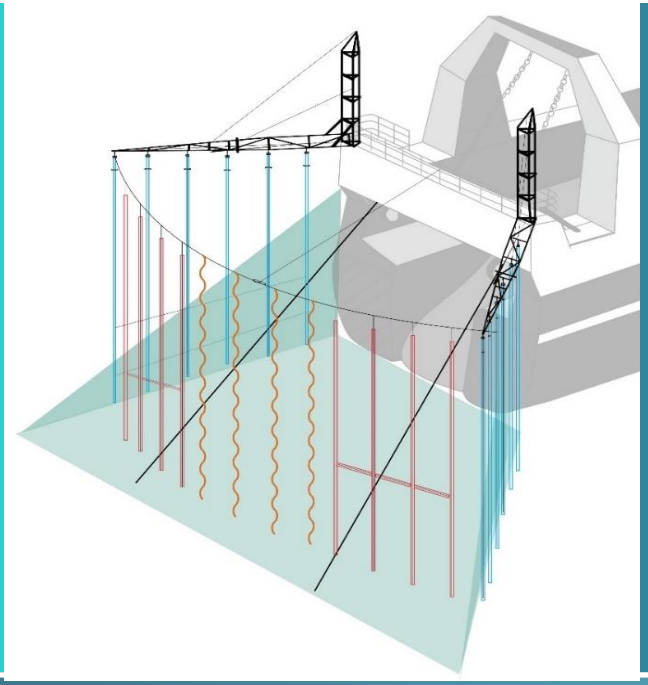
CLEMENT & ASSOCIATES LIMITED



Development of bird baffler designs for offshore trawl vessels

CSP Project MIT2013/05

J Cleal & J Pierre – 16 June 2016

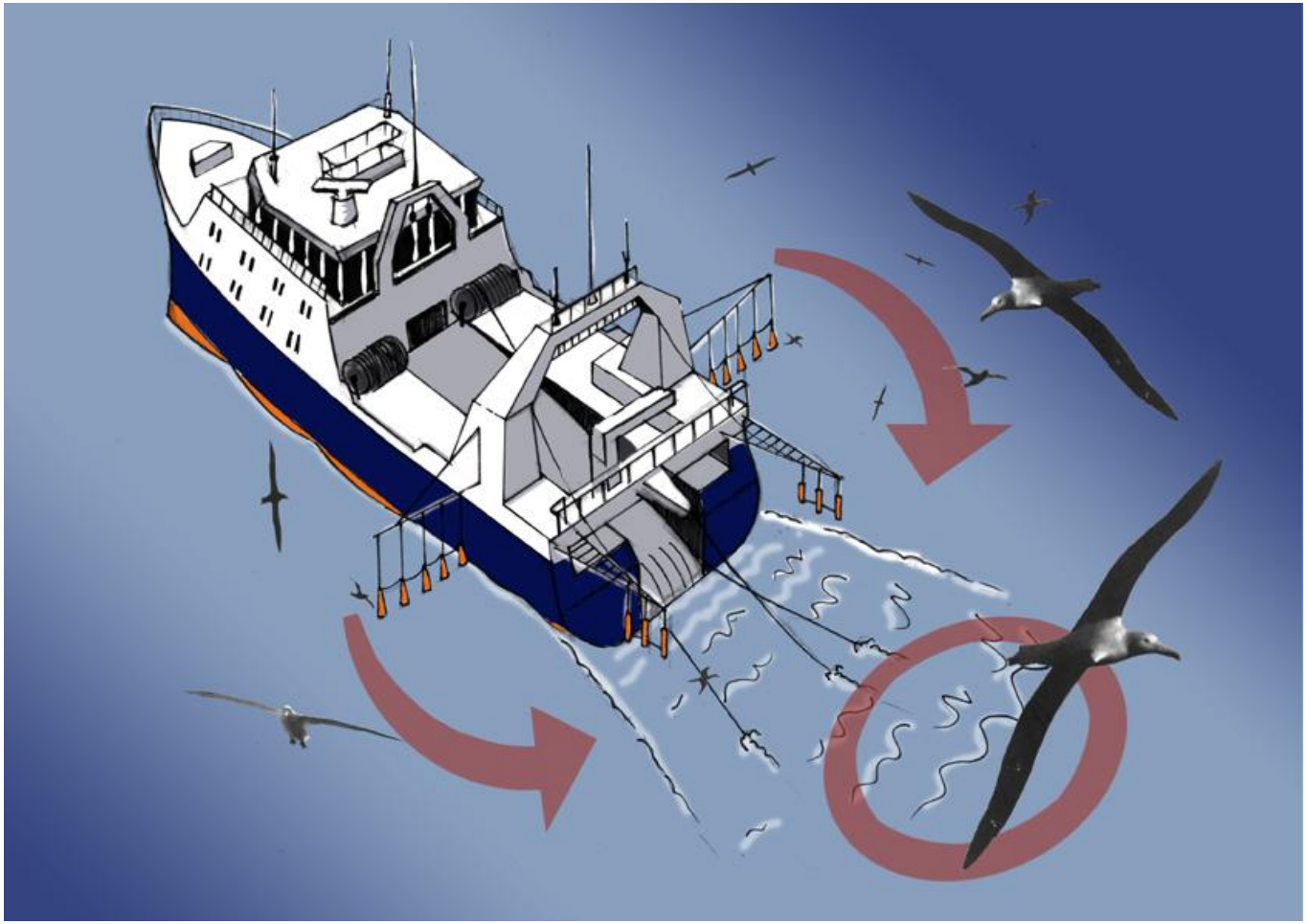
Introduction

- Seabirds foraging on trawler fish waste discharge can strike trawl warps
- Managing fish waste discharge to reduce the amount and time that offal is around the trawl warps reduces the risk of warp strikes
- A secondary mitigation approach is to provide a barrier protecting the trawl warps to reduce seabird access



Baffler Mitigation Devices

Example – Four-boom baffler



Project Objectives: MIT2013-05

The specific objectives:

1. To design and construct one or more improved bird baffler design(s).

2. To conduct at sea trials of the improved baffler(s) in order to assess efficacy and utility of the design.

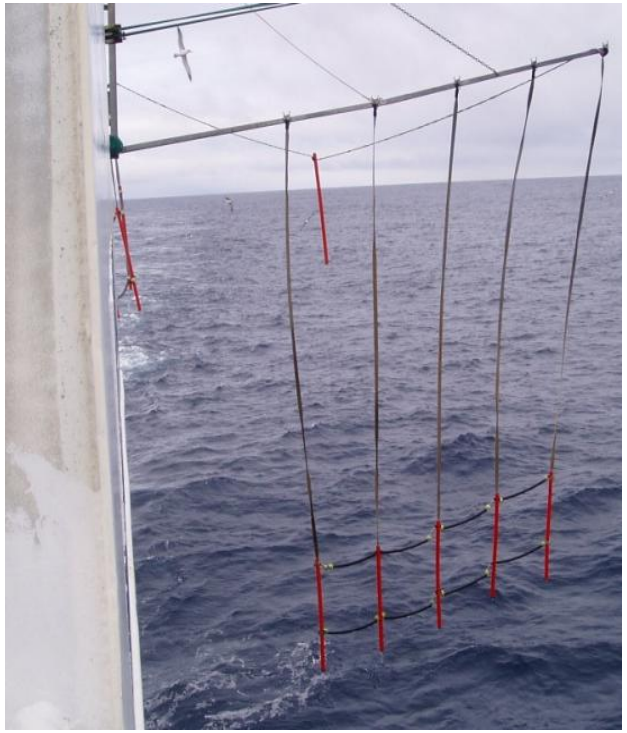
3. To produce recommendations on the construction of bird baffler designs in a variety of media in order to maximise uptake in commercial fisheries.

Current Warp Mitigation Devices

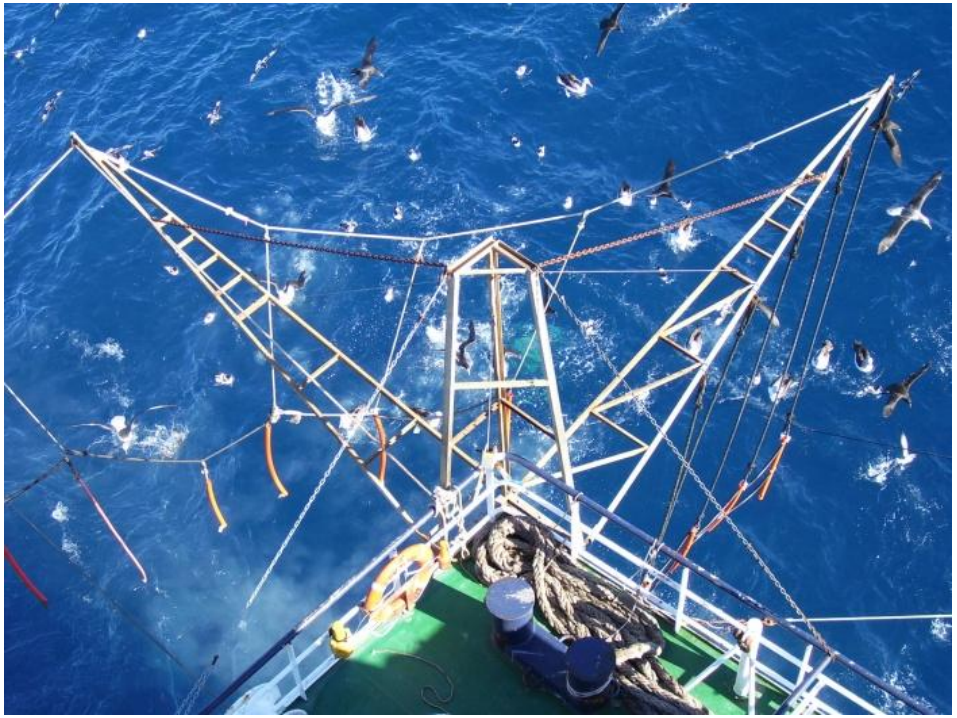
- Three mandatory devices for deepwater trawlers over 28 m:
  1. Tori lines – all carry these
  2. Warp deflector (clips onto warp) – not used
  3. 2 or 4 boom bafflers – almost all use as their primary device. 30% use a 4-boom system.
- 2 or 4 boom bafflers are of varying designs:
  - generally 4 to 5 m long booms, droppers spaced 1.5 to 2 m apart
  - often droppers are ropes hanging down to water, with approx 1 m of orange plastic cone fitted at the end of each dropper
  - most 4-boom bafflers have aft droppers removed, or very short aft droppers to avoid tangling with trawl warps
  - most baffler designs don't enclose the warp

Baffler Mitigation Devices

Two Boom



Four boom - San Waitaki

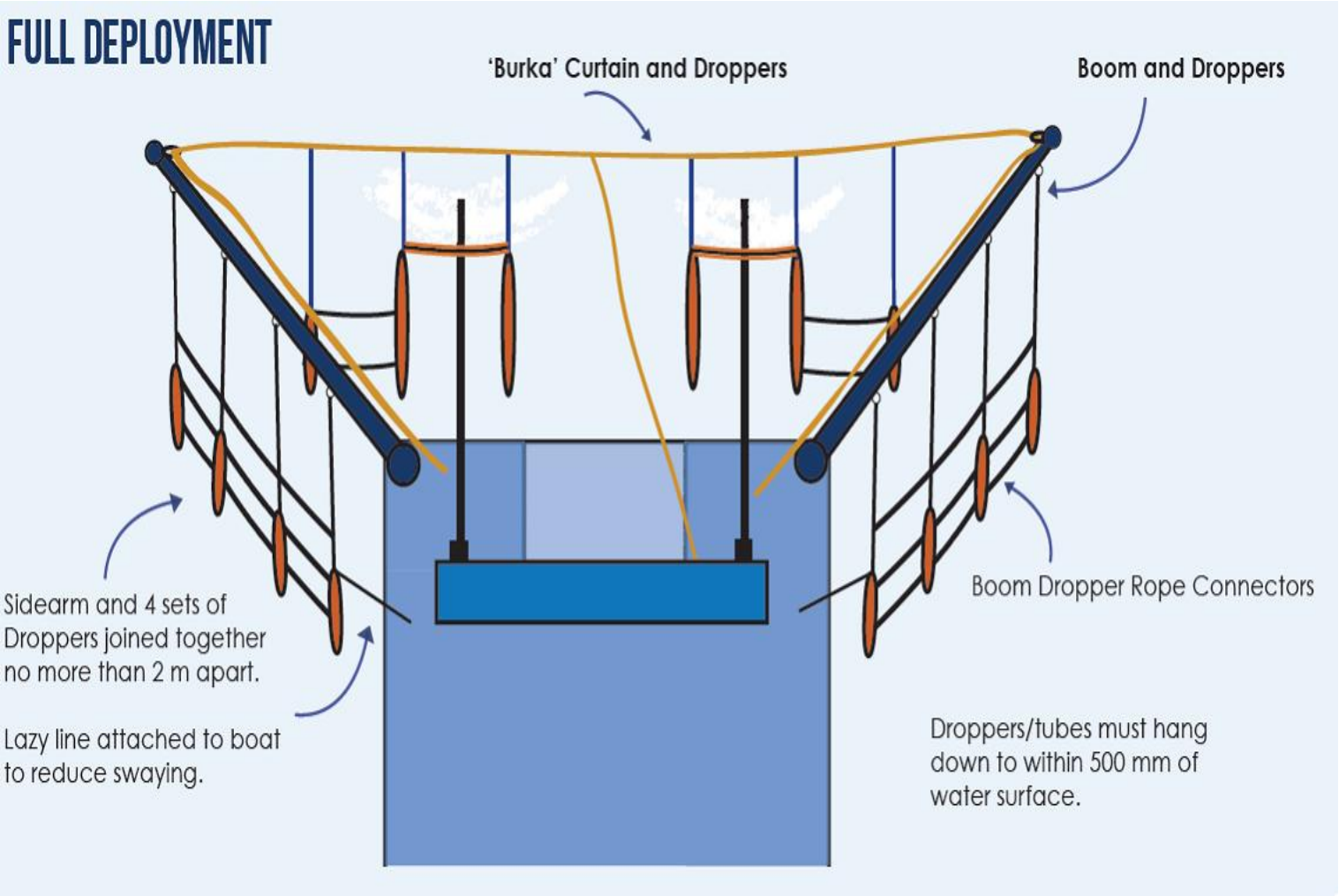


FV. San Waitaki: first vessel to run aft droppers between the aft booms to endeavour to get droppers over the full WDZ

Prototype – I (Pole System)

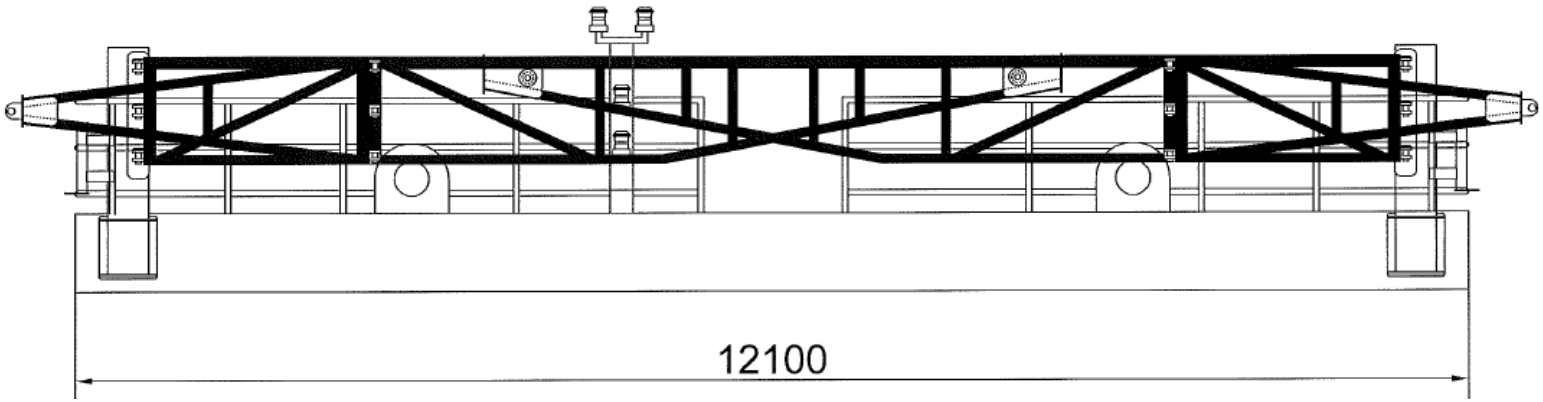
- Design developed with input from experts, skippers, observers (Dec 2013)
- Warp more enclosed
- Main operational improvement:
  - adjustable boom angle (wider angle so boom/droppers still provide ‘cover’ when warps move outboard of the hull
  - position aft booms outside warps
  - droppers wont tangle around the warp
- New configuration: rope between the two aft booms and droppers hanging astern, providing ‘curtin around the warp
- Design failed due to unresolvable engineering challenges with supporting and securing the pole astern the vessel

Prototype – I (Pole System)

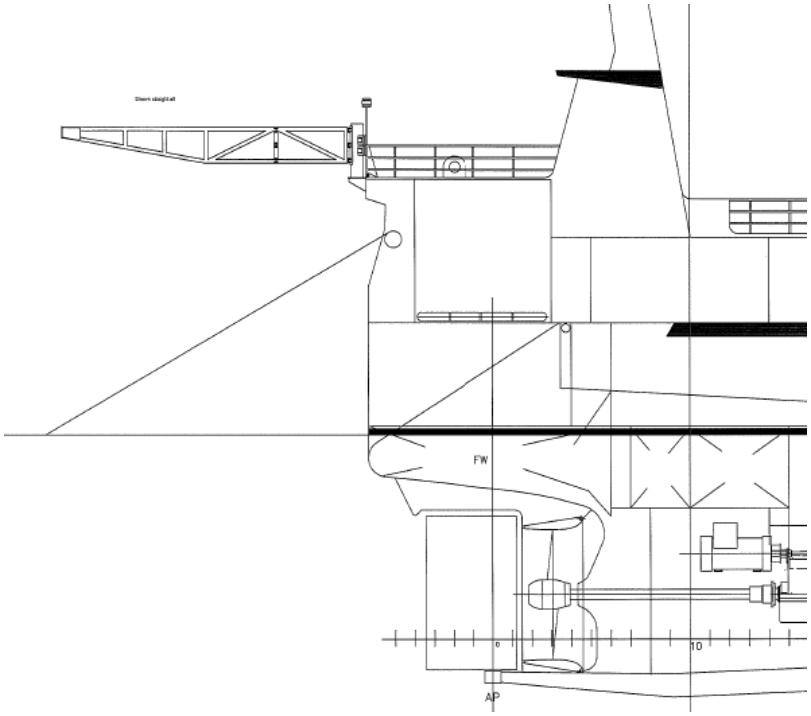


Prototype – II (Gate System)

- Lighter construction and lower cost than Prototype I
- One set of 10 m gates
- Retained the concept of adjustable booms to optimise warp protection
- Multiple design attempts
- Naval architects couldn't find a safe and practical way to secure the gates in place once deployed

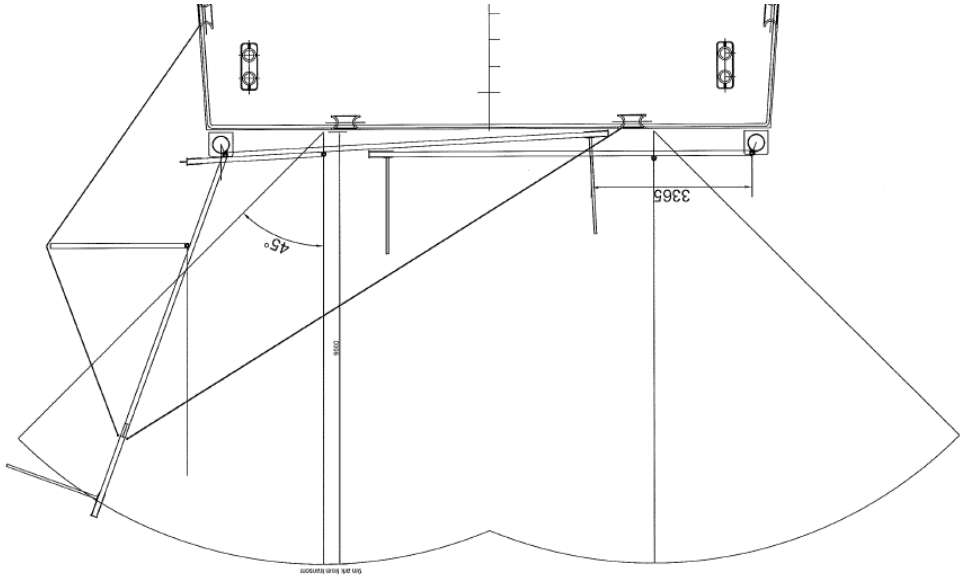


Prototype – II (Gate System)



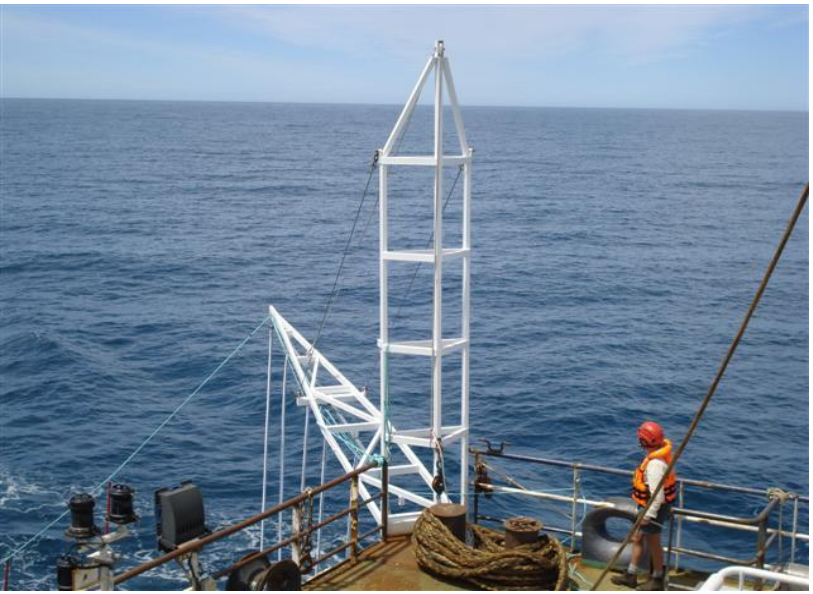
Below: port gate deployed, note side-bracket to give more angle of attack for stay-wires (like ‘stays’ on a yacht mast)

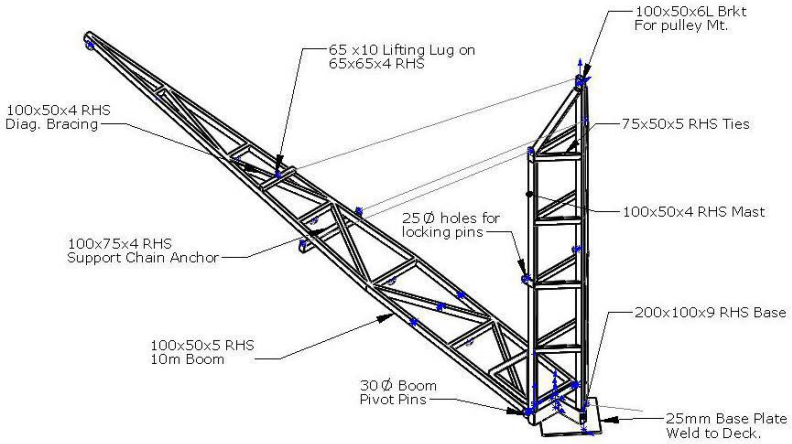
Lines astern show angles the warp moves outboard of the hull

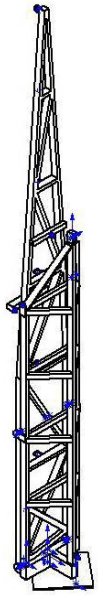


Prototype – III (Tower & Boom System)

- Final testing design, built and fitted to the vessel
- 6 m support-tower
- 8.4 m boom weighing 1 ton per side
- Load meant decks required strengthening before installation





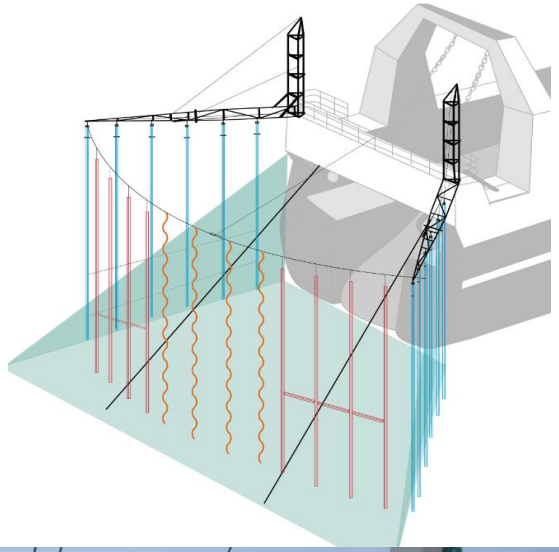


Prototype – III (Tower & Boom System)

Starboard view: Old 2 boom-pole and New tower & boom baffler

Prototype – III (Tower & Boom System)

- To maximise warp protection, target boom length was 10 m
- Engineering loads and safety issues required shorter boom: 10 m to 8.4 m
  - Booms would otherwise dip and roll in heavy seas
- Booms are lifted and deployed using a ‘lazy-wire’ and vessel existing winches
- A safety chain fixed between the boom & tower holds booms at 10 degrees above horizontal
- Locking pins on the towers fix booms upright when not in use
- Boom and tower install: Nov 2015



Prototype – III (Dropper System)

- Load testing at Hampidjan NZ Ltd to determine load on booms
- Port side: ‘conventional’ dropper system of rope and plastic pipe
- Stern curtain: red 25 mm diameter hose
- Weak link in stern curtain to release if one boom was lost at sea
- Starboard side: new dropper design of 38 mm diameter hose

Prototype – III (Dropper System)

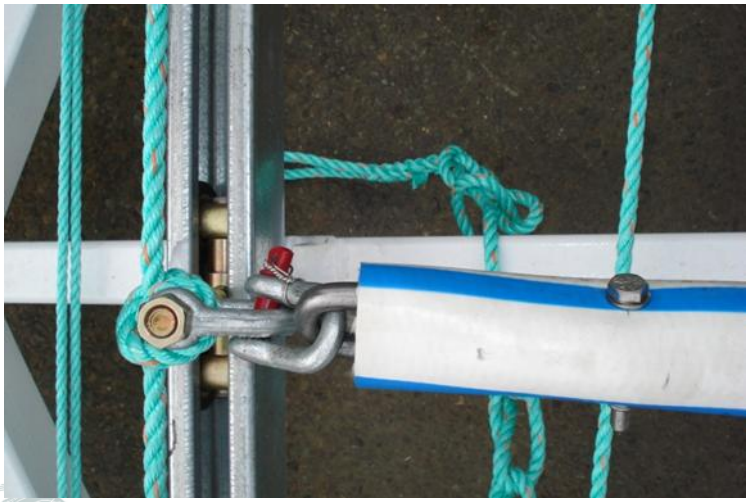
- 11 mm diameter ‘Kraton’ streamer material in centre of stern curtain

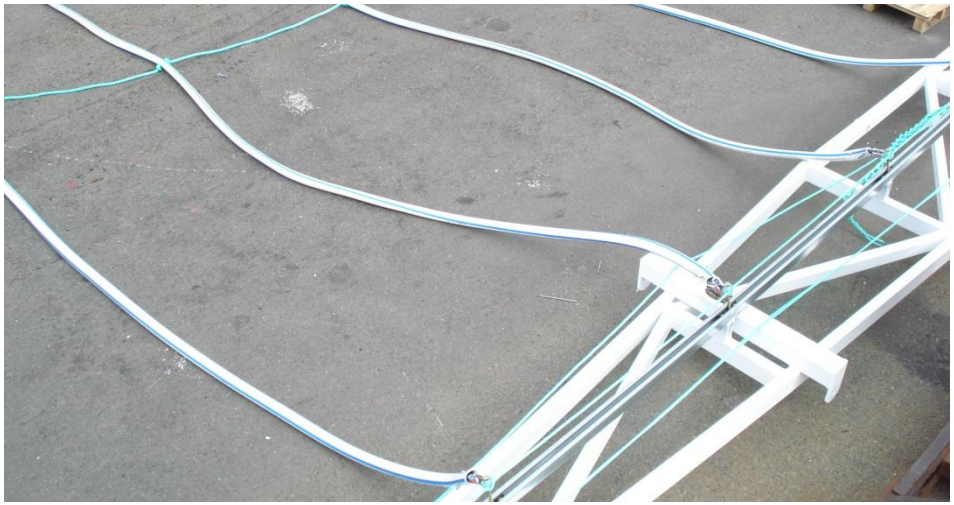
At sea testing - baffler trials

- Preliminary testing:
  - One day transit trip
  - Crew tested boom deployment and retrieval
  - Made changes to locking-pins
  - Added extra droppers to stern curtain to reduce bird access

At sea testing - baffler trials

- Preliminary testing:
  - One day transit trip
  - Company observer
  - Tested dropper system
  - Considered booms too high and dangerous for crew to access
  - New sliding rail system fitted
    - each dropper loaded on a roller within a track
    - all can be lifted or lowered into position like a curtain rail



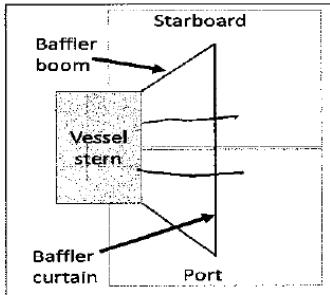


At sea testing - data collection

- Crew observations, 23 December 2015 – 13 January 2016
  - normal fishing trip
  - minor design modifications made after return to port e.g. addition of rope cleats
- Two government fisheries observers, 24 January – 28 February 2016
  - fishing trip targeting hoki
  - observations recorded on data collection form
  - photos and video

B&B Baffler Performance Form Observer name: Rick Gould

Date:	Vessel towing:	Beaufort (0 – 9):	Vessel speed (knots):	Start obs time:	End obs time:
13.2.16	(Y) / N	2	4.1	1353	1413



Draw the location of the trawl warp on the diagram.

Was the warp enclosed inside baffler curtain (circle)?
Y / (N)

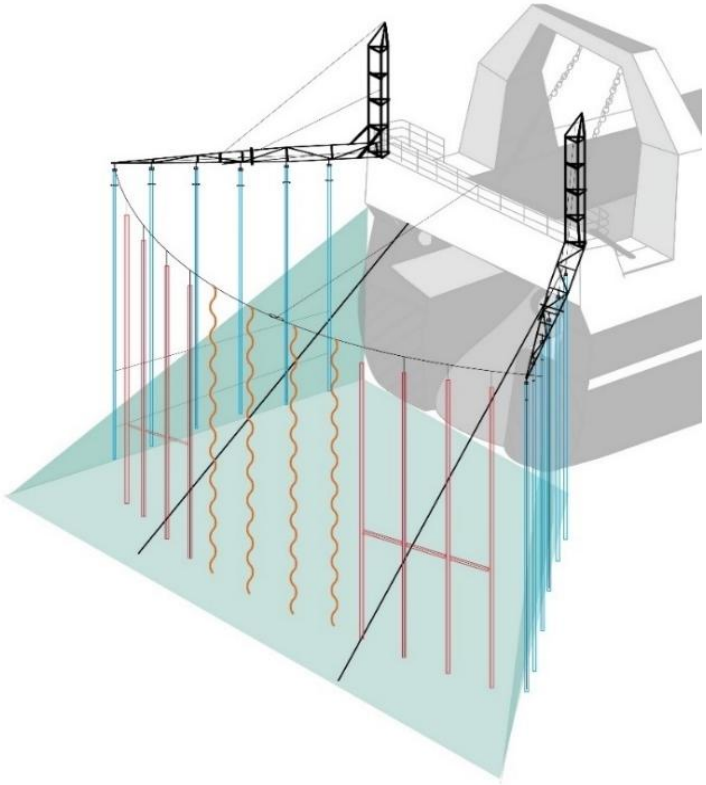
How much of the warp extended outside the baffler curtain when the vessel steamed straight ahead (circle):
(0 m) 1-2 m 3-4 m 5-6 m 7-8 m 9–10 m > 10 m

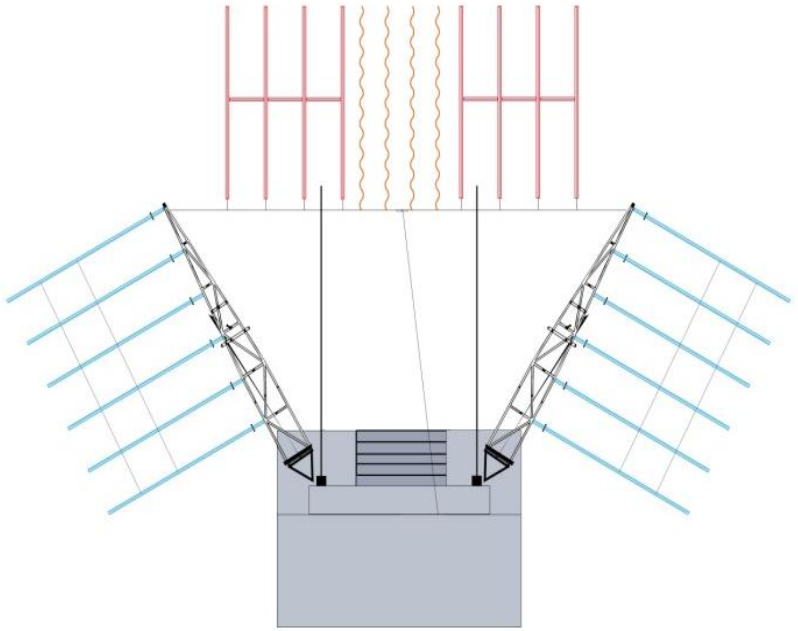
If the vessel turned during your observations, how much of the warp extended outside the baffler box during the turn? (circle):
0 m 1-2 m 3-4 m 5-6 m 7-8 m 9–10 m > 10 m

Was offal discharged during this observation period? (Y) / N

From the scuppers or sump?	From the main offal chute?
(Y) / N	Y / (N)

Final tested design





At sea testing - Results

- Government fisheries observers: 47 forms, 06:00 – 20:00 NZST
- Observation periods: 20 – 35 mins (mean = 24 mins)
- Vessel tow speeds: 3.9 – 4.2 kn
- Beaufort sea state: 1 – 6

- Droppers and stern curtain: 0 – 1.0 m from sea surface
- Exposed warp:
    - 0.5 – 2 m in calm conditions,
    - 0 – 4 m in 5-m swells
    - 0 – 2 m during vessel turns

At sea testing - Results

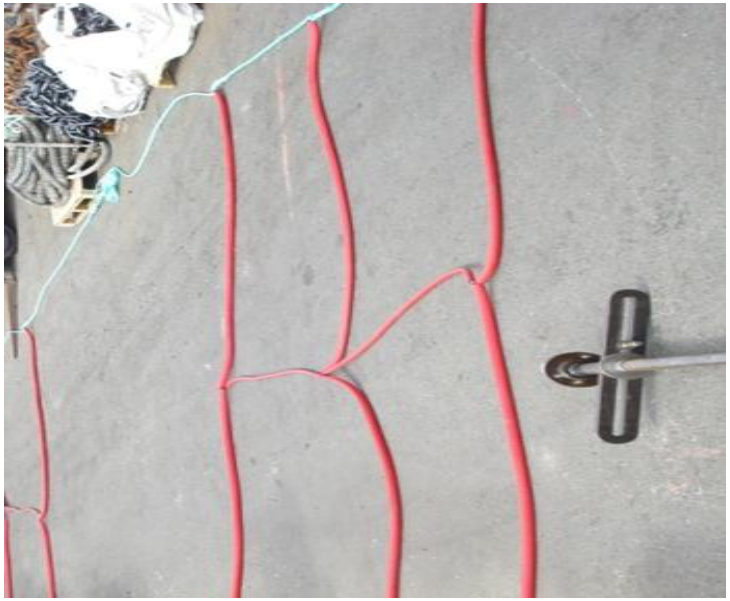
- Kraton streamers in centre of stern curtain tangled
- Hose droppers more effective than rope and pipe system
  - Tangled less, more durable, better warp coverage
- Stern curtain broke in a gale (40 – 45 kn)
  - Was readily repaired and redeployed next morning

At sea testing - Results

- Most birds remained outside the area enclosed by the boom droppers and stern curtain
  - Birds inside during 26 obs periods with offal
  - Outside during 8 periods with offal
  - Outside during 13 periods with no offal
- Salvin's, Buller's albatross
- White-chinned, Cape and giant petrels
- Birds sometimes caught up on lowest rope for a few seconds

At sea testing - Recommendations

- Increase height of lowest ropes to approx. 2 m
- Replace Kraton noodles in centre stern curtain with hose
- Extending the booms 1.5 – 2 m in length by attaching a lighter-weight pipe could increase warp protection while not risking the loss of the main tower
  and boom structure
- Address friction and strength of rope ties (knots wearing out) at the top of the hose droppers on booms and stern curtain



Discussion

- Design challenges exemplary of what must be considered for real-world fishing operations
- Prototype III baffler expensive at around ~$40,000
  - Twice the cost of a conventional 4-boom baffler
  - Five times the cost of a 2-boom device
  - Many times the cost of two tori lines!
- Design challenges and vessel scheduling also caused time delays
- Some warp still exposed with the final design
  - Vessel trawls 500 – 800 m depths
  - More warp would be exposed with shallower trawls
- Govt observers reported baffler was the best-performing seen in NZ's deepwater trawl fleet

Acknowledgements

- Talley's Group Ltd
- Sanford Ltd
- Sealord Group Ltd
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