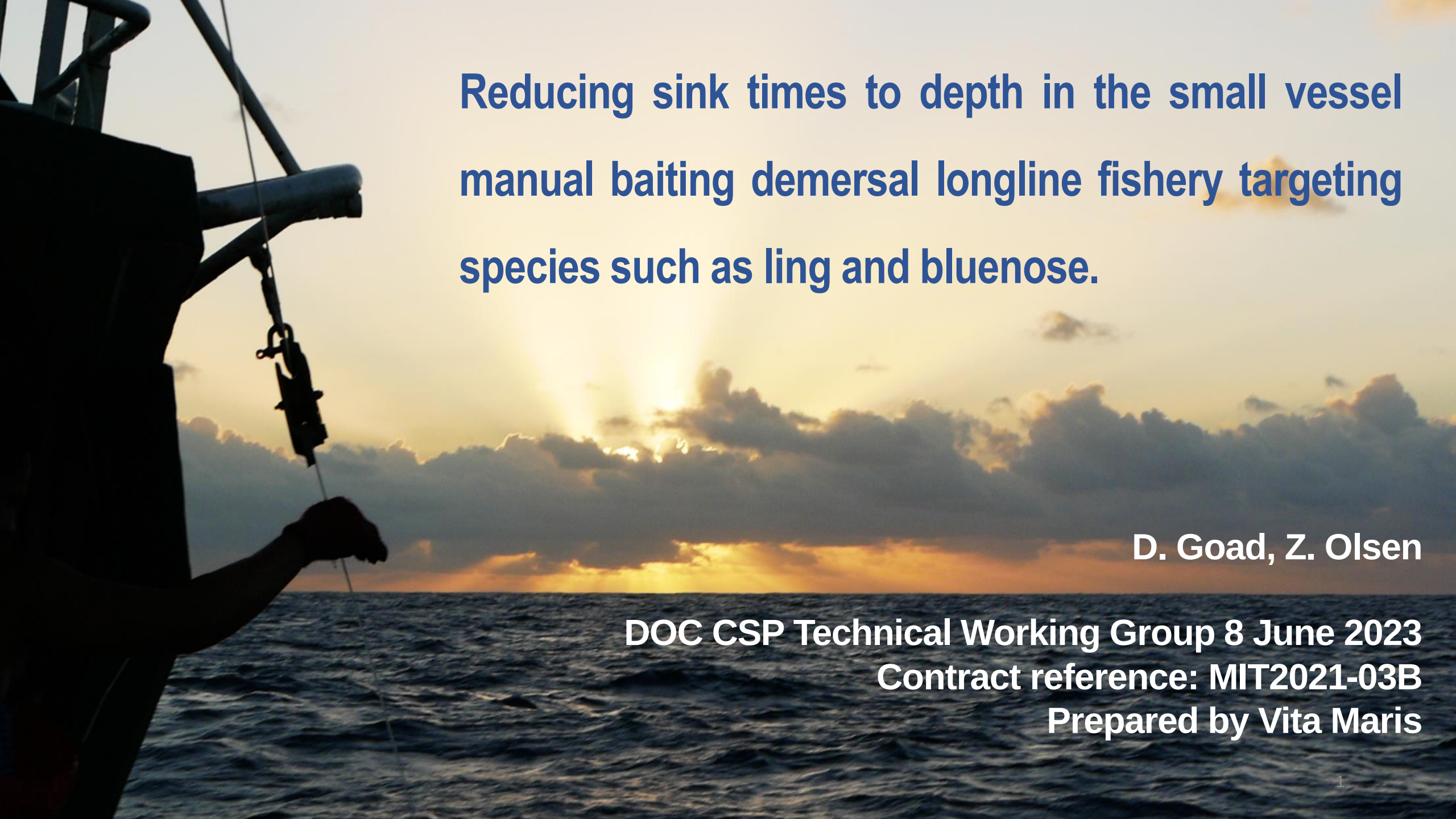


Reducing sink times to depth in the small vessel manual baiting demersal longline fishery targeting species such as ling and bluenose.

D. Goad, Z. Olsen

DOC CSP Technical Working Group 8 June 2023
Contract reference: MIT2021-03B
Prepared by Vita Maris

Background

Mitigation standards introduced 2019.

NPOA 2020 implementation plan.

Regulations changed 2021.

Switched to an ‘outcome-based’ input control on demersal longline weighting, requiring five metres depth at the end of the tori line aerial extent.

There is a lack of data supporting strategies for improving sink times to five metres by the end of the tori line, for the ling and bluenose clip-on bottom longline fleet.

Positive feedback from similar ‘snapper longline’ project

- This project addresses the ‘heavier gear’, clip–on bottom longline fleet.

The fishery….

Hand-baited hooks clipped onto backbone

Depth above seabed controlled by:

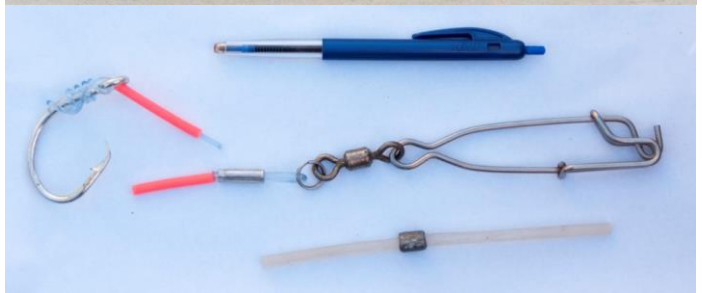
length of rope between weight and backbone, and

float and weight configuration

Target species:

Ling just off the bottom (clean ground)
weight, float, weight

Bluenose higher off the bottom, “semi-pelagic”, “floating”
weight+float, float, float, float, weight+float



Project Objectives

1. To identify options for increasing the sink rate of hooks in small bottom longline fisheries.

2. To test the performance and efficacy of methods to increase the sink rate of hooks in small bottom longlines

Methods 1.

Reviewed current gear setups (PSRMPs)

Workshop and follow up discussions to refine approach and gear setups to be tested

At sea trials:

CEFAS G5 Time Depth Recorders (TDRs), three repeats.

Most of gear set without hooks (faster, daylight, no need for special permit)

Also trialled: hooks / no hooks

monofilament nylon and rope backbone

increased line tension

tori lines: 100 m aerial section

7.3 m high pole

various drag options

Methods 2

Gear set at three knots

Weight spacings of 60, 120, and 180 m (also 150, 240, and 300 m).

Weight sizes of 6, 9, 12, 15 kg (all set on a 2 fm (3.6m) dropper rope with 150 mm float).

Varied number of floats between weights (longer spacings generally = more floats).

“Modified floats”

allow line to sink to the length of the rope,

then equivalent to a single float.

Figure 1. Modified float with TDR housing attached, ready for deployment

Reviewed times to depth daily to prioritise gear setups to test – crossed some off the list and added others on.

Most setups tested with TDRs at half and three-quarters of the way after a weight.

Results – depth profiles over time

Example depth profile

Sink rate (gradient) changes over time

0 seconds = + 2.6 m (on this boat)

70 m aerial extent tori line provides coverage for 46 seconds at 3 knots

TDRs measure pressure

Pressure not necessarily proportional to depth close to the boat (e.g. prop wash) so have excluded first 10 s.

Reported max sink times to 6 m to allow for inaccuracies including the distance between the TDR and the hook

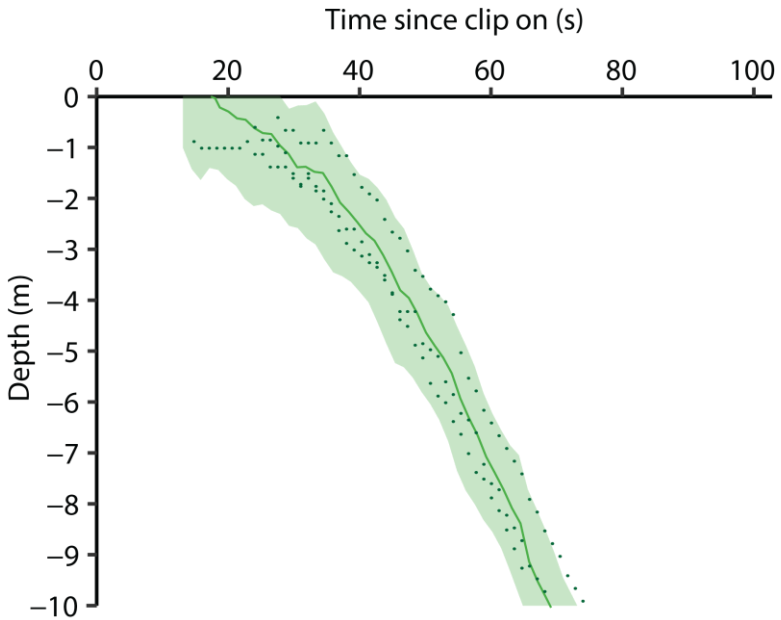


Figure 2.0. Example depth profile.

Points show individual TDR records, lines show smoothed mean depth, and shaded areas showing +/- s.d..

Results – depth profiles over time

Example depth profile

Sink rate (gradient) changes over time

0 seconds = + 2.6 m (on this boat)

70 m aerial extent tori line provides coverage for 46 seconds at 3 knots

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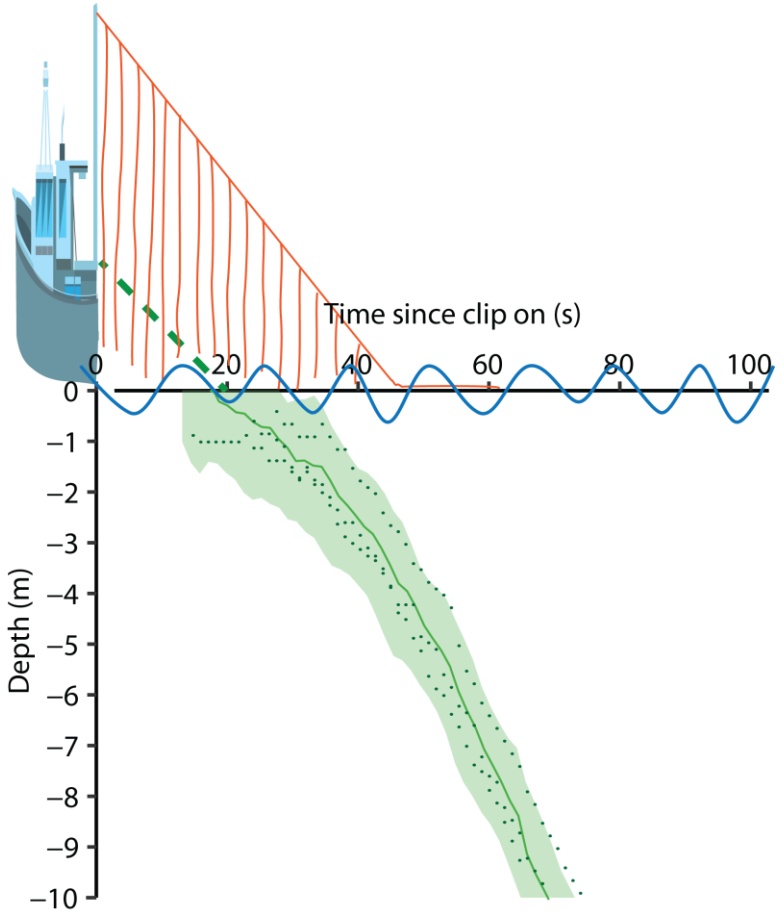


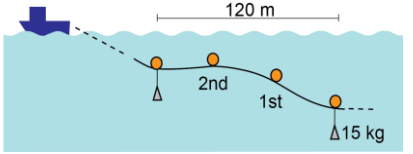
Figure 2.1. Example depth profile with vessel and tori line added to scale.

Points show individual TDR records, lines show smoothed mean depth, and shaded areas showing +/- s.d..

Results – factors influencing sink time to depth

Hooks / No hooks

Not really any difference to 6 m. Reassuring.



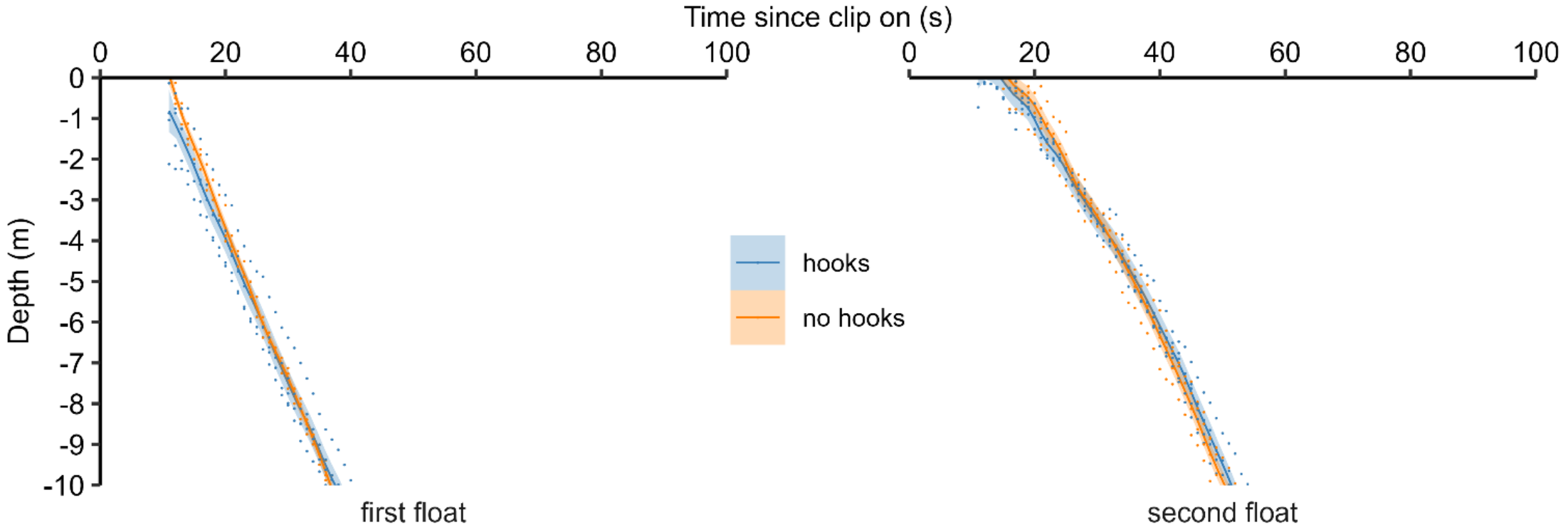
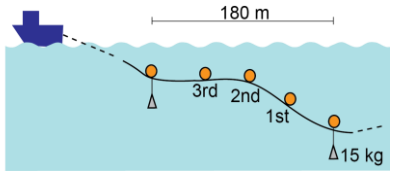


Figure 4. Depth over time for TDRs deployed on sections with and without hooks.
Gear configuration was 120 m spacing, 15 kg weights and two floats between weights

Results – factors influencing sink time to depth

Line tension

Higher tension sinks line between weights faster



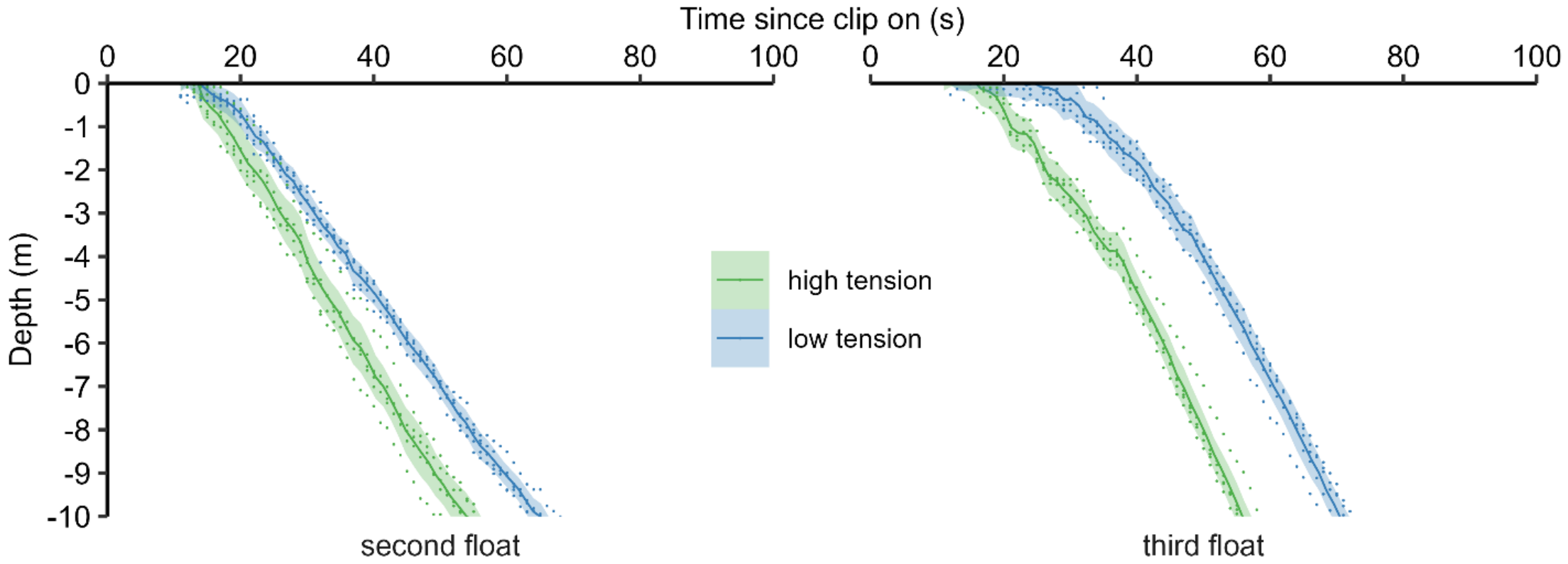
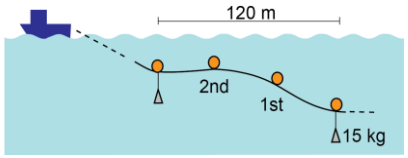


Figure 5. Depth over time for TDRs deployed at 23-26 kg (low) and 60-66 kg (high) line tension. Gear configuration was 15 kg weights at 180 m spacing, with three floats between weights.

Results – factors influencing sink time to depth

Backbone type

8 mm rope backbone sank slower than 6 mm monofilament nylon



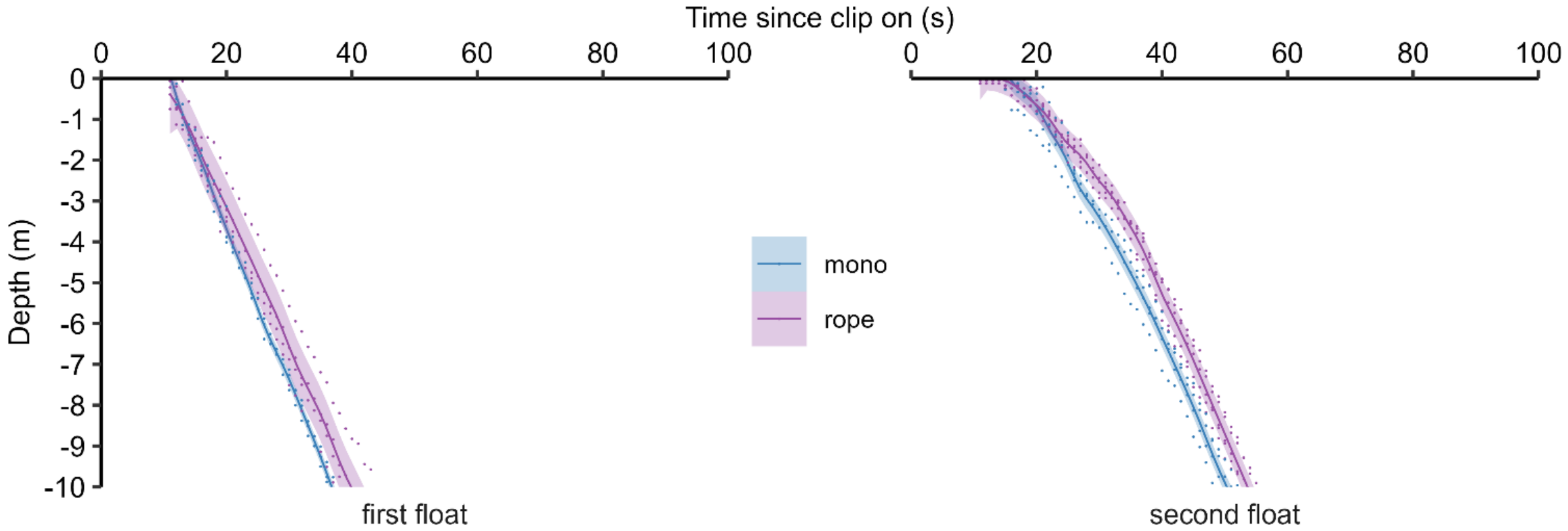
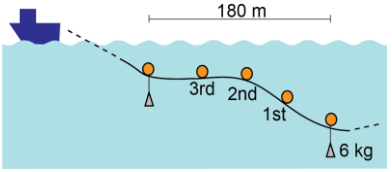


Figure 6. Depth over time for TDRs deployed with rope and monofilament backbone.
Gear configuration was 15 kg weights, 120 m spacing, and two floats between weights.

Results – factors influencing sink time to depth

Current / tide

Shooting with the tide sinks gear faster



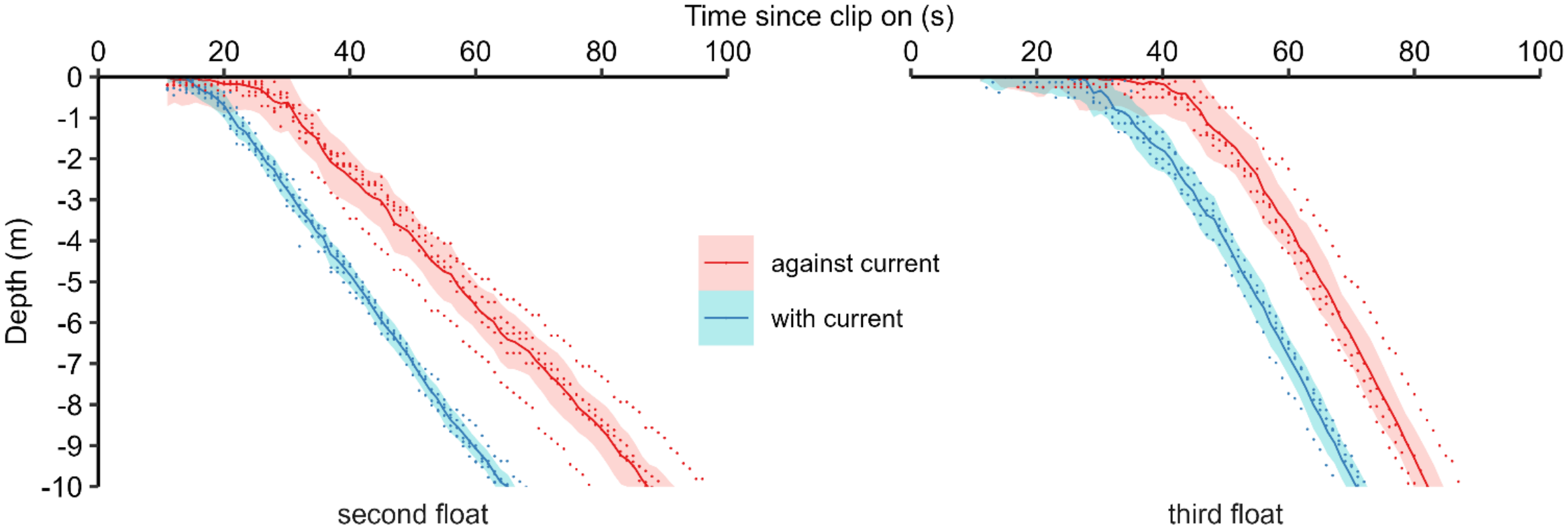


Figure 7. Depth over time for TDRs deployed on lines with and against the current.
Gear configuration was 15 kg weights at 180 m spacing, and three floats between weights.

Results – factors influencing sink time to depth

Weight size

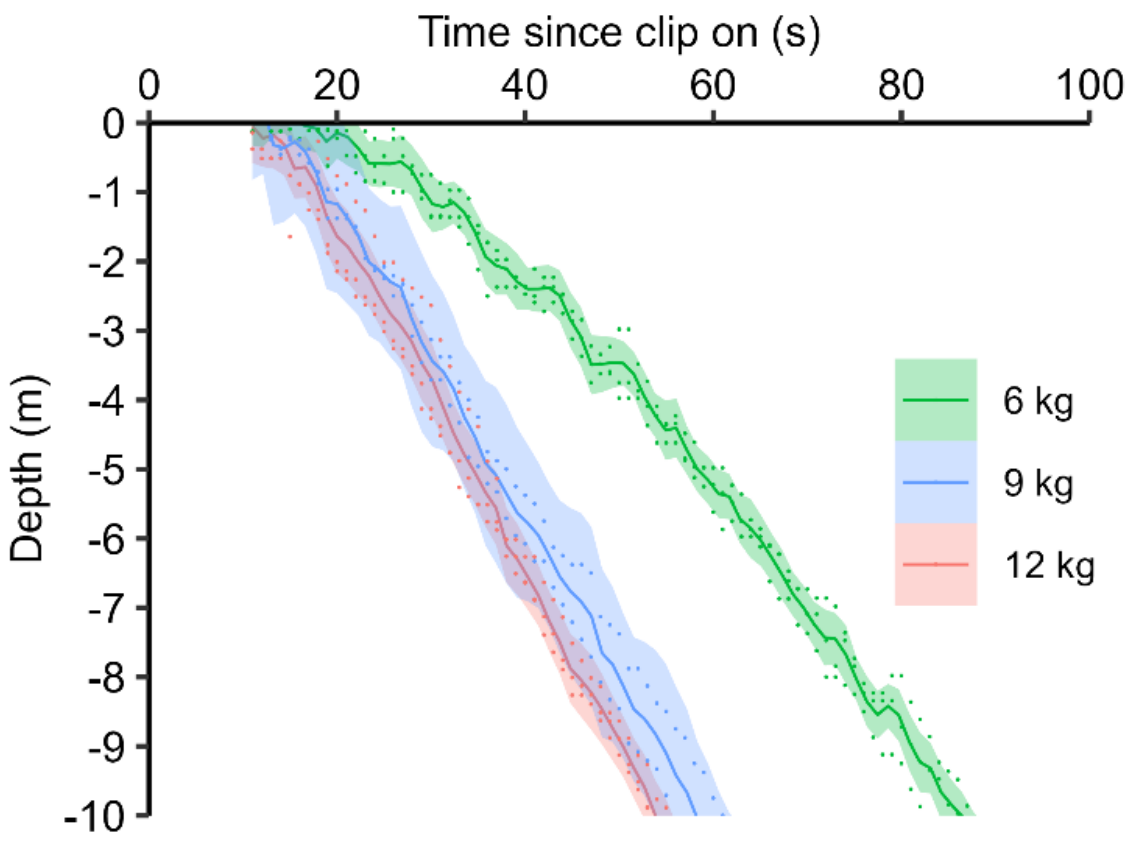


Figure 8. Depth over time for TDRs deployed midway between weights on single float configurations with 120 m weight spacing and varying weight size.

Weight spacing

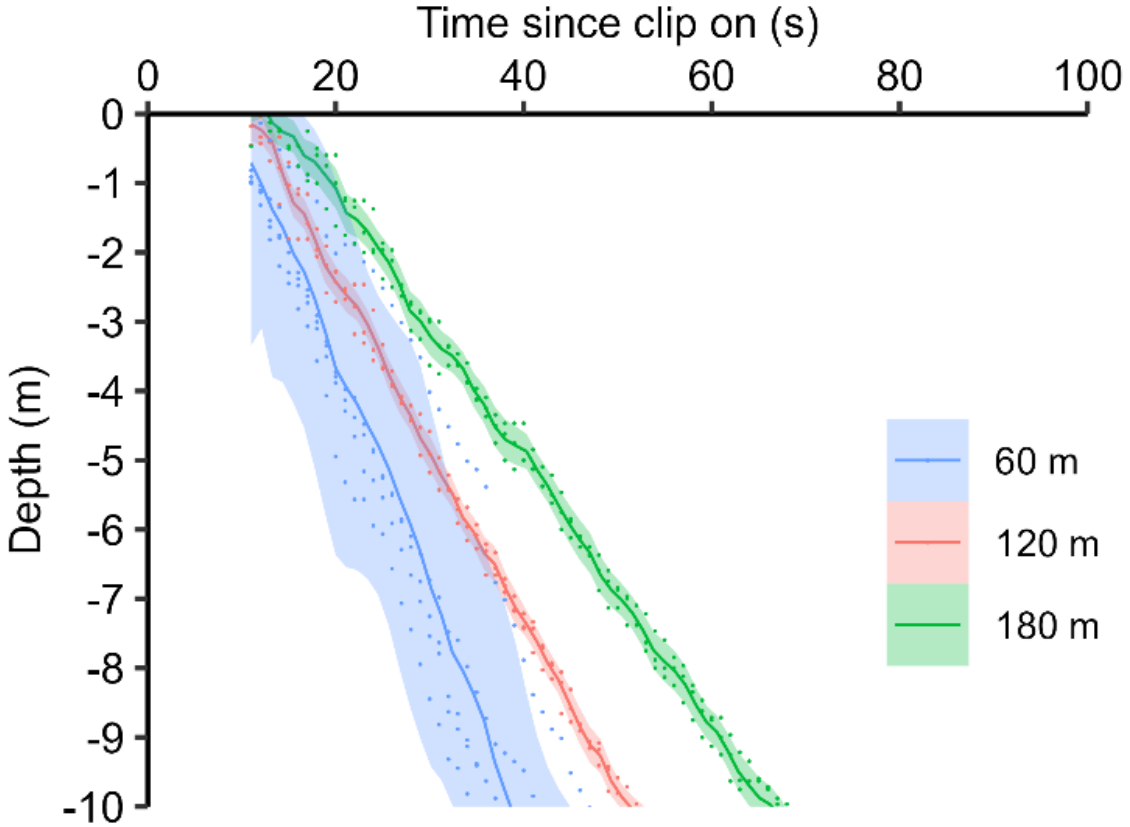


Figure 9. Depth over time for TDRs deployed midway between 6 kg weights with no floats between weights and varying weight spacing

Results – factors influencing sink time to depth

Number of floats between weights

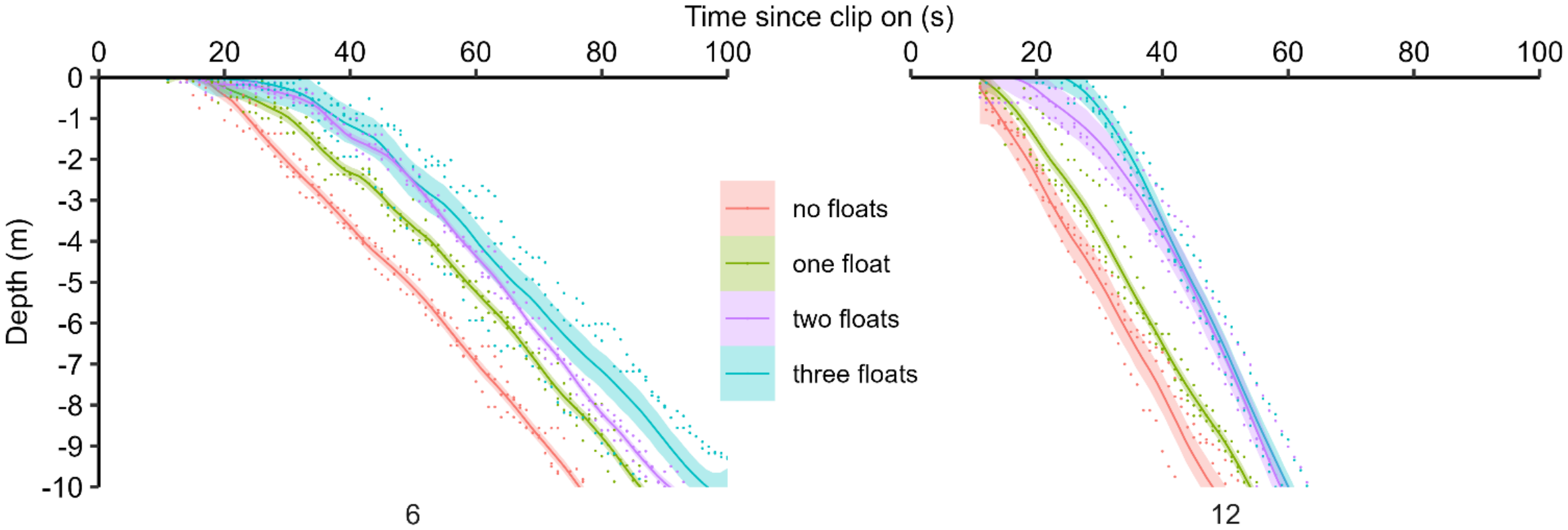


Figure 10. Depth over time for TDRs on line configurations with 0, 1, 2, and 3 floats between 6 or 12 kg weights and a weight spacing of 120 m.

Results – factors influencing sink time to depth

TDR position within weight / float sequence

It depends…

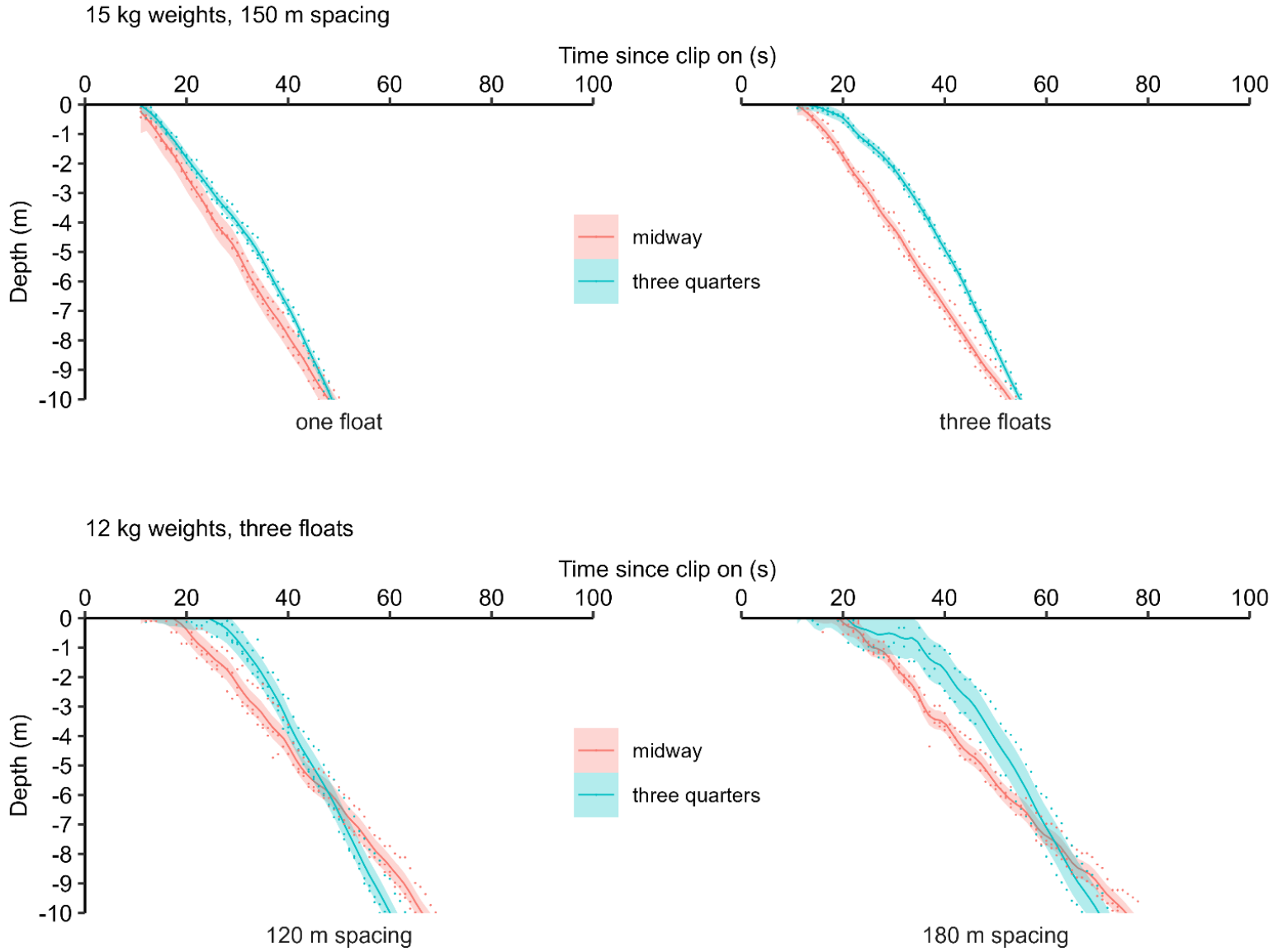


Figure 11. Depth over time for TDRs placed midway between weights and three quarters of the way after a weight for different line configurations.

Results – factors influencing sink time to depth

Modified floats

Sink the line much faster

Normal floats on 2 fm ropes help too

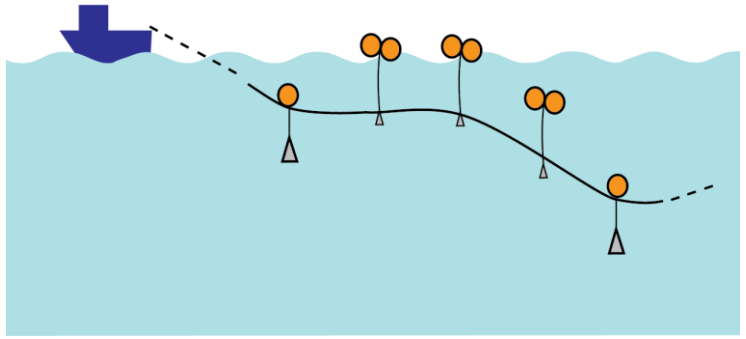
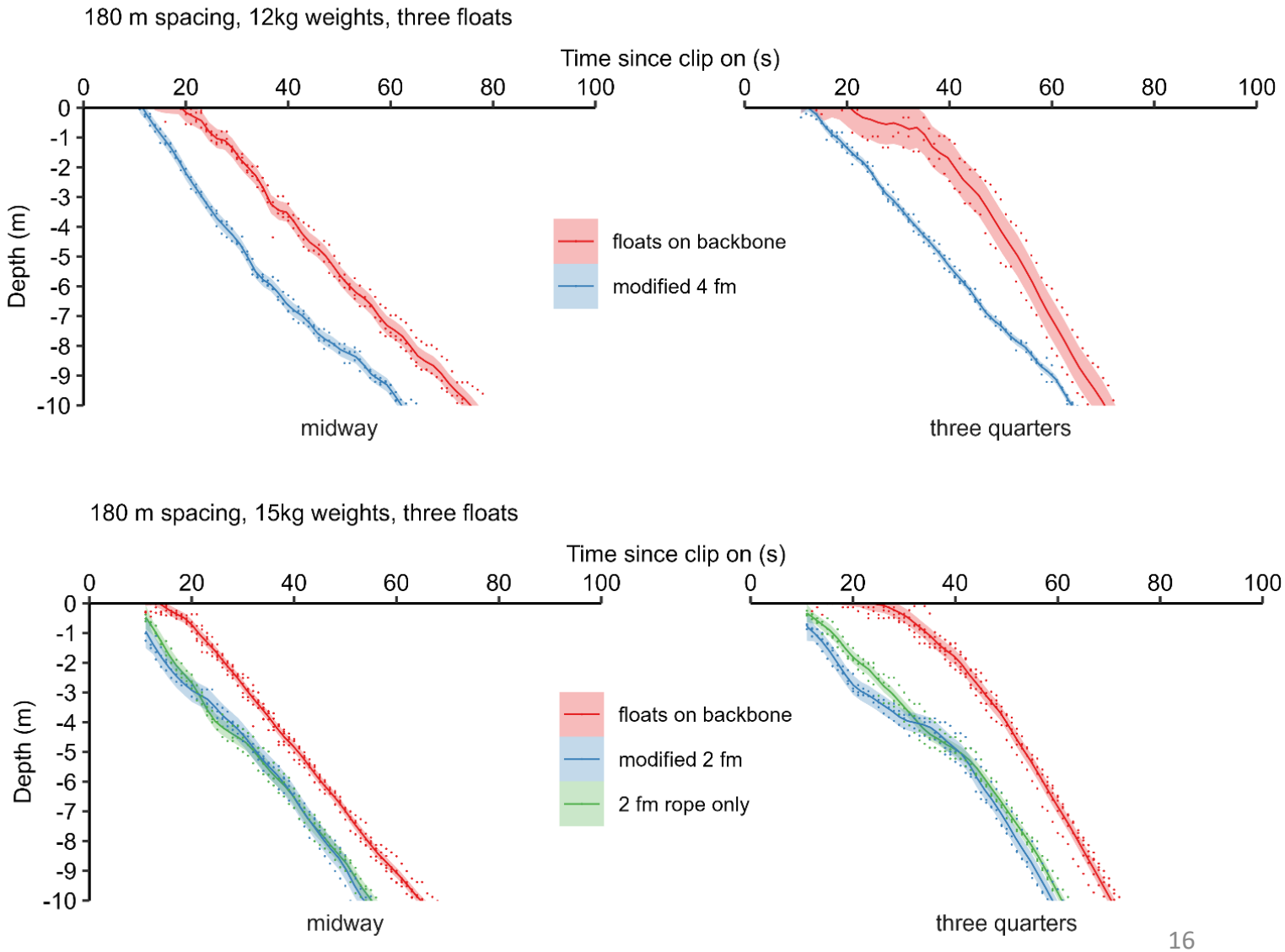


Figure 12. Depth over time for TDRs placed midway between weights and three quarters of the way after a weight for modified float configurations.



Tori lines

Need much more drag at lower speeds

Series drag options performed better

- More consistent drag
- Best compromise enough drag without being too long / bulky

Figure 13. Tori line aerial and drag sections

Table 1. Summary of tori trials

Drag section description	Speed (knots)	Min aerial extent (m)	Max aerial extent (m)	Min drag (kg)	Max drag (kg)
18 m 32 / 52 mm rope with 8 cones, 30 m 9 mm + 30 gillnet floats	3.0	95	105	12	15
	2.5	75	100	10	13
	2.3	70	75	8	9

Overall results summary

Our benchmark was a 70 m tori at 3 knots (or 100 m at 4 knots).

60 m spacing: 6 or 9 kg weights ok, usually only 1 float anyway.

120 m spacing: 9 kg weights ok, but needed: heavier weights (15kg), or modified floats for 3 float setups.

180 m spacing with 3 floats: Required: modified floats (12 kg weights), or 15 kg weights and 2 fm ropes.

150 m spacing: 15 kg weights, 3 floats ok

240 m spacing: about the limit with 4 fm modified floats, 4 float setup

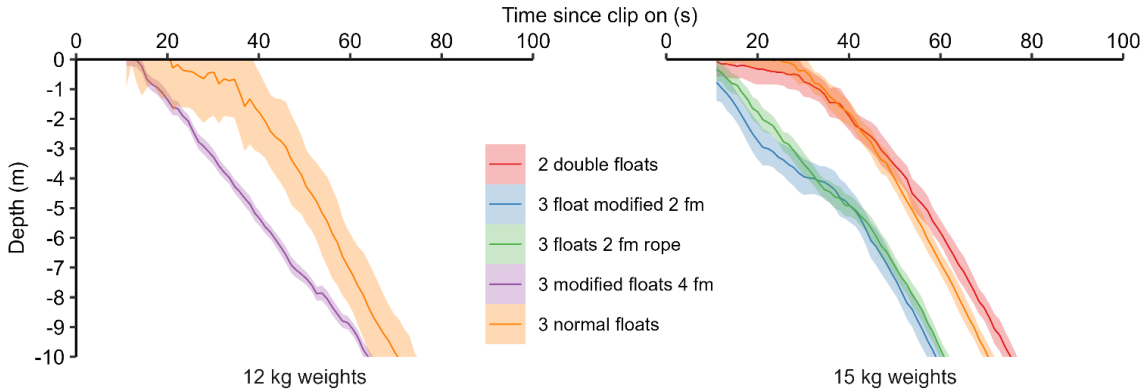
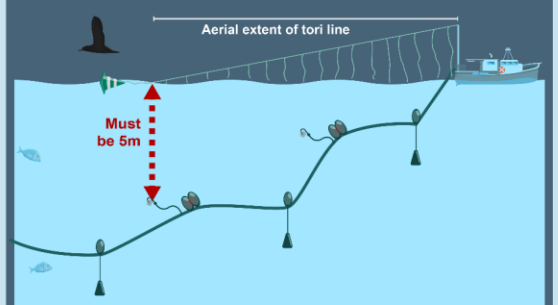


Figure 14. Depth over time for TDRs placed on last float for configurations with 180 m weight spacing

Presenting results to fishers

Keep seabirds from accessing hooks

New Regulations (August 2021)



The regulations require the slowest sinking hook to be at least five metres deep before the end of the tori line aerial extent.

During high-risk periods tori line aerial extent must always reach at least 50 m.

Three guiding principles to improve tori line aerial extent

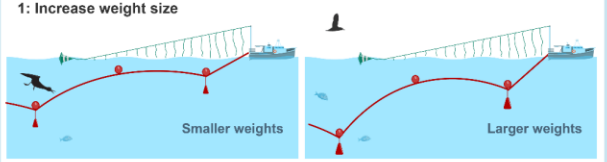
1. Increase the height of your tori pole
2. Increase drag to hold up longer tori lines
3. Make aerial sections lightweight so they are easier to hold up

The recommended aerial section of tori line is 3 mm dyneema with light streamers.

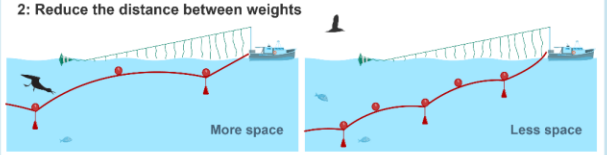
✓ If this still doesn't provide enough aerial extent, reduce weight spacing and / or use larger weights.

Seven guiding principles to help sink your line closer astern

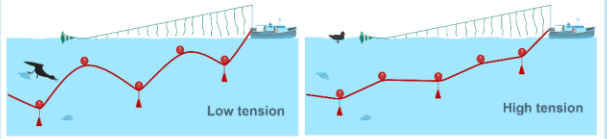
1: Increase weight size



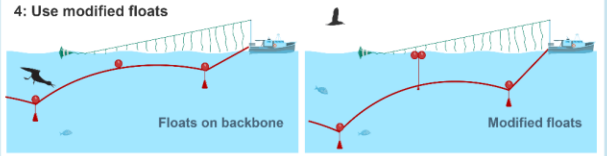
2: Reduce the distance between weights



3: Increase line tension *More tension on the line speeds up sink rate for hooks between weights*



4: Use modified floats



5: Increase line weighting on rope backbone
Larger diameter and rope backbones sink slower, so require more weight.

6. Reduce setting speed
Hooks will sink closer to the boat and reduce the aerial extent required.

7. Set with the tide
Lines set into the tide will sink slower

Tables for estimating required tori line aerial extent (m)

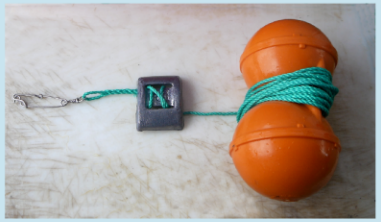
Look up different gear set-ups in the tables below to estimate the tori line aerial extent required to protect hooks up to a depth of 5 m.

Tori aerial extent required : Green = recommended < 70 m Orange = difficult to achieve Grey = not recommended

Gear setup			Tori aerial extent	
spacing	weight	floats	3 knots	4 knots
60 m	6 kg	0	49	65
60 m	6 kg	1	57	76
60 m	9 kg	0	57	76
60 m	9 kg	1	46	61
120 m	6 kg	0	88	117
120 m	6 kg	1	102	136
120 m	6 kg	2	109	145
120 m	6 kg	3	136	181
120 m	9 kg	0	56	75
120 m	9 kg	1	66	88
120 m	9 kg	2	77	103
120 m	9 kg	2 modified	57	76
120 m	9 kg	3	88	117
120 m	9 kg	3 modified	54	72
120 m	12 kg	0	56	75
120 m	12 kg	1	59	79
120 m	12 kg	2	77	103
120 m	12 kg	3	80	107
120 m	12 kg	3 modified	63	84
120 m	15 kg	2	63	84

Gear setup			Tori aerial extent	
spacing	weight	floats	3 knots	4 knots
150 m	15 kg	1	59	79
150 m	15 kg	3	69	92
180 m	12 kg	1	82	109
180 m	12 kg	2	100	133
180 m	12 kg	2 modified	66	88
180 m	12 kg	3	83	111
180 m	12 kg	3 modified	68	91
180 m	15 kg	3	91	121
180 m	15 kg	2 double	97	129
180 m	15 kg	3 modified (2fm)	74	99
240 m	15 kg	3 modified	60	80
300 m	15 kg	4 modified	71	95

Numbers will vary between boats so this should only be used as a guide.
These guidelines are based on trials conducted with a free-wheeling hydraulic drum with 6 mm mono backbone, lead weights,150 mm diameter hard floats, weights on 3.6 m rope droppers.
Lines set into the tide, and with rope backbones, will sink slower



Modified floats consisted of two 150 mm floats on 4 fathom (7.2) m ropes (unless stated otherwise), with a 1.3 kg lead weight at the clip.

Tori line drag sections require thick rope and / or multiple cones, especially at low speeds.

Conclusions

Results should be useful for fishers and liaison officers, and hopefully improve compliance

Should be broadly applicable across the fleet,
noting potential influence of other variables e.g. backbone, tension etc.

Options for fishers:

- Shoot with tide
- Improve tori lines
- Larger weights (and / or reducing spacing maybe)
- Modified floats / increased tension likely necessary for weight spacings > 150 m

Regulations are achievable

But not sure of trade-offs in a fishing context (time, catch rates, modified float practicality)

Recommendations

Trial legal gear setups during a normal fishing trip (catch rates / practicality / trade offs).

Check PSRMPs to ensure that all gear configurations in use are recorded, with a vessel-derived sink time to five metres.

Collate and review vessels' sink rate data (target vessels that need to improve sink times).

Use the information presented here to support fishers both generally,

for example in port-based workshops, and individually, for example on fishing trips.

Improve tori lines. Include tori (drag) specifications on PSRMPs.

Train and brief observers to audit PSRMPs and provide feedback to fishers .

Expecting fishers (and observers?) to measure the sink time to depth for the slowest hook is probably unreasonable. The regulations could be simplified, especially as 5 m is arbitrary.

Acknowledgements

The authors would particularly like to thank the following people:

- Workshop participants and fishers who provided input to the list of gear configuration to be tested.
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- John Cleal at FVMS for advice, and for sharing his knowledge of the fleet.
- Fisheries New Zealand.

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