Inshore bottom longline seabird mitigation

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Dragonfly Science

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Conservation Services Programme Technical Working Group

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Draft Final Report: MIT2011-03, MIT2012-01

Inshore bottom longline seabird mitigation

Project objectives:

- To develop strategies to mitigate seabird captures in inshore bottom longline (IBL) fisheries by increasing line sink rates.
- To design a process of experimental testing, and analyse the results, to determine the effectiveness of seabird mitigation strategies used by inshore bottom longline fishermen.

Presentation to CSP Technical Working Group
Combined projects: MIT2011-03 and MIT2012-01

Background

Photo: DOC

"Inshore bottom longline":

- SNA, BNS, HPB, LIN
- FMA 1, 2, 9
- Focus on Hauraki Gulf

Issues:

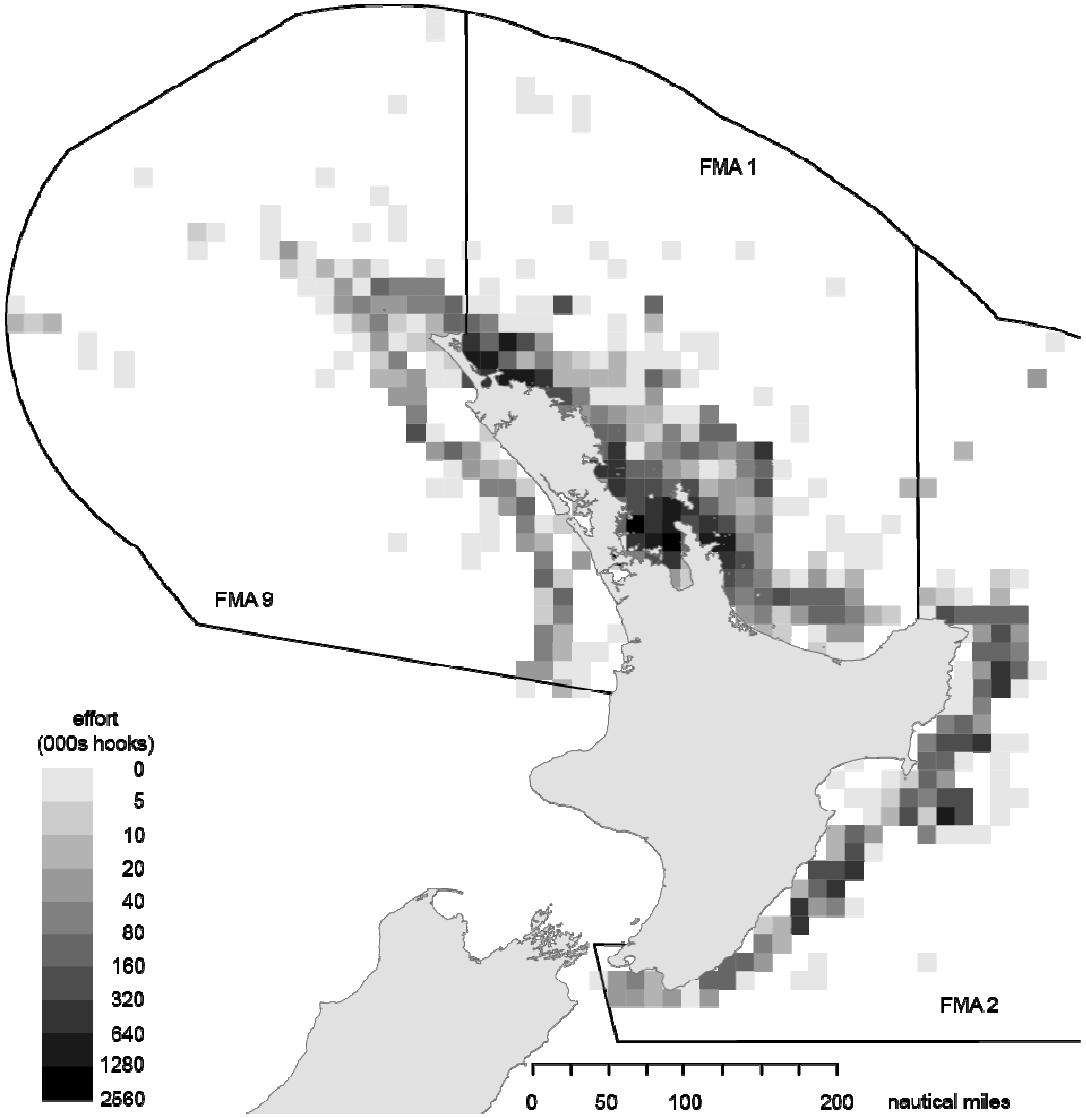
- Black petrel: est. potential mortalities highly likely to be above the population's sustainability limit (Richard and Abraham 2013).
- Mitigation measures available that should decrease bycatch risks
- Efficacy of approaches deployed?

Research approach

- Characterisation of northern IBL fisheries
- Workshop with scientists, skippers, observers, fishery managers and eNGOs
- Project priorities and information needs
- Development of data collection protocols
- Analysis
- Conclusions, recommendations

The FMA1 bottom longline fishery

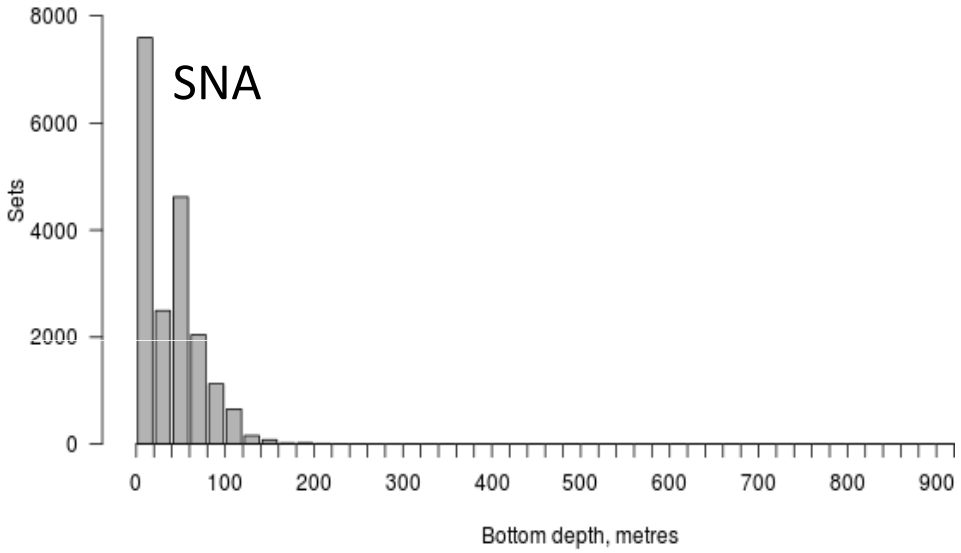
Effort Oct – June 2009/10 – 2011/12

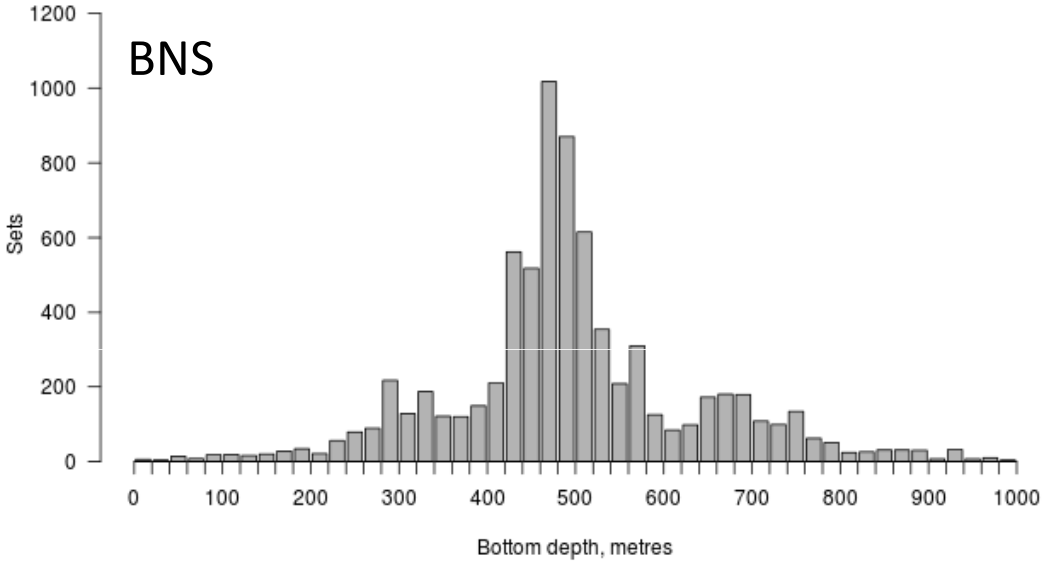


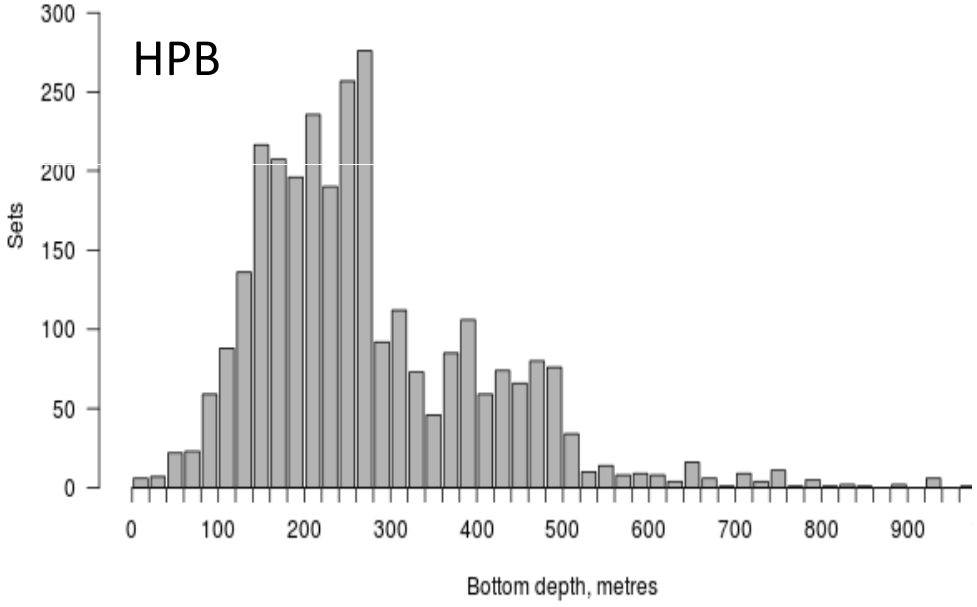
Total effort 2009/10 -2011/12

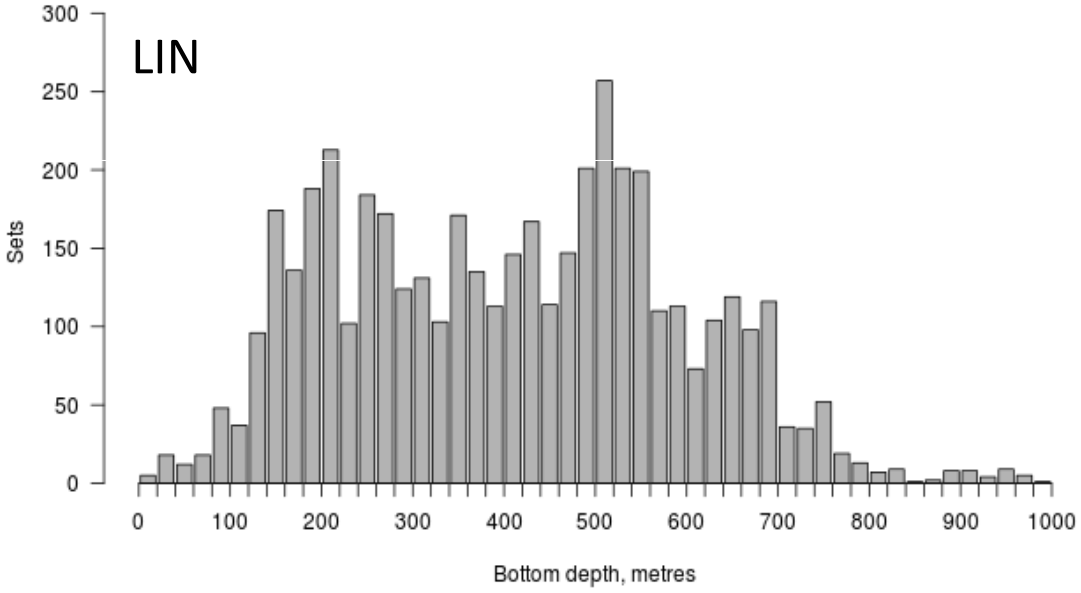
Target species	Number of sets	Number of hooks
SNA	18 972	32 997 294
BNS	2 941	4 676 978
HPB	596	727 123
LIN	749	1 214 684
TAR	127	368 042
SCH	70	90 164
RIB	37	78 224
RSN	80	191 560
GUR	180	337 797
Other	81	118 400
Total	23 833	40 800 266
Total number of vessels	93	
Number of vessels making up 90% of sets	50	

Fishing depth: 2009/10 – 2011/12









Past observer coverage in IBL fisheries

2002/03 – 2010/11

- FMA 1: 8 of 9 years, max. 4.4 %
- FMA 2: 6 of 7 years, max. 10.3%
    - 0 - 2.5% since 2007/08
- FMA 9: 3 of 9 years, max. 2.3 %

Photo: DOC

Seabird captures: Observed

2009/10 – 2011/12

- FMA1, 2
- 68 birds caught
- Black petrel, flesh-footed shearwater
- SNA, BNS, HPB
- Caught on sets deployed at night and day
- Most birds hooked (66)
- Most birds released alive (42)

Photo: Duncan Wright, CC BY-SA 2.0

Seabird captures: Fisher-reported

2009/10 – 2011/12

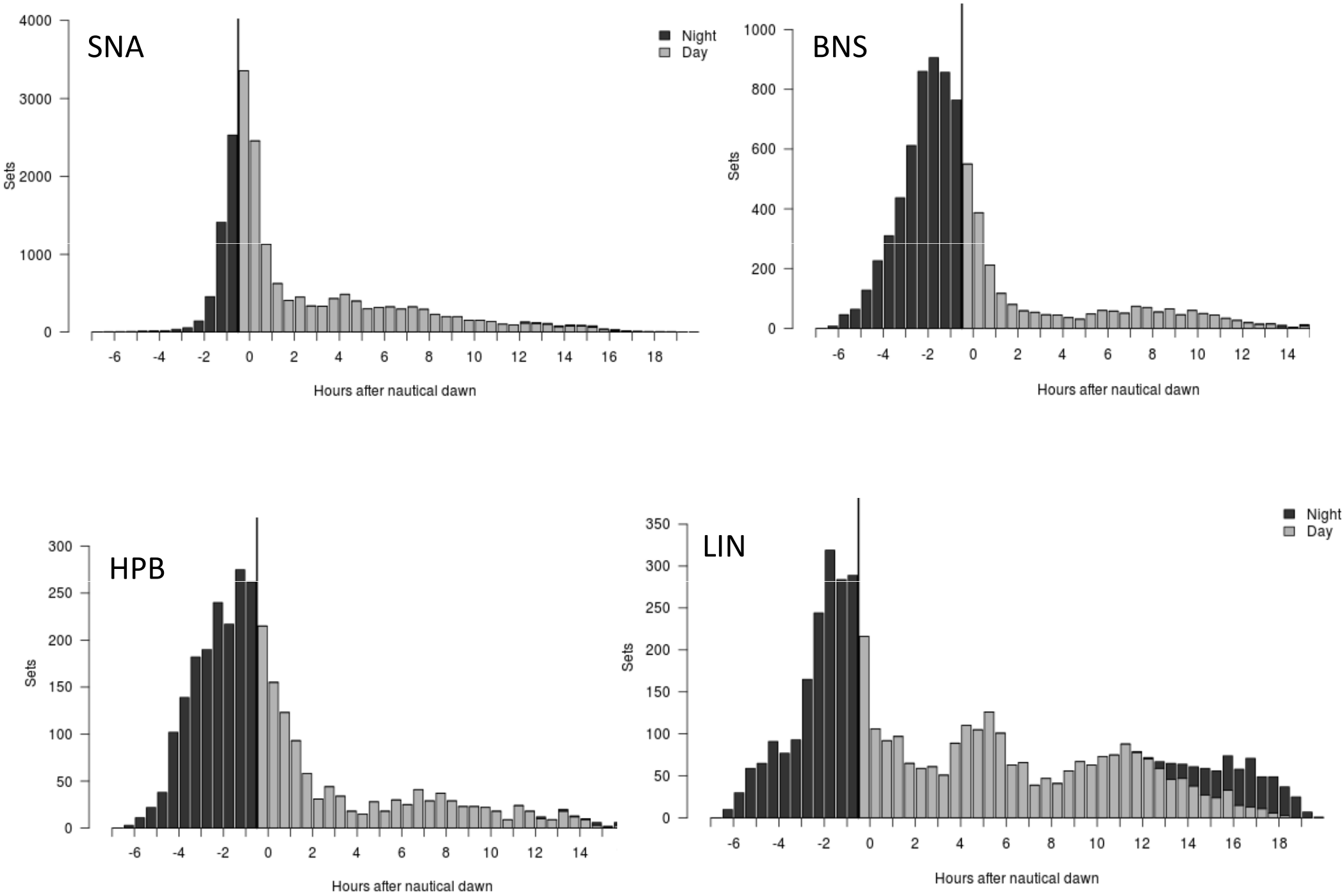
- FMA1, 2, 9
- 192 reported captures
- Black petrel, flesh-footed shearwater
- Salvin's albatross
- Sooty, Buller's, fluttering shearwater
- Cape, Westland petrel
- Generic species codes
- SNA, BNS
- Most birds dead (118)

Mitigation: Night-setting

- ‘Night’ = > 30 mins after nautical dusk until > 30 mins before nautical dawn

2011/12	FMA 1		FMA 2		FMA 9	
Target species	Number of sets	% night sets	Number of sets	% night sets	Number of sets	% night sets
SNA	5951	28	10	10	29	41
BNS	815	70	1061	56	126	83
HPB	188	68	288	34	477	65
LIN	249	68	873	45	192	56

Mitigation: Night-setting



Mitigation usage: Streamer lines

- Variable construction and deployment
- Sometimes more than one streamer line
- Sometimes not used
- Greater usage during day sets

% sets used	Diameter (mm)	Number of streamers	Streamer type	Aerial extent (m)	Total length (m)	Height	Towed object
0 - 100	5 - 10	0 - 23	strapping, tubing	10 - 80	25 - 200	1.5 - 8	float / rope

Mitigation usage: Other

- Blue-dyed bait
- Fish and vegetable oil
- Avoiding birds
- Stopping fishing activity

Photo: DOC

Current project: Implementation

Vessel selection:

- Target fish species
- Port of departure
- Location of fishing
- Skipper interest
- Skipper willingness to host observer
- Vessel capacity

Photo: DOC

Fluid observer tasking:

- Vessel characteristics
- Willingness to trial mitigation
- Results to date
- Meeting objectives of both projects

At sea

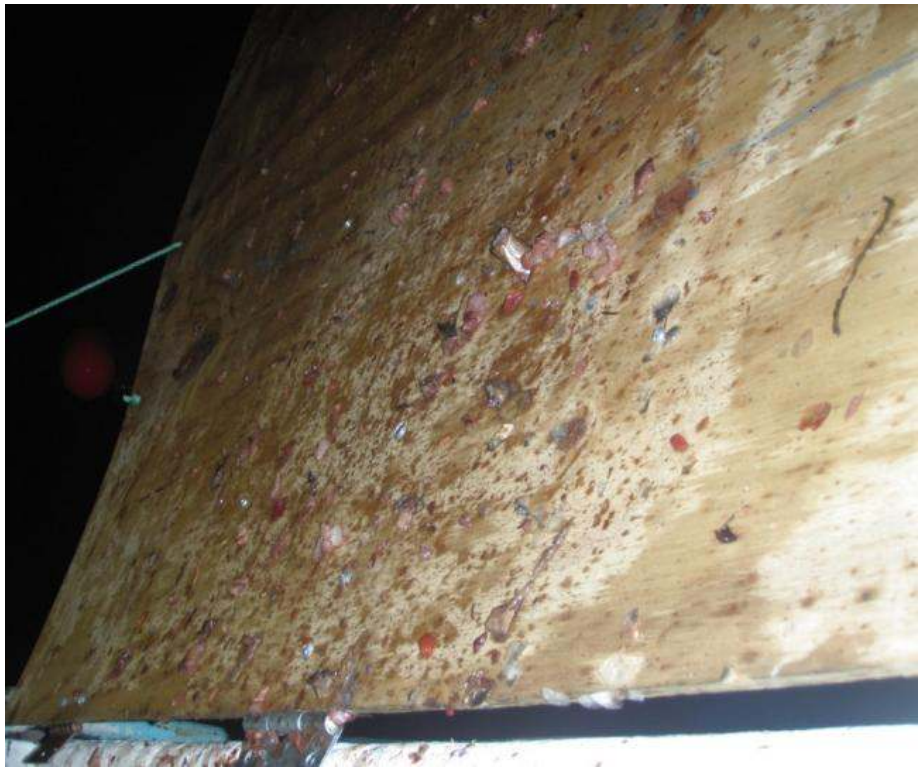
- Documenting current practice
  - Set, haul location
  - Bait type, state
  - Gear characteristics
  - Mitigation measures
  - Line sink rates
  - Seabird abundance and activity
- Refining existing approaches to bycatch reduction
- Exploring new options for mitigation measures

At sea: Refining existing approaches

- Modification of streamer lines
- Bait and discard retention at hauling
- Novel weighting regimes

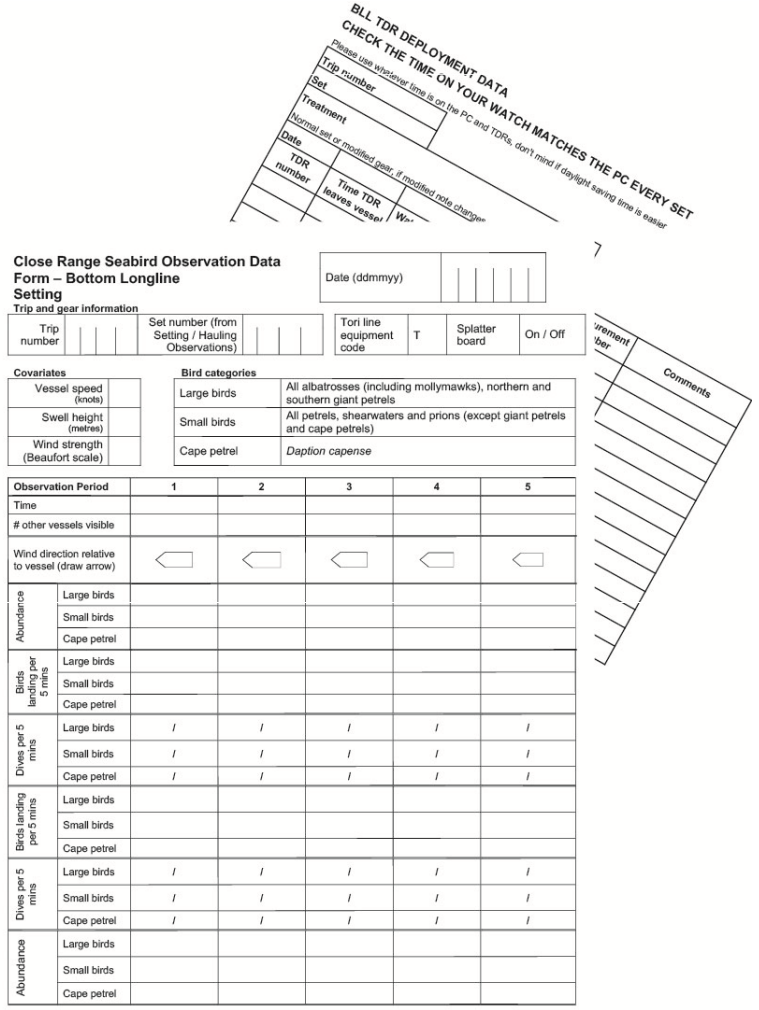
At sea: Exploring new mitigation measures

- Retaining bait fragments at setting: splatterboard
- Extending ropes on subsurface floats
- Haul mitigation



Data collection protocols

- MPI forms: set and haul; tori line details
- CSP form: Longline details form
- Trip report, diary
- Project-specific protocols, forms
    - Seabird abundance and activity
    - Time Depth Recorders
- Project-specific forms tested and refined on one vessel
- Testing simplified protocols



BLL TDR DEPLOYMENT DATA
CHECK THE TIME ON YOUR WATCH MATCHES THE PC EVERY SET
Please use whichever time is on the PC and TDRs, don't mind if daylight saving time is easier

Trip number
Set
Treatment
Normal set or modified gear; if modified note change
Date
TDR number
Time TDR leaves vessel

Close Range Seabird Observation Data Form – Bottom Longline Setting

Date (ddmmyy)

Trip and gear information

Trip number	Set number (from Setting / Hauling Observations)	Tori line equipment code	T	Splatter board	On / Off

Covariates

Vessel speed (knots)	
Swell height (metres)	
Wind strength (Beaufort scale)	

Bird categories

Large birds	All albatrosses (including mollymawks), northern and southern giant petrels
Small birds	All petrels, shearwaters and prions (except giant petrels and cape petrels)
Cape petrel	*Daption capense*

Observation Period		1	2	3	4	5
Time						
# other vessels visible						
Wind direction relative to vessel (draw arrow)						
Abundance	Large birds					
	Small birds					
	Cape petrel					
Birds landing per 5 mins	Large birds					
	Small birds					
	Cape petrel					
Dives per 5 mins	Large birds	/	/	/	/	/
	Small birds	/	/	/	/	/
	Cape petrel	/	/	/	/	/
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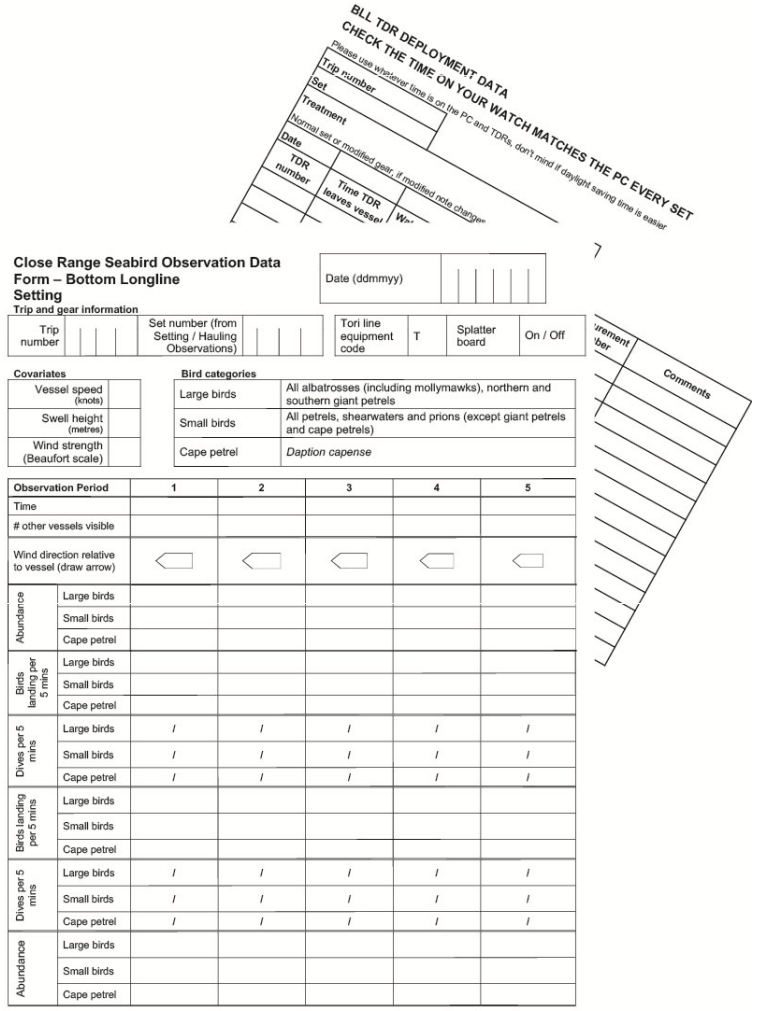
	Small birds					
	Cape petrel					
Dives per 5 mins	Large birds	/	/	/	/	/
	Small birds	/	/	/	/	/
	Cape petrel	/	/	/	/	/
Abundance	Large birds					
	Small birds					
	Cape petrel					

Comments

Data collection protocols: seabirds

- Setting and hauling
- Sampling abundance and activity in specified areas
    - activity: dives, landings
- Repeated counts through time
- Counts by species group
    - large birds, small birds
- Covariates: weather, sea state, discharge



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	Small birds	/	/	/	/	/
	Cape petrel	/	/	/	/	/
Abundance	Large birds					
	Small birds					
	Cape petrel					

Comments

Data collection protocols: TDRs

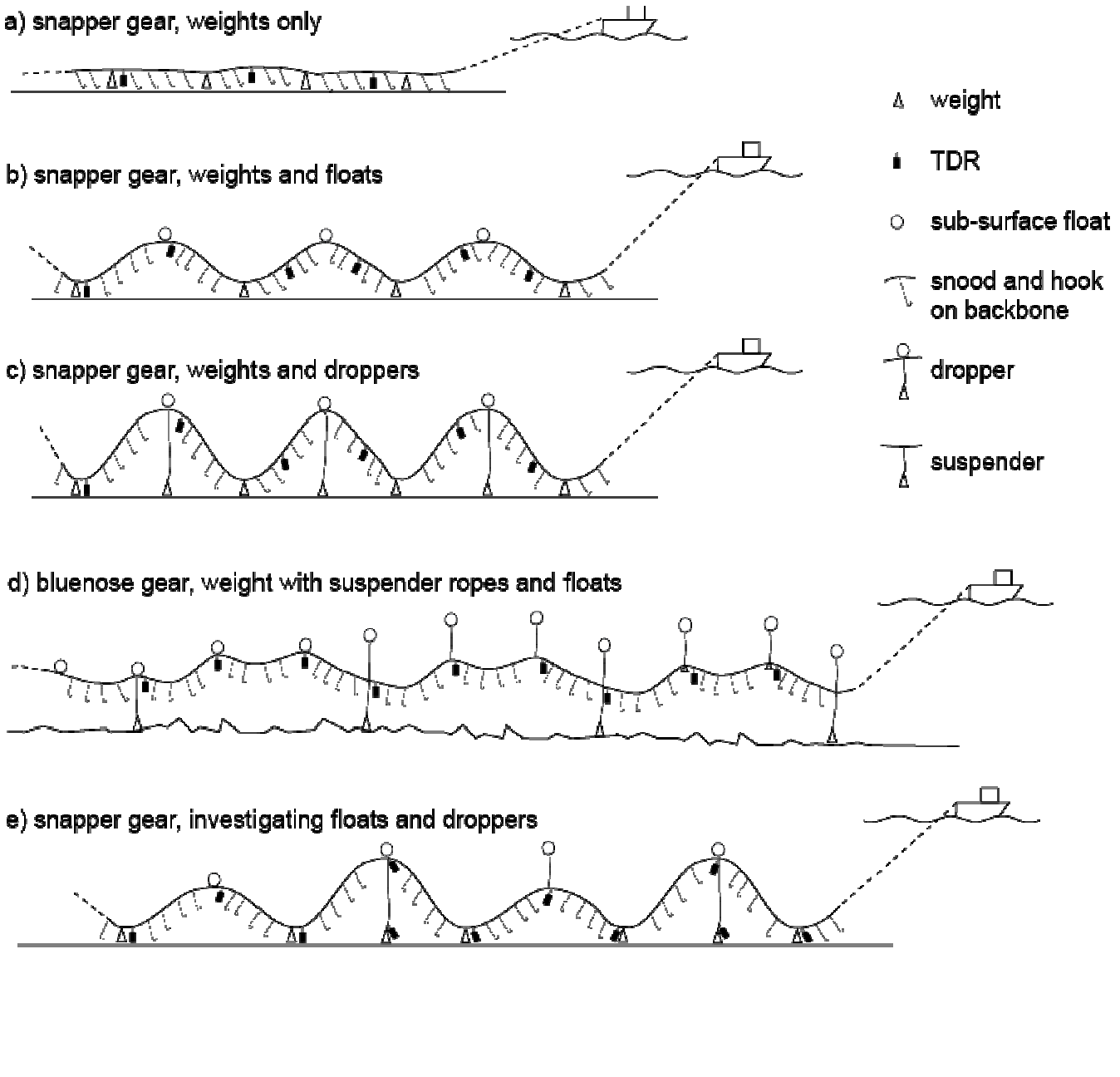
Set:

- Record environmental conditions
- Record gear variables
- Clip TDRs on line
- Record time TDRs left vessel
- Line tension measurement

Haul:

- Check TDR placement
- Record line setup around TDRs including weight and float size and spacing

Sink rates - TDR placement



Analysis: TDR data

Normal practice:

- Screen data – inaccurate times / positioning
- Temperature correction
- Randomly discard some results to ensure equal representation of different positions on line
- Box and whisker plots of time to depth and distance behind vessel, using vessel speed
- Continuity with previous work
- Feedback including report for skippers

Changing weighting / gear setup / float ropes

- TDR positioning tailored to specific objective

Summary of at sea data collection

Vessel code	Main target species	Total sets () = TDRs	Number sets with bird obs	Number hauls with bird obs	Mitigation tested () = number of sets
L	snapper	31 (9)	20	31	slower setting speed for some of set (4)
M	snapper	10 (4)	4	10	smaller weight spacing (2)
N	snapper	32 (16)	16	15	retaining baits(8), tori line (2), splatterboard, float ropes (5), smaller weight spacing (2)
O	tarakihi / mix	13 (4)	0	13+1	
P	bluenose / hapuku	32 (10)	0	32	retaining baits (2), float ropes (7)
Q	bluenose	2 (2)	0	2	float ropes (2)
R	snapper	2 (0)	0	2	
S	snapper	1 (0)	0	1	

Documenting current practice – Fishing operations

Snapper

- 1 or 2 sets per day, 53 % at night, 1500 - 7500 hooks per day
- smaller vessels, lighter gear, shorter soaks, shallower sets

Bluenose

- 1-4 sets a day, 100 % at night, 600 - 1800 hooks per day
- larger vessels, heavier gear, longer trips, deeper sets

Documenting current practice – Streamer lines

Vessel	Target	% sets used	Diameter (mm)	Number of streamers	Streamer type	Aerial extent (m)	Total length (m)	Height (m)	Towed object
L	SNA	100	4	13	tubing	40	120	2 - 6.6	rope loop
L	SNA	13	4	9	tubing	20-35	80	3	rope loop
M	SNA	40	6	17	strapping	50	56	6	500 mm float and rope
N	SNA	56	5	9-10	strapping	40-50	90	4	speargun float
O	MIX / TAR	8	5	18	tubing	30	50	5.2	traffic cone
R	SNA	100	2	15	bin bag strips	-	66	-	polystyrene float
Q	BNS	100	4	6	strapping	15	25	5.1	300mm float

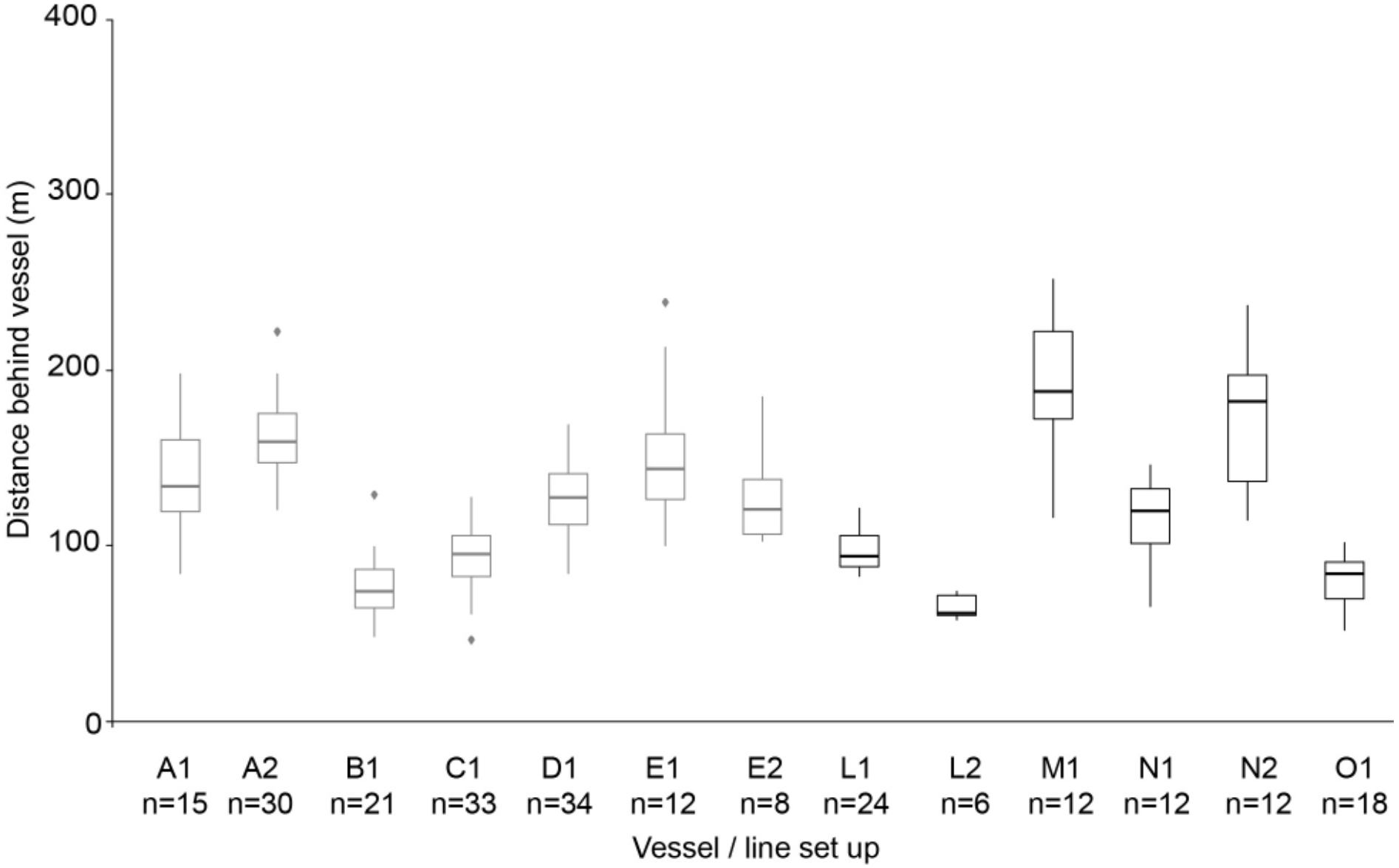
Documenting current practice – Streamer lines

- Used during 28 % of night sets, 85 % of day sets
- Sometimes deployed part-way through setting, in response to perceived increase in bycatch risk

Gear variation - snapper

Vessel / set up	Line setup	Kg weight per 100m of line	Weight type	Number of sets sampled	Setting speed	Shooting height (m)	Line tension
A1	droppers and weights	1.5	steel	2	4.7	2.1	
A2	droppers	1.0	steel	3	4.7	2.1	
B1	droppers and weights	5.0	lead	2	2.7 - 3.6	1.6	
C1	weights	1.6	rocks	3	2.2 - 3.5	1.3	
D1	weights	1.3	lead	3	4 - 4.7	1.6	
E1	weights	2.1	steel, lead	2	5.0	1.5	
E2	droppers	2.7	steel, lead	2	5.0	1.5	
L1	weights	6.2	steel	3	4.9 - 5.5	1.6	med
L2	weights	5.9	steel	1	5.0	1.6	-
M1	weights	1.3	steel	2	5.5 - 5.8	2.0	high
N1	weights	3.1	steel	3	4.5 - 5.8	2.0	low -med (5)
N2	weights and floats	2.2	steel	3	5.2 - 5.5	2.0	low - med (5)
O1	weights	2.9	steel	4	2.3 - 3.3	2.5	low (0.7 - 1.4)

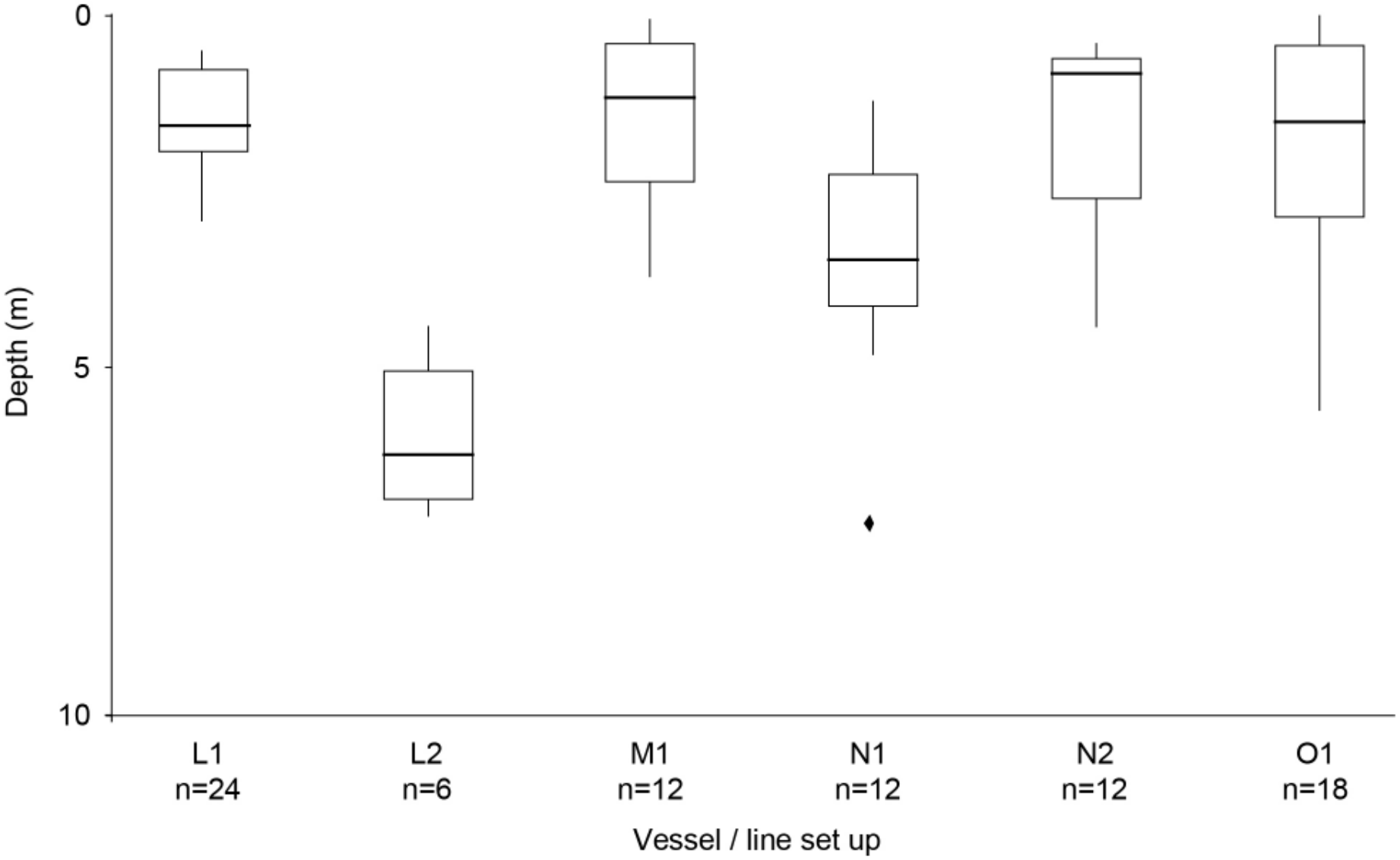
Snapper - distance astern TDRs reached 10m



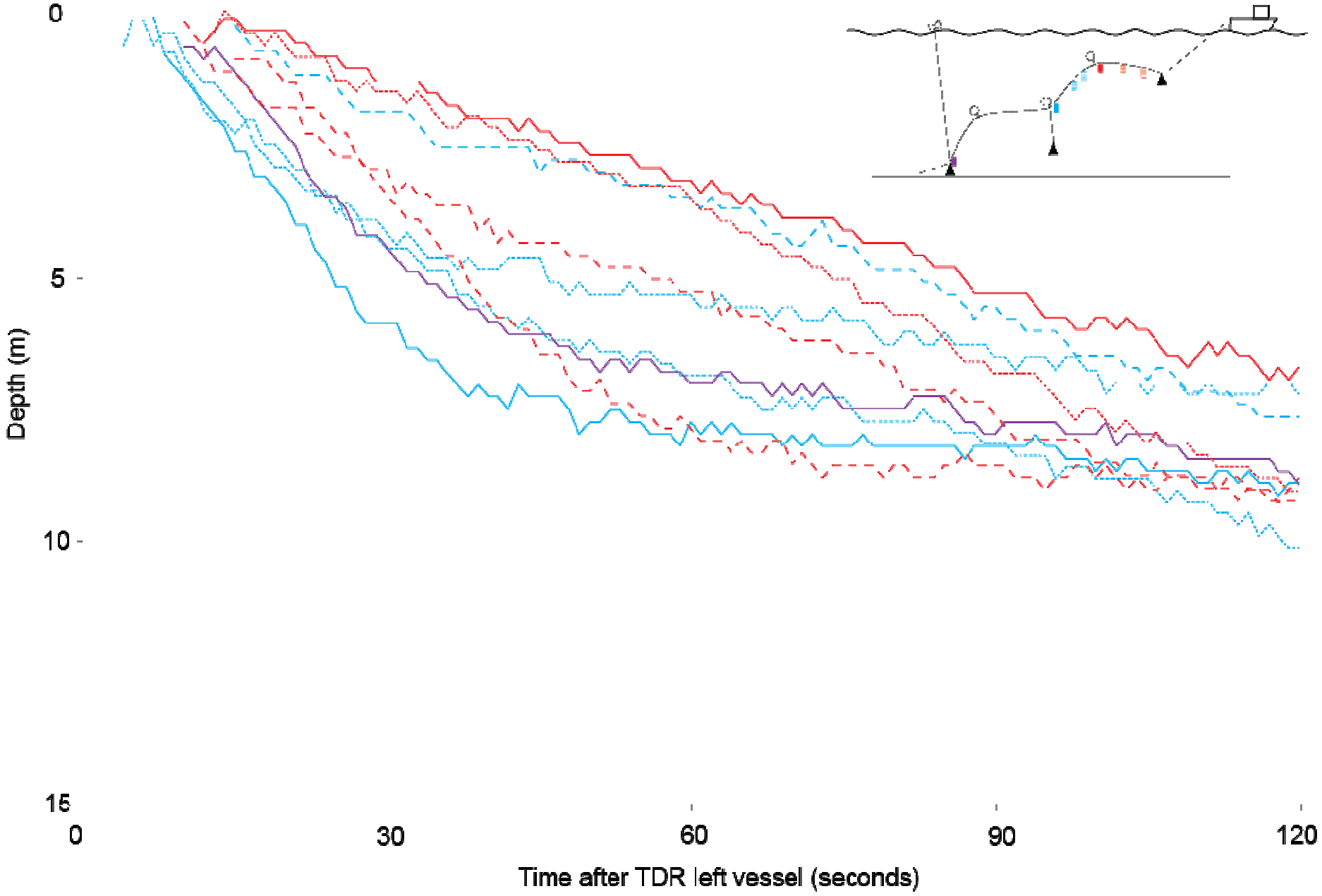
Snapper – tori line details

Vessel	Target	% sets used	Line diameter (mm)	Number of streamers	Streamer type	Aerial extent (m)	Total length (m)	Height (m)	Towed object
L	SNA	100	4	13	tubing	40	120	2 - 6.6	rope loop
L	SNA	13	4	9	tubing	20-35	80	3	rope loop
M	SNA	40	6	17	strapping	50	56	6	500mm float and rope
N	SNA	56	5	9-10	strapping	40-50	90	4	speargun float
O	TAR / MIX	8	5	18	tubing	30	50	5.2	traffic cone
R	SNA	100	2	15	bin bag strips	-	66	-	polystyrene float
Q	BNS	100	4	6	strapping	15	25	5.1	300mm float

Snapper – depth at aerial extent of tori line



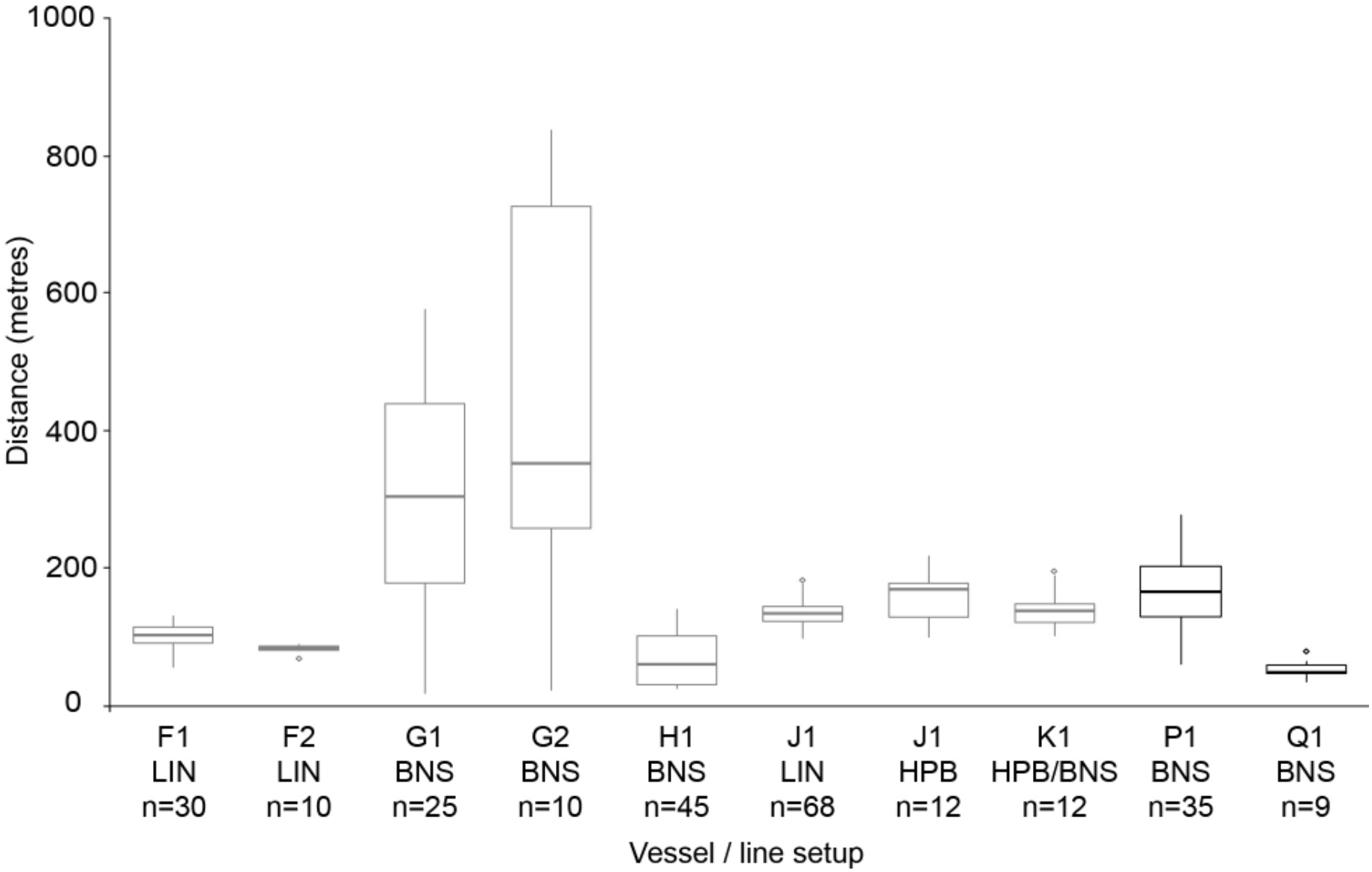
Snapper – shallow set



Gear variation – bluenose / ling / hapuku / bass

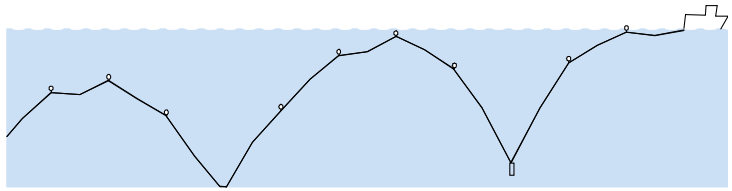
Vessel / set-up	Repeated line sequence	Float diameter (mm)	Weight per 100m (kg)	Weight type	Backbone material	Number of sets sampled	Setting speed (knots)	Shooting block height (m)	Line tension
F1 LIN	dropper, float	150, 120	3.3 (3.0)	lead	mono	6	3.5 - 3.7	2.9	Med
F2 LIN	droppers	150	5.5 (5.0)	lead	mono	1	3.5	2.9	Med
G1 BNS	weight, 4 floats	180	5.4	steel	tarred rope	5	4.6 - 5.1	2.5	-
G2 BNS	weight, 4 floats	180	3.6	steel	tarred rope	2	4.5	2.5	-
H1 BNS	dropper, 3 floats	180, 135	3.3	steel	mono	7	1.8 - 2.2	2	Low
J1 HPB	dropper, float	180, 135	5.7	steel	mono	7	3.6 - 3.85	2.6	High
J LIN1	droppers	180, 135	5.7	steel	mono	2	3.1 - 4.1	2.6	High
K BNS / HPB	suspender, 2 floats	150	4.5	steel	mono	3	2.8 - 3.0	2.0	Med - High
P1 BNS	suspender, 2-3 floats	150	6.7 (4.2)	concrete / rock	mono	10	3.5 - 4.0	2.0	High
Q1 BNS	dropper, 3 floats	150	4.5	steel	mono	2	1.7 - 2.4	2.0	Low

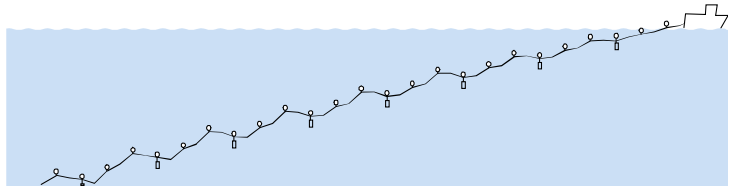
Distance astern TDRs reached 10m



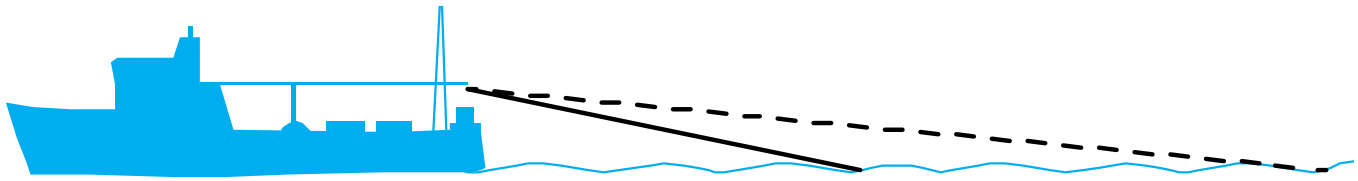
Line tension / setting speed

- Not a very controllable variable
- Varies with setting speed, faster = more tension.
- **Lower** tension + large weight spacing = more variability in sink rate, faster sink times, and ‘m’ shaped sink profile
- **Higher** tension + small weight spacing = more uniform sink profile





Setting speed confounds the relationship between sink time and line tension, and influences the distance astern hooks reach a given depth.



Refining existing approaches – streamer lines (SL)

- Added weight where SL attached to vessel
- Positioned 2 SLs almost directly vertically aligned
- “Bottle brush” as terminal object
- Floats forward of terminal object
- Glow sticks added to aerial section

- Increase drag = increase aerial extent
- More visible towed object may have increased bird interest
- Risk of tangling
- Dedicated testing required

Refining existing approaches - weighting

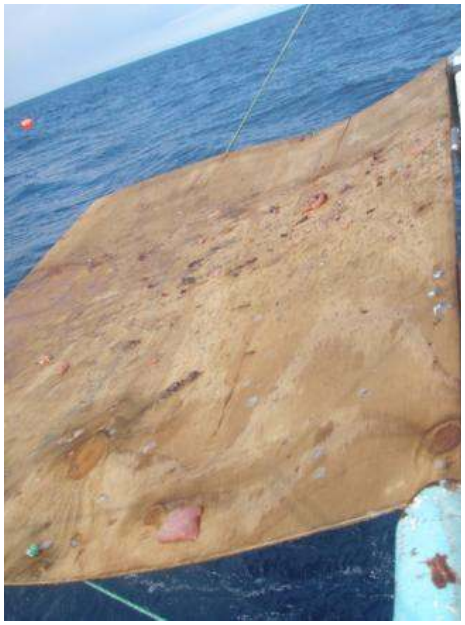
- Spreading weight more evenly reduces maximum sink times
- But is not appropriate for all setups

Refining existing approaches – bait retention

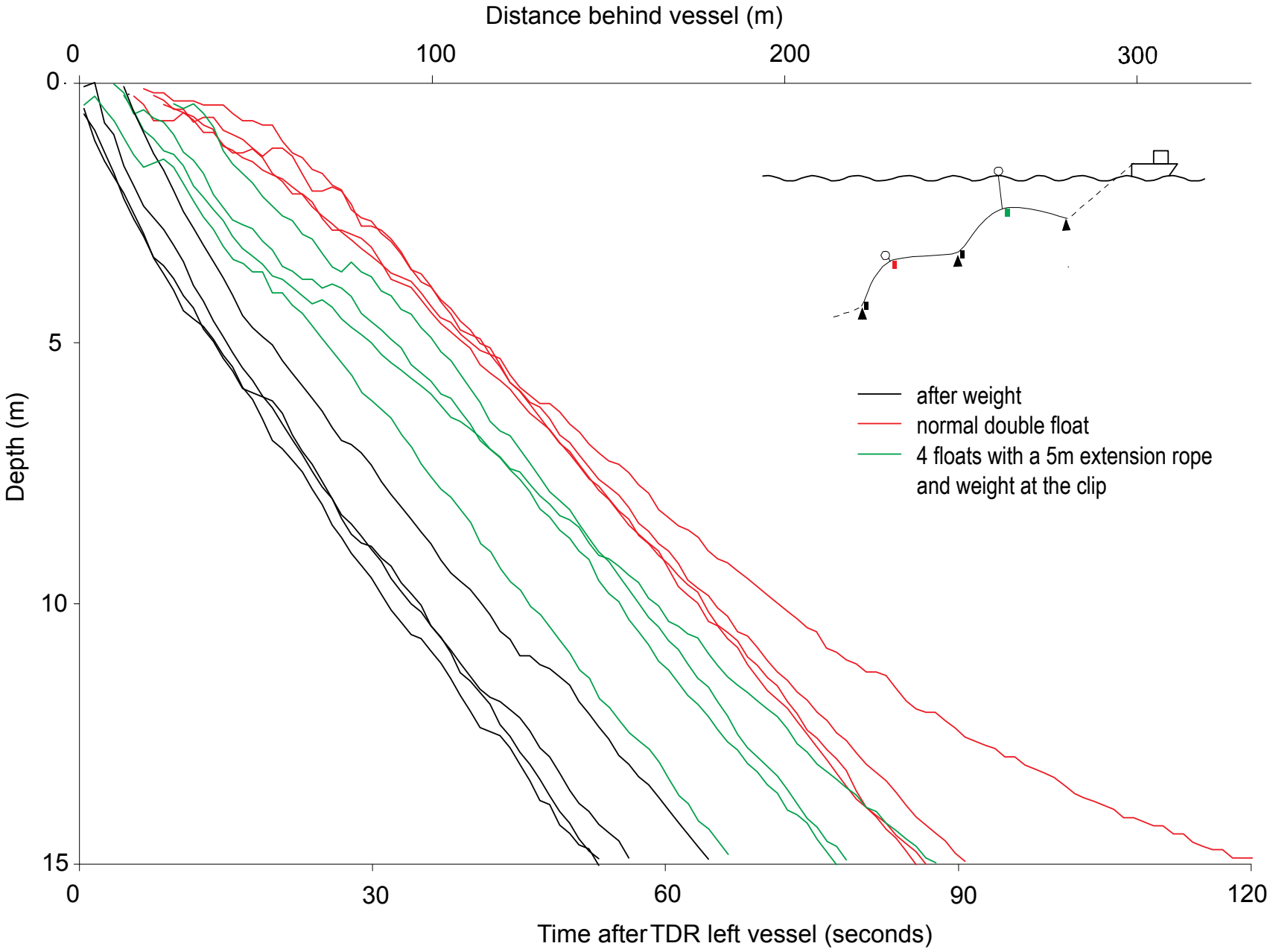
- Hauls with and without bait discharge
- GLM, negative binomial distribution
- Fixed effect: each day of each trip
- Holding baits reduced seabird attendance during hauling
- Holding discards showed a non-significant negative effect on seabird attendance
- High within-trip variation in seabird abundance
- Improve quantification of effect by:
    - sampling across more trips
    - using a more manipulated experimental approach

Exploring new mitigation measures - retaining bait fragments during setting

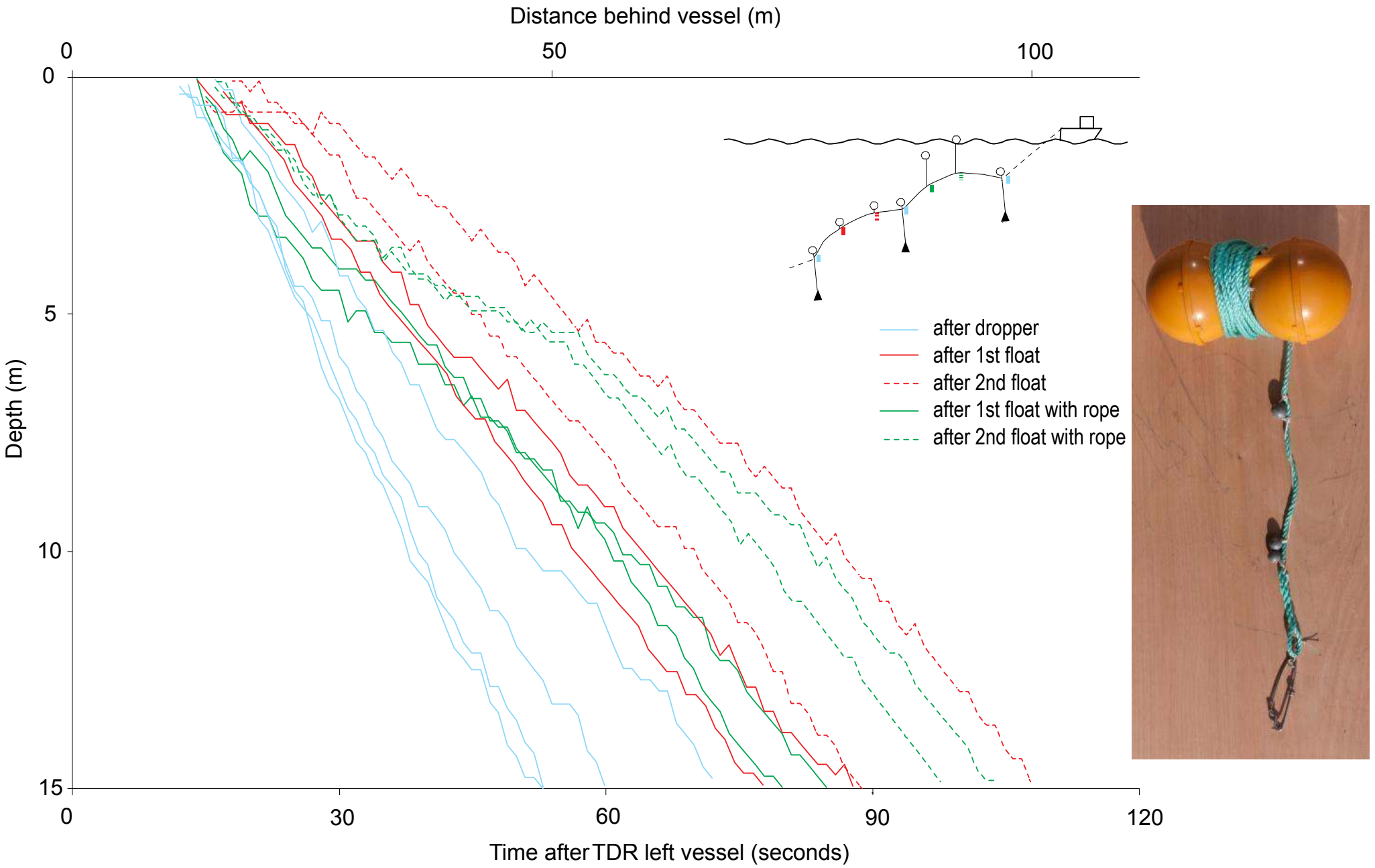
- Trialled on 5 sets
- Effectively retained bait fragments, odd whole baits, 2 complete snoods.
- Could be refined to be more user-friendly
- Not possible to quantify efficacy with bird observations, would need lots of daytime sets.



New options – extending float ropes (SNA)



New options – extending float ropes (BNS)



Recommendations - Methodology

- More sea time for data collection
- Two stage approach:
    - **Document current practice where not well understood**
        - Identify mitigation options for testing
    - **Conduct dedicated testing**
        - Vessels focused on testing one measure
        - More trips
        - More controlled experimental setups
        - Trained observers

Photo: DOC

Recommendations – IBL mitigation

- Improve performance of line-weighting strategies
  - Add more weight
  - Use more even-sized weights
  - Space weights closer together
  - Use longer float ropes
  - Set at slower speeds
  - Self-monitor sink rates (e.g., bottle tests)

- Improve design and construction of streamer lines
  - Risk of tangles
- Sink longlines to 10 m at end of streamer lines
- Hold baits and discards during hauling
- Use best practice mitigation at all times

Acknowledgements

- Skippers and crews who worked with observers at sea.
- Observers: A. Blommart-Klay, S. Chalmers, S. Hornby, N. Hunia, J. Williamson
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- Technical Advisory Group: I. Debski, C. Dolfing, W. Dreadon, L. Mitchell, K. Ramm, B. Sharp, J. Williamson
- MPI Observer Services: A. McKay
- CSP: Projects principally funded through a levy on the quota holders of relevant commercial fish stocks.

Photo: DOC