CSP Project MIT2014-02: Improving tori line performance in small-vessel longline fisheries

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Introduction

- Small vessel longline fisheries: particularly high risks to some seabird populations + high uncertainty in capture extent
- Proven mitigation strategies available for these fisheries
- Ongoing controversy about efficacy and operational feasibility of tori lines amongst some fishers

CSP project MIT2014-02 Overall Objective:

- To develop improved tori lines which are specifically optimised for safe and effective use on small longline vessels

Methods

- Workshop and literature review
  - to identify issues and possible solutions
- On-land testing to refine approach to at-sea work
- At-sea testing on four different fishing vessels

Photo: J. Pierre

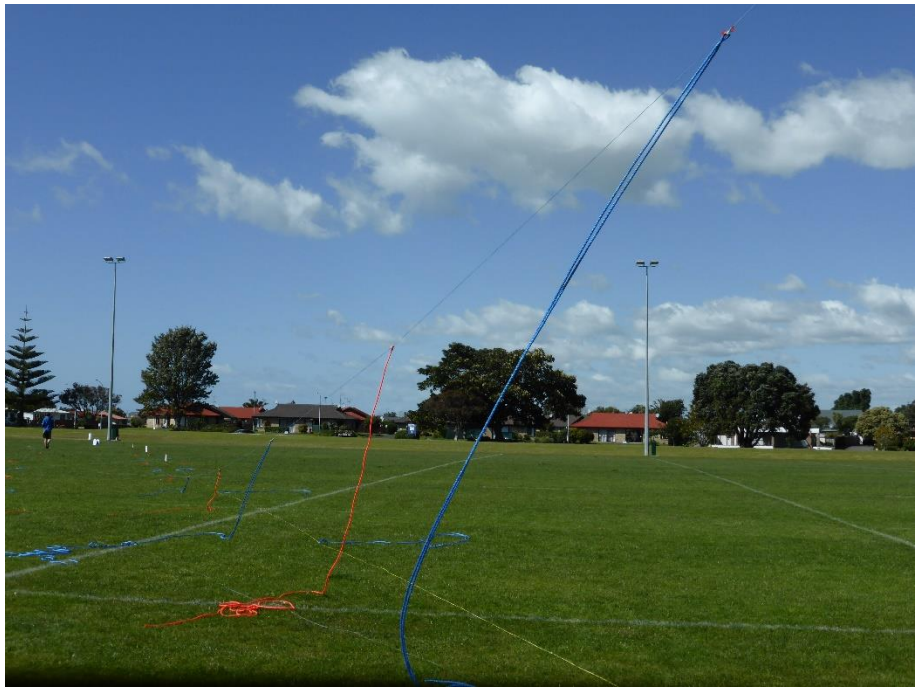
Methods - Workshop

Issues identified:

- Vessel setting speed
- Attachment height of tori line
- Attachment method
- Weak links to be incorporated
- Drag requirement
- Weight of tori line
- Storage
- Availability of materials

Methods – On-land testing

- Three backbones
  - 3 mm monofilament,
    3 mm Dyneema, 3 mm Ashaway
- Three deployment heights
  - 5 m, 7 m, 9 m
- Fibretube pole
- Streamers of 9 mm Kraton (or equivalent weight)
  - Every 2.5 m or 5 m
  - 5 to 0.5 m in length
- Variable numbers of shark clips
- Drag (kg) for every 10 m aerial extent, 40 m – 80 m



Methods – At-sea testing

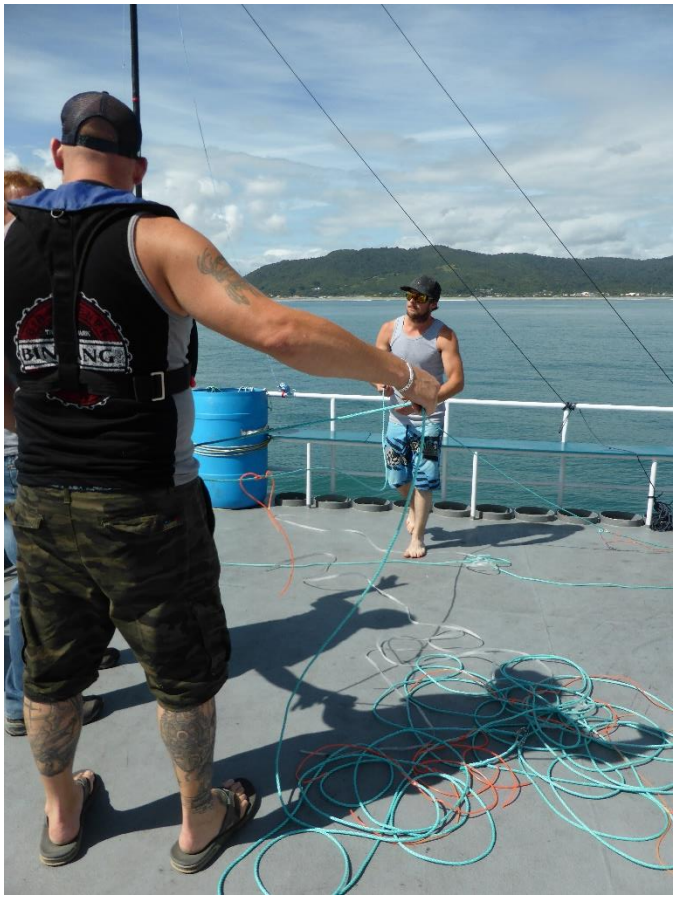
- Five sets of at-sea trials
  - Preliminary drag testing
  - FV Royal Salute
  - FV Moonshadow
  - FV Coastal Rover
  - FV Kotuku
- Structured testing with respect to setting speeds, e.g.
  - 2.2 – 5 kn snapper
  - 1.8 – 5.1 kn bluenose
  - 2.6 – 4.1 kn ling
  - 6 – 8 knots (or more) SLL

Methods – Drag testing

- Drag measured at 2.6, 4.2, 6.5 kn
- 16 test sections, e.g.
  - Rope + road cone
  - Series of gillnet floats
  - Cone + float combinations
  - etc.
- Test sections held at 1.5 m high
- Drag measured using Salter scales

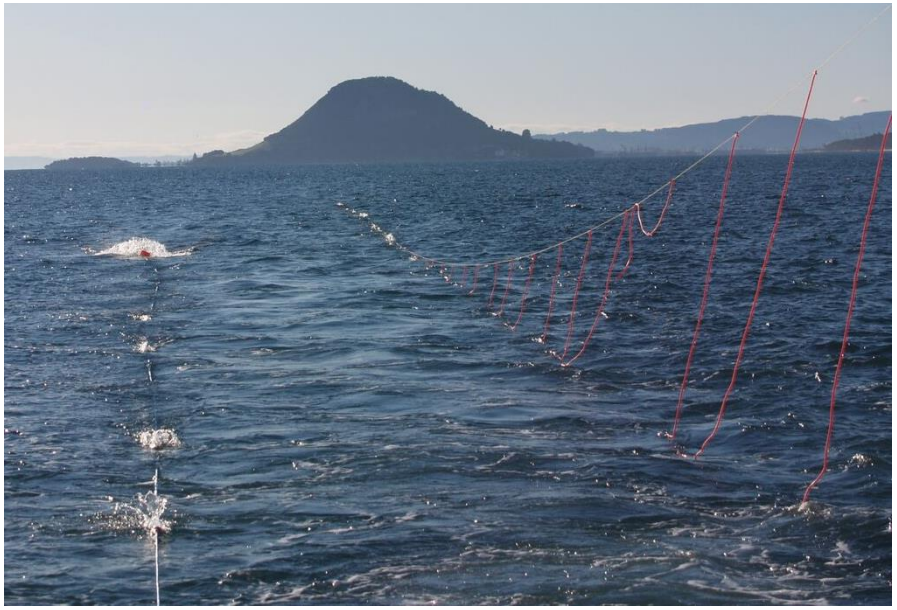
Methods – Fishing vessel tests

- Tori lines clipped into variable tension link
- Lazy line as backup to secure TL to vessel
- Hoisted using ‘flagpole method’
- Fibretube poles
- Range of vessel speeds
- Drag measured
- Tori line released
- Aerial extent measured alongside marked rope
- Weather conditions (wind speed and direction, sea state) recorded
- Photos and video taken



Methods – Fishing vessel tests

- FV Royal Salute
  - Dec 2015
  - Test speeds: 2.7, 4, 6 kn
  - Pole Mk 1 (42 mm diameter)
  - Tori line:
    - 6-m deployment height
    - 70 m aerial section
    - single streamers 2.5 or 5 m apart
    - streamers 9-mm or 5-mm plastic tubing
  - 9 in-water drag sections



Methods – Fishing vessel tests

- FV Moonshadow
  - March 2016
  - Test speeds: 3.5, 5, 7 kn
  - Pole Mk 2 (52 mm diameter)
  - Vessel's own tori line
  - Test tori line:
    - 6-m deployment height
    - 70 m aerial section
    - single streamers 3.5 apart
    - streamers 5-mm plastic tubing
  - 8 in-water drag sections
  - One tori line design tested at 7 m deployment height

Methods – Fishing vessel tests

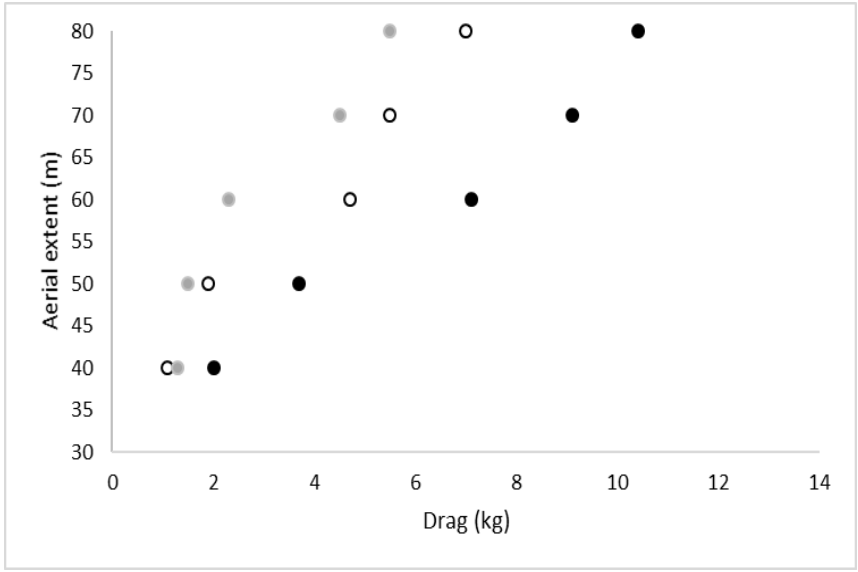
- FV Coastal Rover
  - April 2016
  - Test speeds: 2.7, 3.5, 4, 6, 7 kn
  - Pole Mk 2 (52 mm diameter)
  - Test tori line:
    - 6-m deployment height
    - 70 m aerial section
    - single streamers 3.5 apart
    - streamers 5-mm plastic tubing
  - 12 in-water drag sections
  - One tori line design also tested at 3, 4, and 5 m deployment height

Methods – Fishing vessel tests

- FV Kotuku
  - April 2016
  - Test speed: 3.5 kn
  - Drag test only
  - One in-water section

Results – On-land testing

- Drag required to achieve aerial extents increased with deployment height
- Drag on the pole caused bending



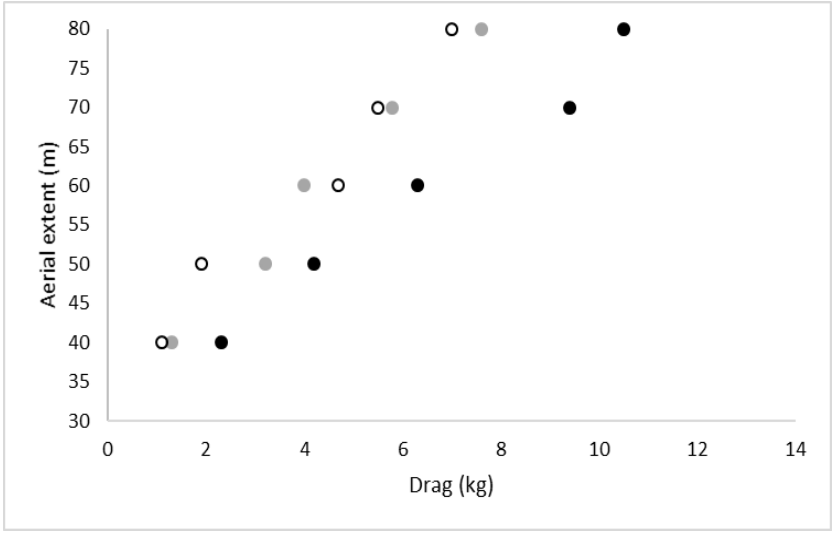
Results – On-land testing

Backbone:

- Monofilament sagged and stretched most (black dots)
  - required most drag to achieve aerial extent
- Ashaway (grey) and Dyneema (black circles) performed better

Streamers:

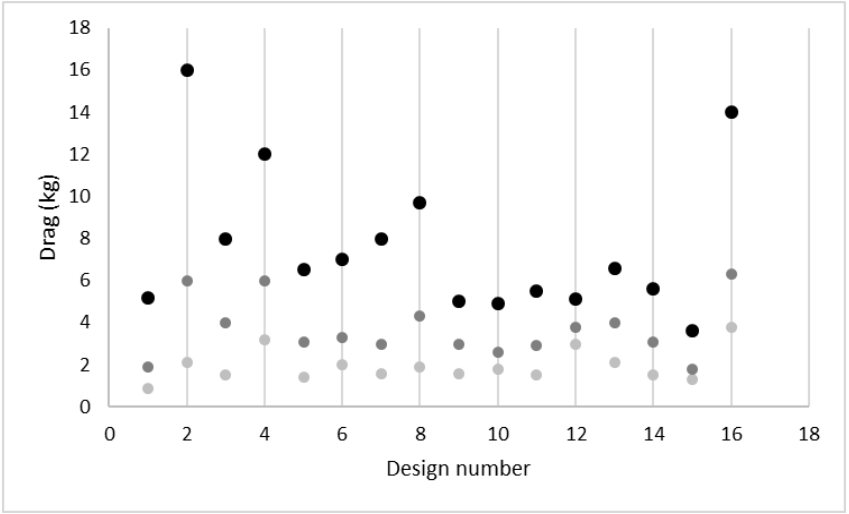
- Streamer weight increased drag required to achieve aerial extent
- Shark clips less important



Results – Drag testing

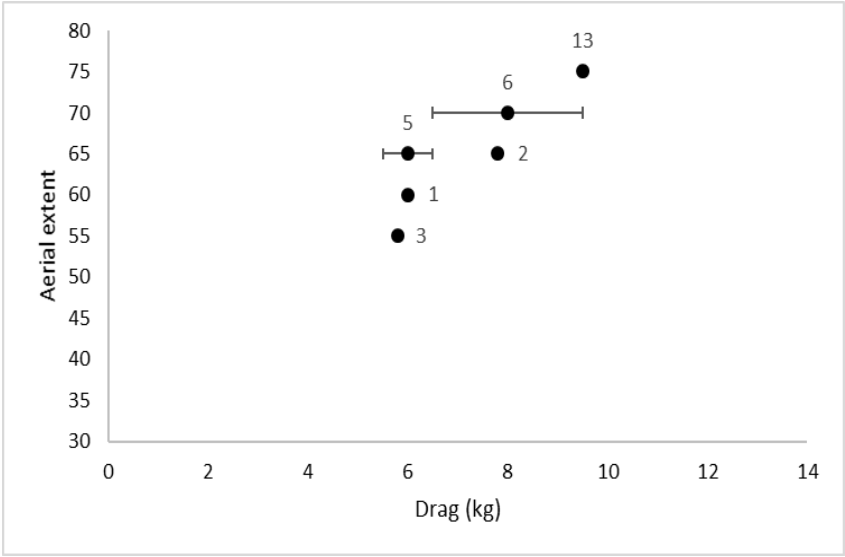
Preliminary drag testing:

- Most designs tested did not generate sufficient drag for 70-m aerial extent
- Low speeds worst
- Back to the drawing board!



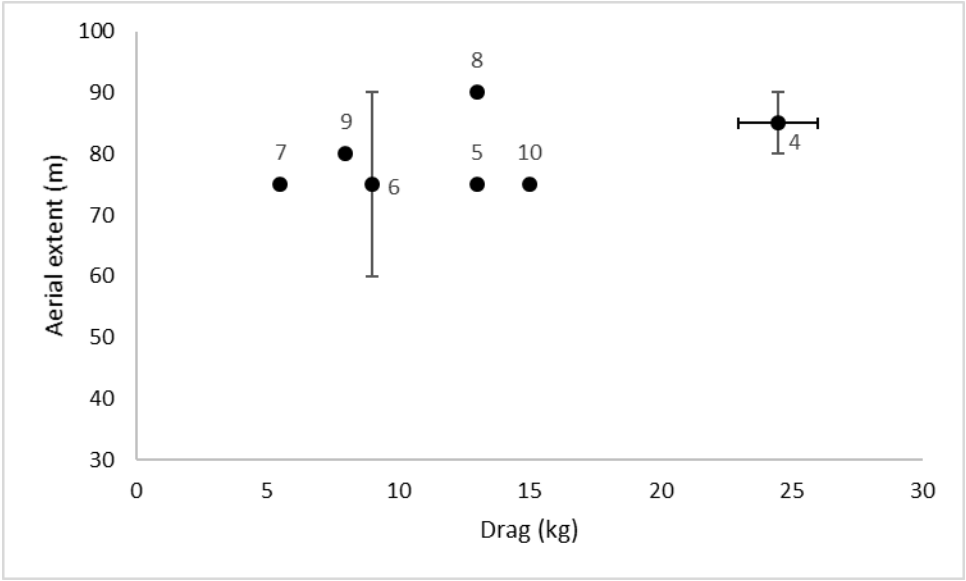
Results – Fishing vessel tests

- FV Royal Salute:
  - 23 tests conducted
  - 2.7 knots:
    - aerial extents 45 – 70 m
    - drag 4.5 – 12 kg
  - 4 knots:
    - aerial extents 50 – 70 m
    - drag 2.7 – 13 kg
  - 6 knots:
    - aerial extent 55 – 75 m
    - drag 5.8 – 9.5 kg
  - Some in-water sections gave inconsistent drag at higher speeds



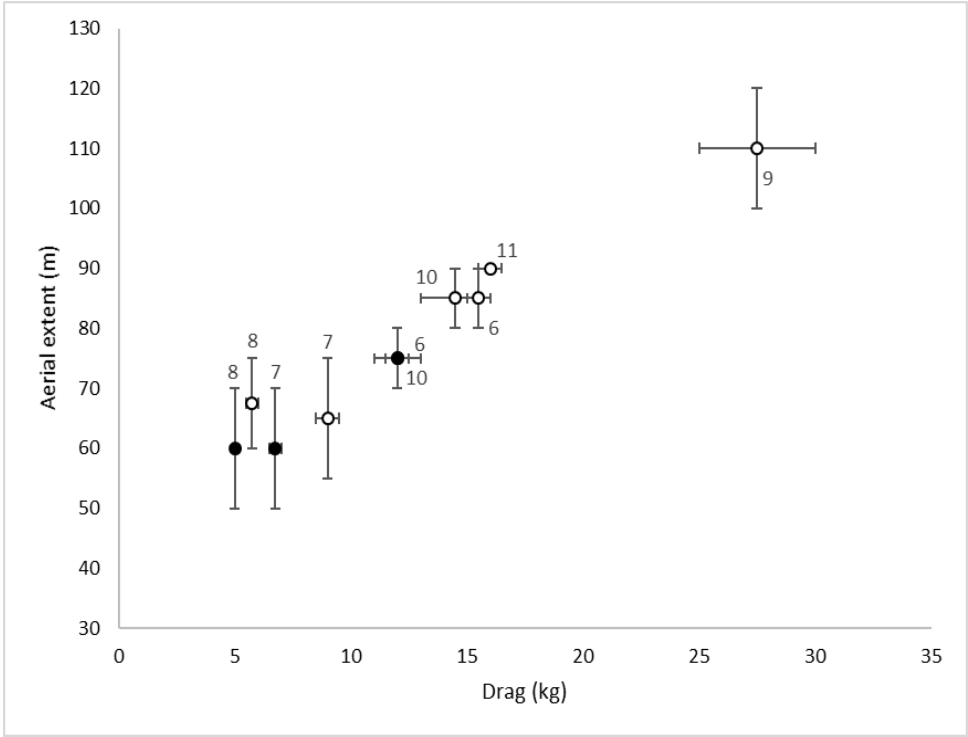
Results – Fishing vessel tests

- FV Moonshadow:
  - 30 tests conducted
  - 3.5 knots:
    - aerial extents 30 – 65 m
    - drag 2.5 – 7 kg
  - 5 knots:
    - aerial extents 50 – 75 m
    - drag 5 – 13 kg
  - 7 knots:
    - aerial extent 60 – 90 m
    - drag 5.5 – 26 kg
  - At 3.5 and 5 knots, increasing height 1 m added 5 m aerial extent
  - Crew preferred simpler designs with less to catch gear on



Results – Fishing vessel tests

- FV Coastal Rover:
  - 34 tests conducted
  - 2.7 – 3.5 knots:
    - aerial extents 65 – 70 m
    - drag 6 – 12 kg
  - 4 knots:
    - aerial extents 65 – 70 m
    - drag 12 – 23 kg
  - 6-7 knots:
    - aerial extent 60 – 120 m
    - drag 5 – 30 kg
- FV Kotuku drag test
  - 3.5 knots, 7.5 – 9.5 kg drag



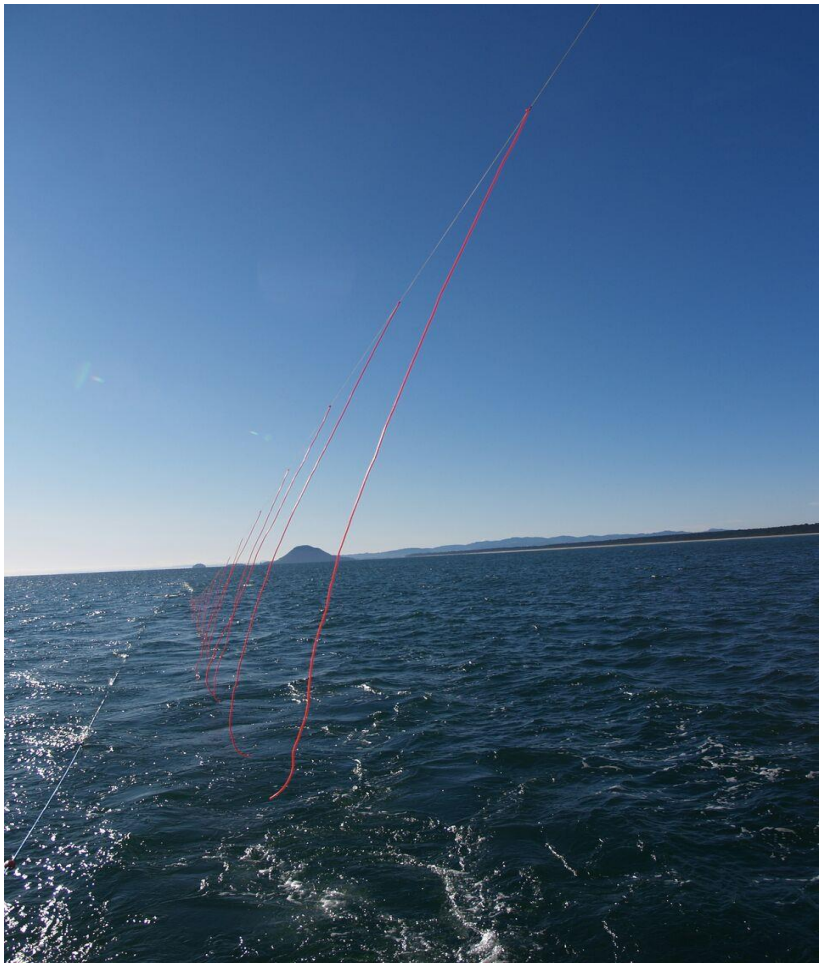
Results – Fishing vessel tests

- Tori line storage and attachment

New materials

Discussion

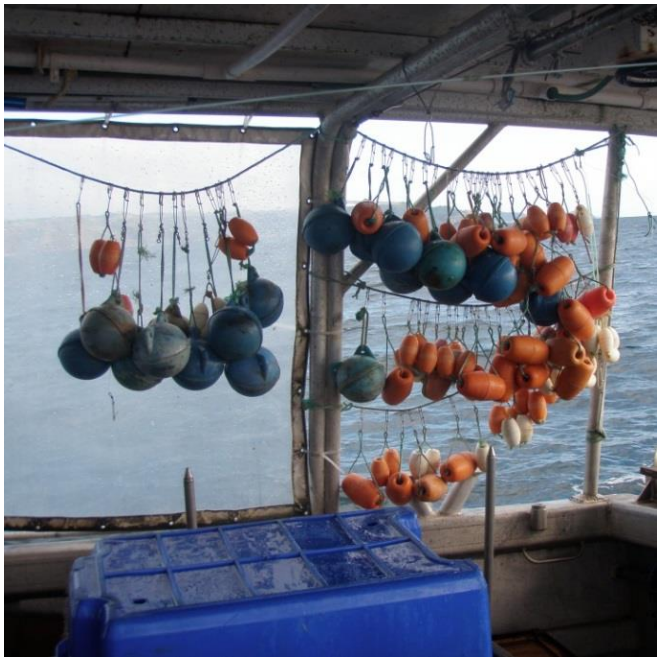
- Pole Mk2 worked well (52 mm diameter)
- Weak link recommended for safety and operational reasons
- Numerous designs achieve 70 m aerial extent
- Drag is the most difficult to refine
    - must minimise tangling risk
- 3 mm Dyneema the preferred backbone, at least 70 m
- 5-mm diameter plastic tubing streamer preferred
- Rule of thumb: 15 kg drag should give 70 m aerial extent



Discussion

2.7 – 3.5 knots

- 100-m length of 8 – 10 mm diameter rope with knots ~1-m apart
- 360-mm diameter surface longline float covered in trawl netting
- three medium-sized road cones at the start, middle and end of a 50 m length of 10-mm trawl braid
- 100 m of 5-mm diameter monofilament followed by one medium or large-size road cone



Discussion

4 – 5 knots

- one large road cone
- 50 small gillnet floats spaced equally along 50 m of 10-mm diameter trawl braid followed by a large road cone
- three large flutterboards at each end and the centre of a 50 m length of 10-mm diameter trawl braid
- 100 m of 5 mm diameter monofilament, plus either 50 large gillnet floats spaced equally along 50 m of 10-mm diameter trawl braid, or a 360-mm diameter float covered with net

Discussion

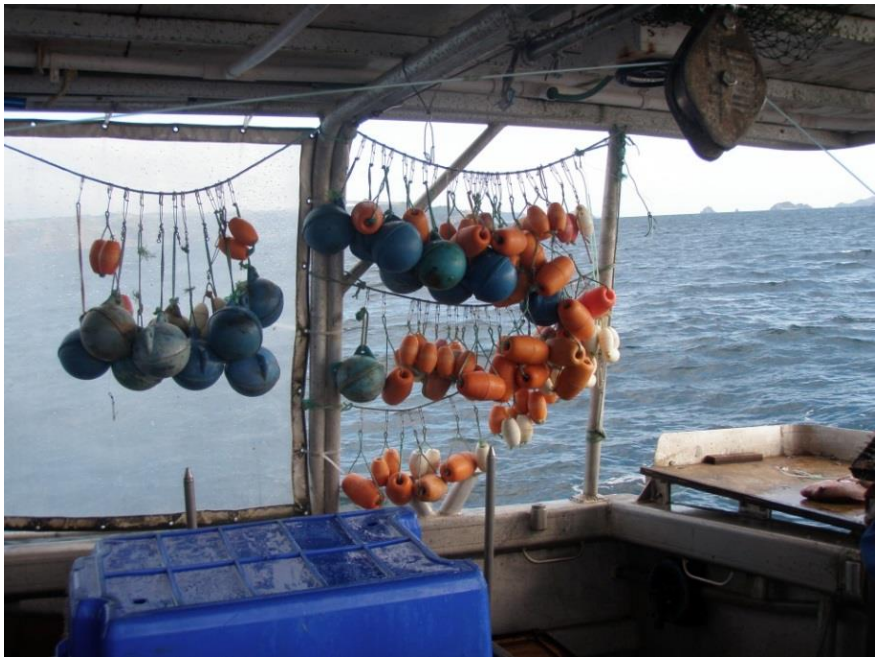
6 – 7 knots

- a 200-m (or longer) length of 5-mm diameter monofilament
- a 100-m length of 8 - 10 mm diameter braided rope
- 100 m of 5-mm diameter monofilament plus 50 large gillnet floats spaced equally along 50 m of 10-mm diameter trawl braid

- Key trade-off – A less ‘catchy’ drag section means a much longer tori line

Discussion

- Endless design options
- Light materials best
    - new streamer material will be made commercially available
- Deployment poles essential on some smaller vessels
    - expensive (~$450) but durable
    - generally easy to attach
- Test designs identified in diverse weather conditions when fishing
- On-vessel sessions for fishers recommended to promote effective design and operation



Acknowledgements

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