoring for cetacean bycatch has only been conducted in a few fisheries operating in the North Atlantic and the sample size is too small to be able to deduce total bycatch levels.
 - Monitoring for bycatch in other species – far less effort employed thus far

Seabird mitigation

- Longline fisheries – during baiting and sinking of hooks
- Trawls – cable-related and net entanglement
- Mitigation involves:
 - Setting times and seasonality
 - Limit access to hooks
 - Deterrents
 - Reduce attractiveness or visibility of bait

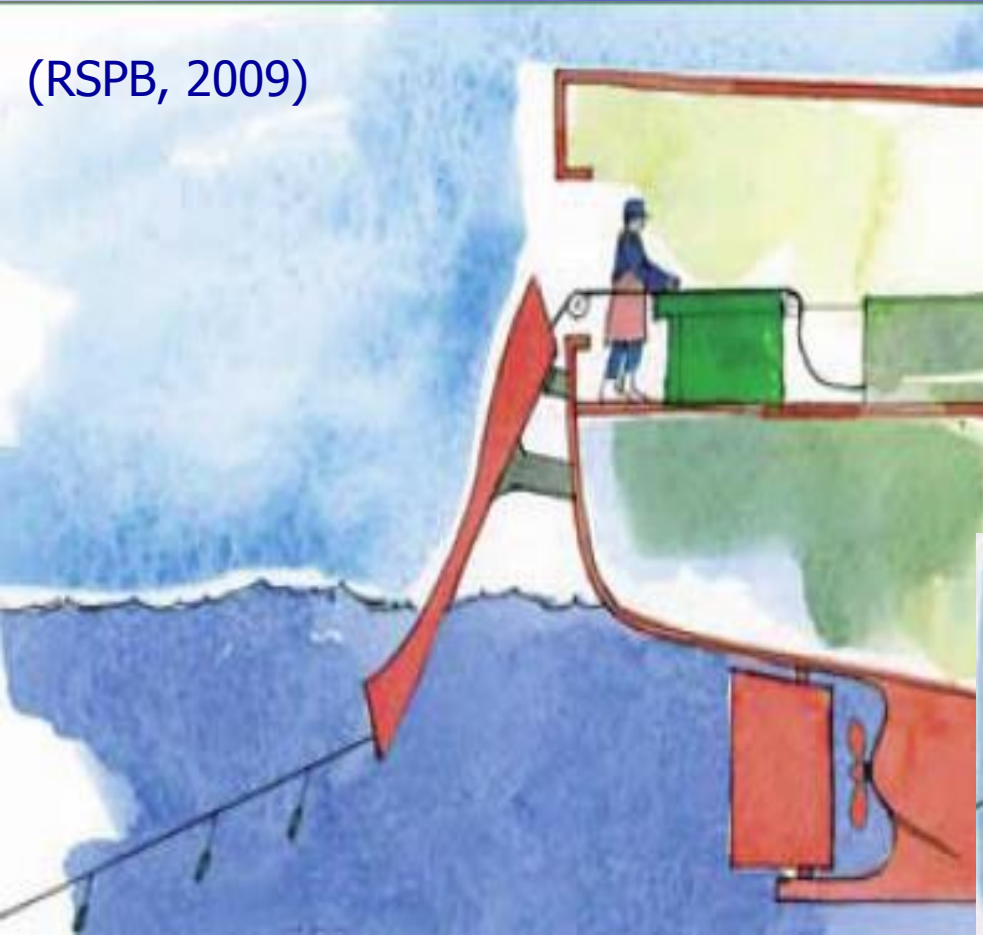
Demersal and Pelagic Longline: Night - setting



- **No fishing gear modification**
- **Between nautical dusk and dawn**
- **Fewer birds actively foraging**
- **Species specific : Albatross vs shearwaters**
- **Moonlit nights and deck floodlights**

Demersal Longline – Underwater setting chute

(RSPB, 2009)



- Greatest threat when baited hooks are @ or near surface

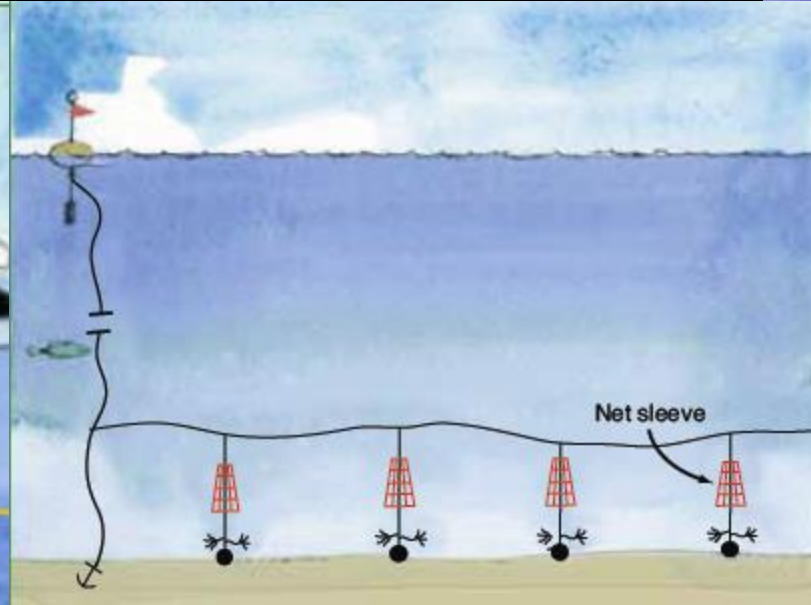
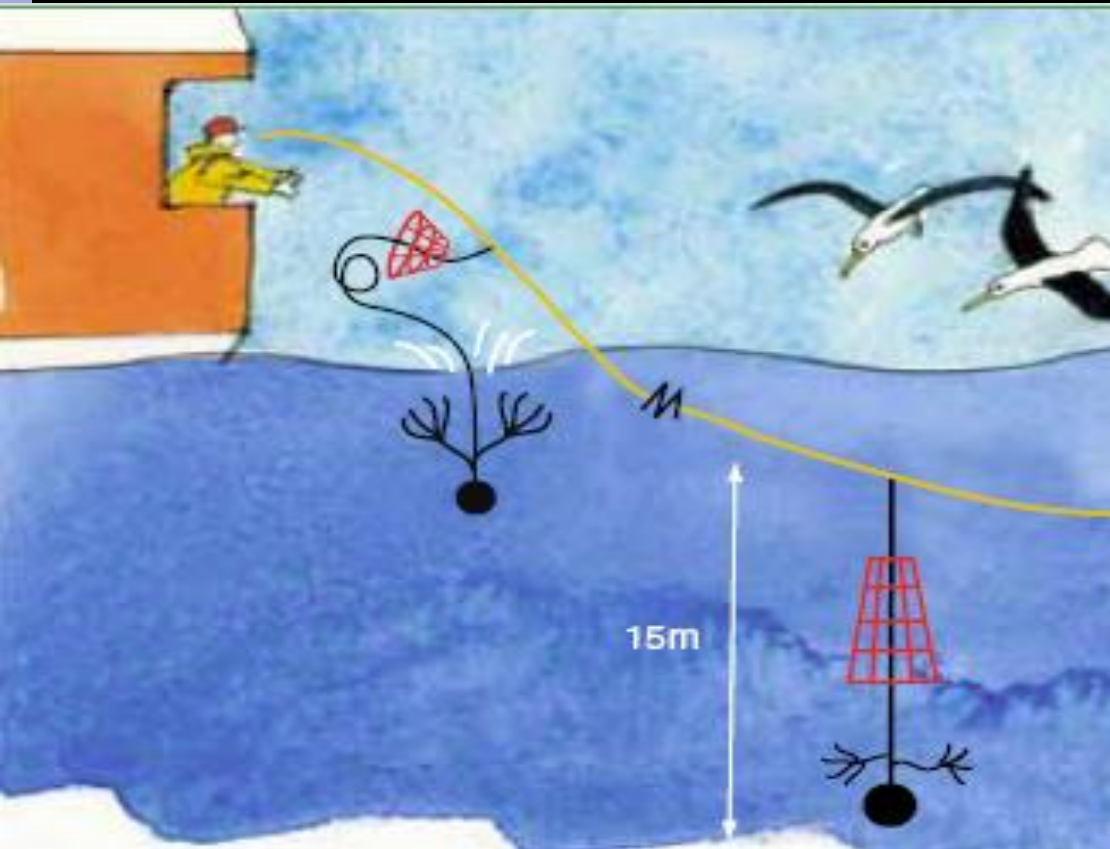
- Bycatch of Northern Fulmars in Norway from 1.75 to 0.49 birds per 1,000 hooks (Løkkeborg, 1998)

In rough weather, setting is less effective

(RSPB, 2009)



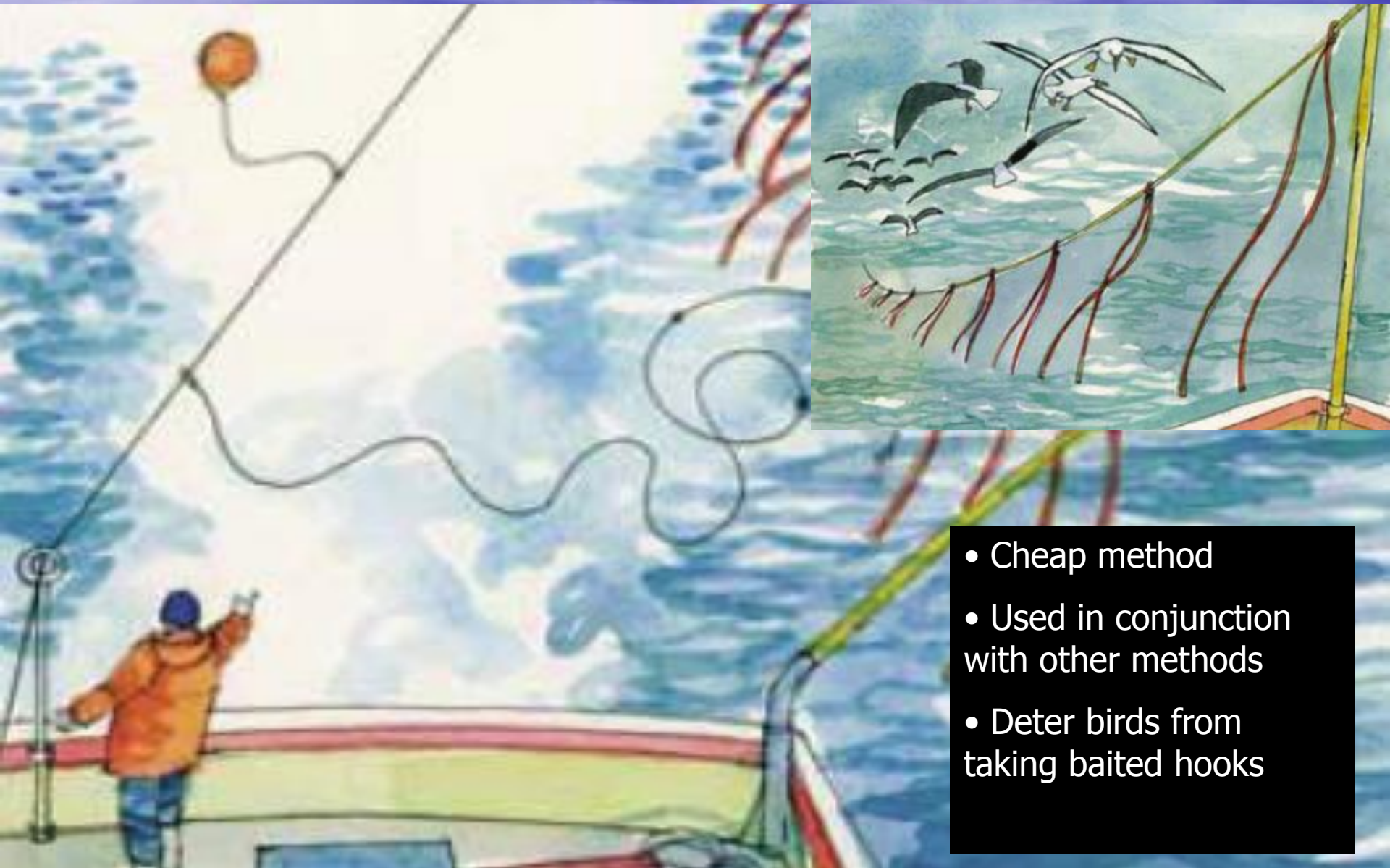
Demersal and pelagic longline – line weighting



- Tension and drag an issue
- Pushing weights from setting table and using metal-lines boxes ↓ tension
- 0.3m/s sink rate and 6kg weights @ 20m intervals (Robertson *et al.*, 2007)

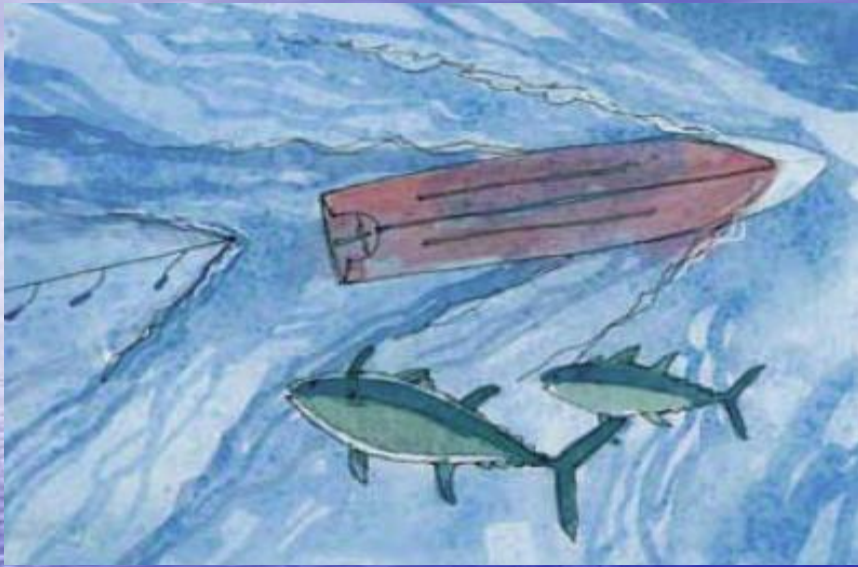


Fisheries bycatch mitigation – streamer lines



- Cheap method
- Used in conjunction with other methods
- Deter birds from taking baited hooks

Pelagic longline – Blue-dyed bait



- Reduced contrast between bait & surrounding sea
- Variable results
- Blue-dyed squid effective; blue-dyed fish bait is not (Cocking *et al.*, 2008)
- Environmental, operational and habituation factors

Shark Bycatch by Fishing Gear

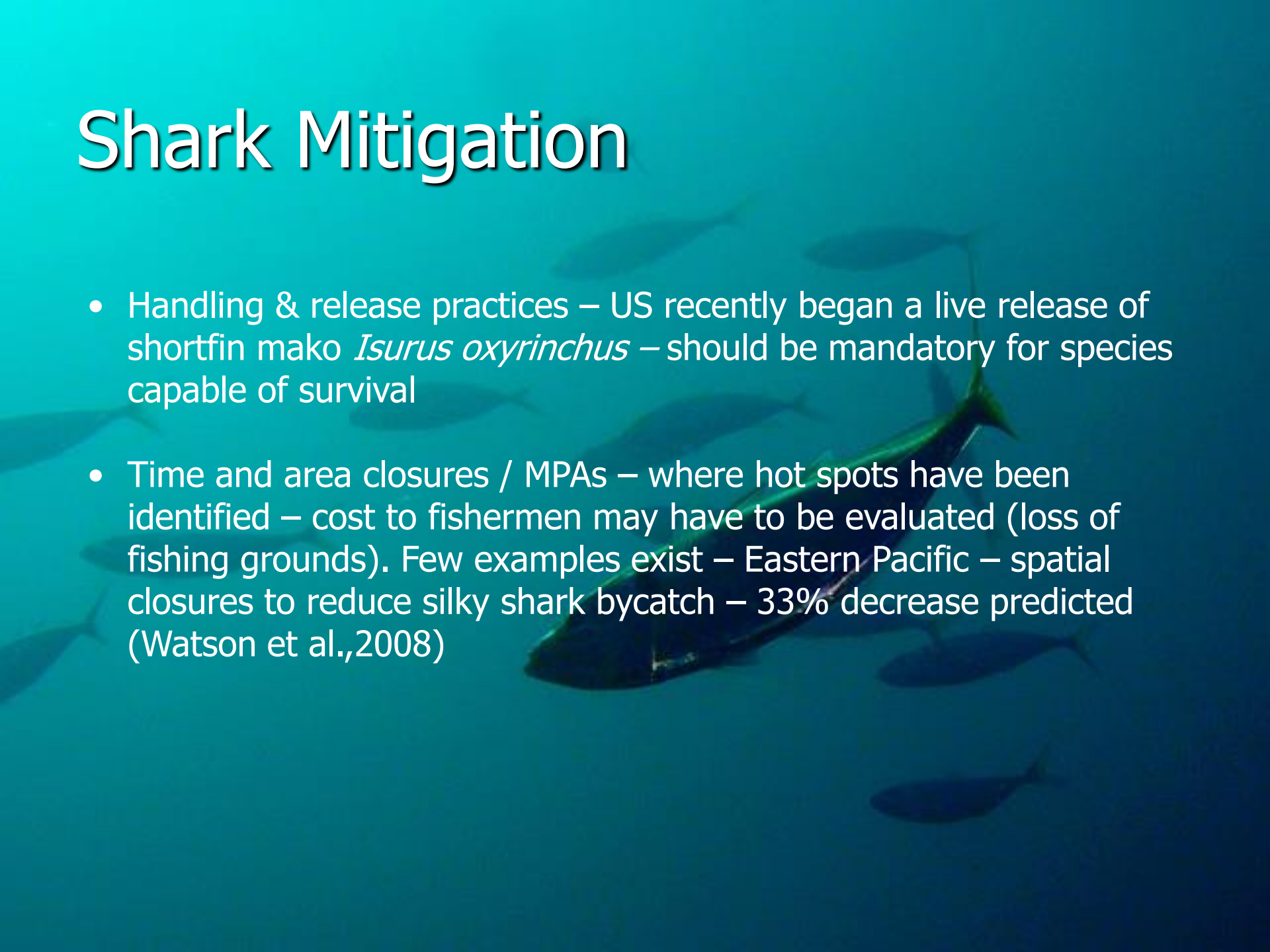
Gear type	Capture mortality (percent)	References
Pelagic longline gear	< 30	Diaz and Serafy 2005, Campana et al. 2006, Francis et al. 2001, Megalofonou et al. 2005
Bottom longline gear	15–90	Morgan and Carlson 2010, Rulifson 2007
Gillnet gear	>70	Manire et al. 2001, Rogan and Mackey 2007, Thorpe and Frierson 2009
Trawl gear	0–60	Rulifson 2007, Rodríguez-Cabello et al. 2005, Mandelman and Farrington 2007, Enever et al. 2009,
Purse Seine gear	Estimated to be very high – may be close to 100%	Molony, 2005

Shark Mitigation

A background image of a shark swimming underwater, viewed through a blue-tinted lens. The shark is white and is seen from below, swimming towards the surface. The water is a deep blue.

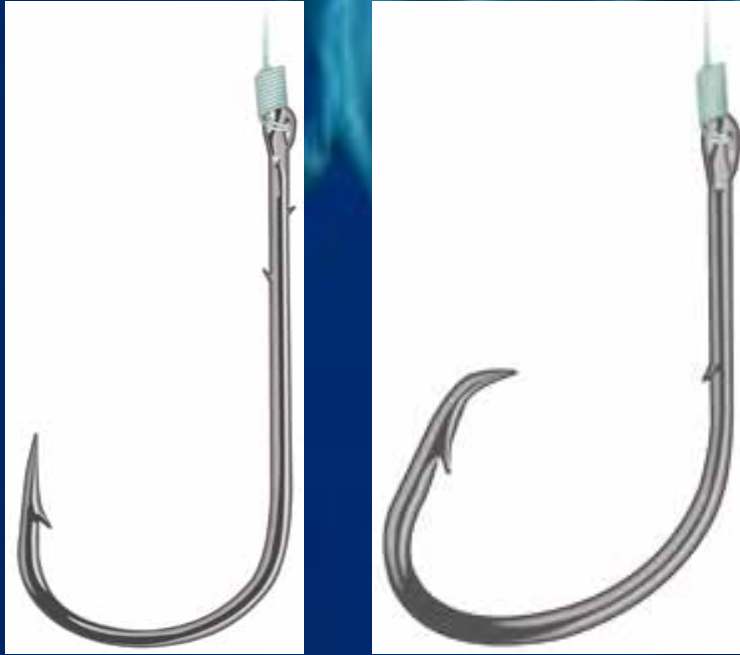
- Effort limitation - reduced capacity of fishing fleet
- Ban catch, landing or sale of shark species
- South African longline tuna & swordfish limits shark landings to 10%
- High seas more difficult to enforce
- Ban shark finning – fine in areas where there is no demand for shark meat

Shark Mitigation

A large shark, likely a shortfin mako, is swimming towards the left in the foreground. Several smaller fish are visible in the background, swimming in the same direction. The water is a deep blue-green color.

- Handling & release practices – US recently began a live release of shortfin mako *Isurus oxyrinchus* – should be mandatory for species capable of survival
- Time and area closures / MPAs – where hot spots have been identified – cost to fishermen may have to be evaluated (loss of fishing grounds). Few examples exist – Eastern Pacific – spatial closures to reduce silky shark bycatch – 33% decrease predicted (Watson et al., 2008)

Shark Bycatch Mitigation

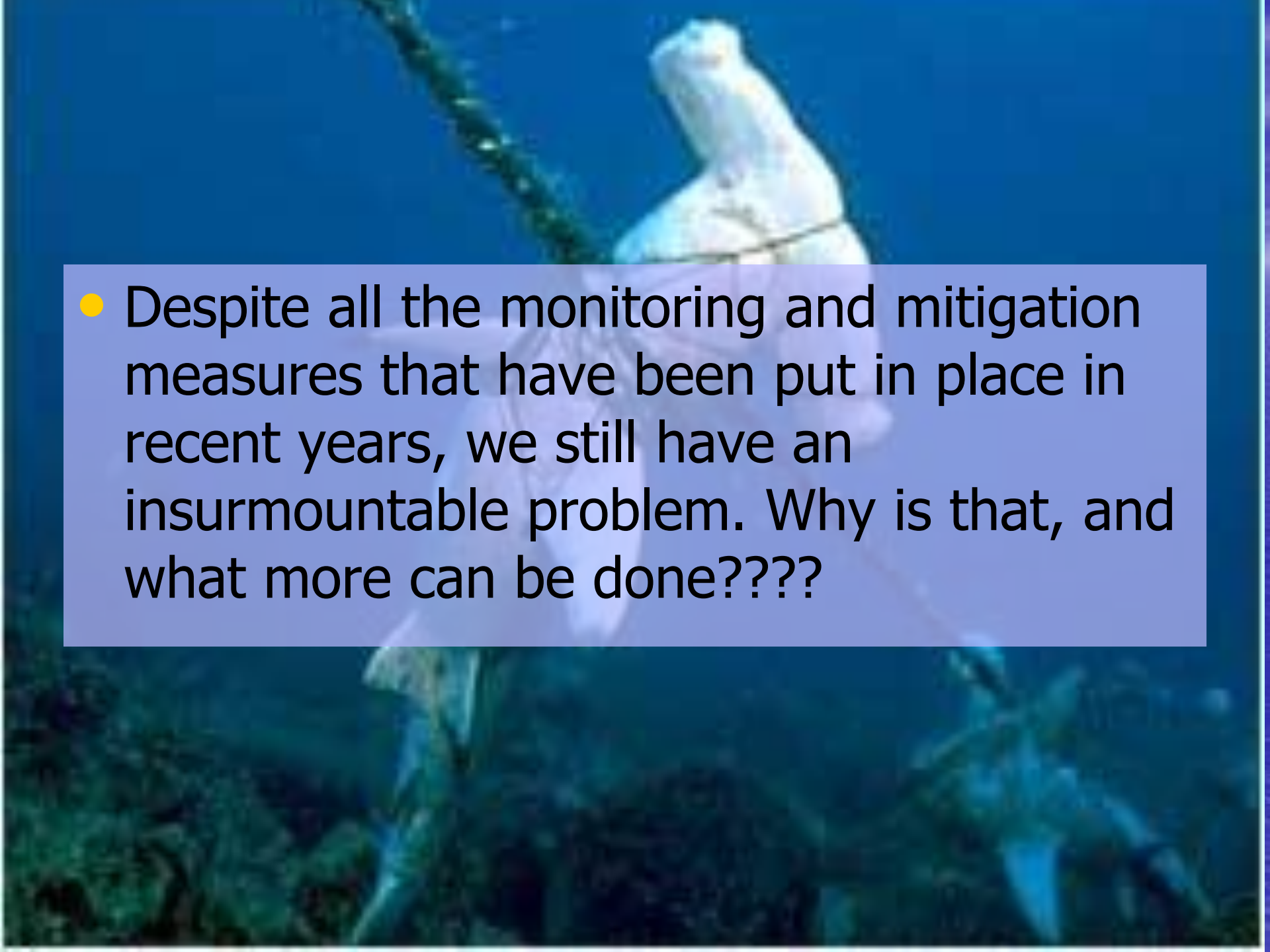


From J hooks → Circle hooks

- Use of circle hooks has significantly reduced turtle bycatch
- Some uncertainty on results for sharks – Kim *et al.*, 2007 – circle hooks led to an increase in capture rate; Gilman *et al.*, 2007b – the opposite!
- Use of circle hooks does appear to reduce injury and lead to a higher survival rate if caught.

Shark Bycatch Mitigation

- **Bait Restrictions** – replacing squid bait with fish bait reduced blue shark catch rate (pelagic longline) (Watson *et al.*, 2005)
- **Temperature avoidance** – setting gear in colder temperatures (colder side of fronts) reduces shark bycatch levels (Gilman *et al.*, 2007) More work on thermocline dynamics necessary
- **Repellents** – certain chemicals trigger a flee response (Ammonium acetate – component of decaying shark flesh). Also magnets – interfere electro-sensory system

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- A white bird, possibly a booby, is perched on a dark, textured branch. The bird is facing right, with its head slightly turned. The background is a clear, bright blue sky. The bird's feathers are white and appear soft. The branch is dark and has some small, light-colored spots.
- Despite all the monitoring and mitigation measures that have been put in place in recent years, we still have an insurmountable problem. Why is that, and what more can be done????

Reports to look up:

1. Longline fishing: a global catastrophe for seabirds
http://www.abcbirds.org/policy/seabird_report.pdf
2. The Net Effect: A review of cetacean bycatch... <http://www.wdcs.org>
3. Cocking, L.J., Double, M.C., Milburn, P.J. and Brando, V.E. (2008) Seabird bycatch mitigation and blue-dyed bait: A spectral and experimental assessment. *Biological Conservation*. 141: 1354-1364
4. Waugh, S.M., Baker, G.B., Gales, R. and Croxall, J.P. (2008). CCAMLR process of risk assessment to minimise the effects of longline fishing mortality on seabirds. *Marine Policy*, 32:442-454
5. Cosandey-Godin, A. and Morgan, A. (2011). Fisheries *Bycatch of Sharks: Options for Mitigation*. Ocean Science Division, Pew Environmental Group, Washington. 19pp