MIT2018-03: Setting mitigation for small longline vessels

Development of an Adaptive Management tool for line setting: final report

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FISHERIES INSHORE NEW ZEALAND

PISCES RESEARCH

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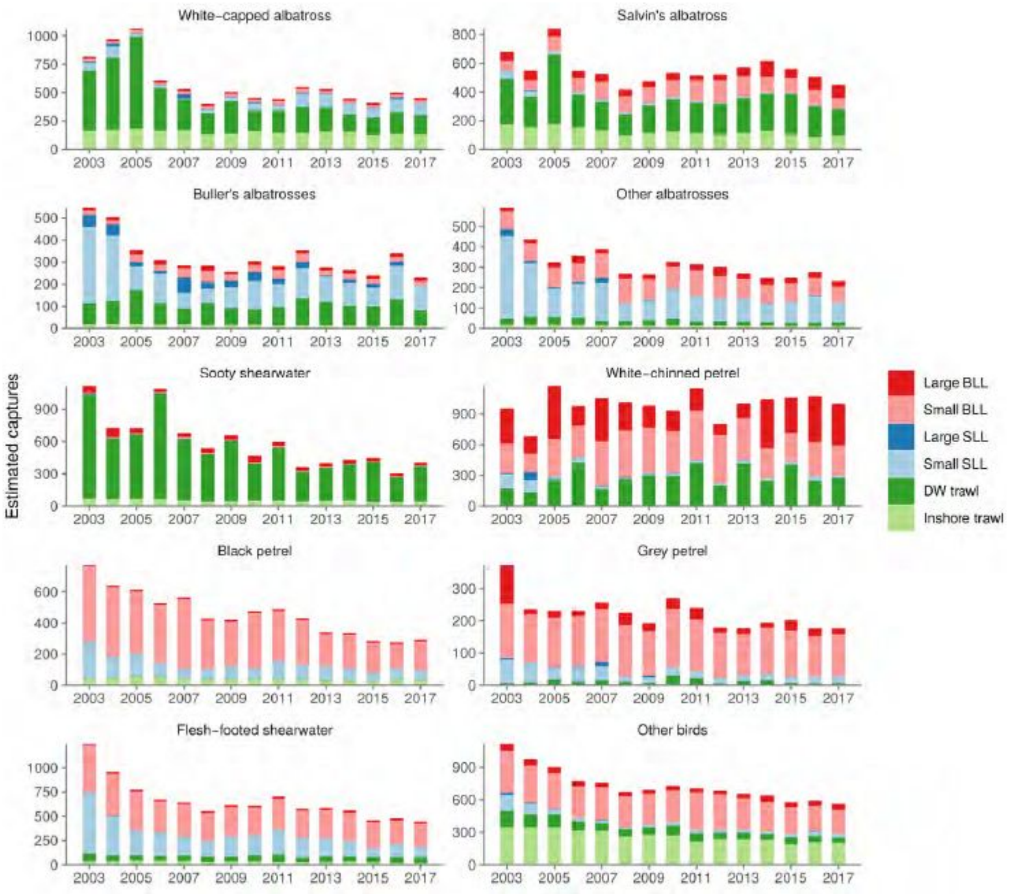
Outline

- Rationale and background
- Methodologies
  - Sensors
  - Data download and transfer
  - Feedback of data to fishers
  - Data processing, calculating depth
- Results
  - Participation
  - Broad comparisons (between method, vessel etc)
  - Evaluation of estimates
  - Fisher feedback
- Conclusions and recommendations

Rationale

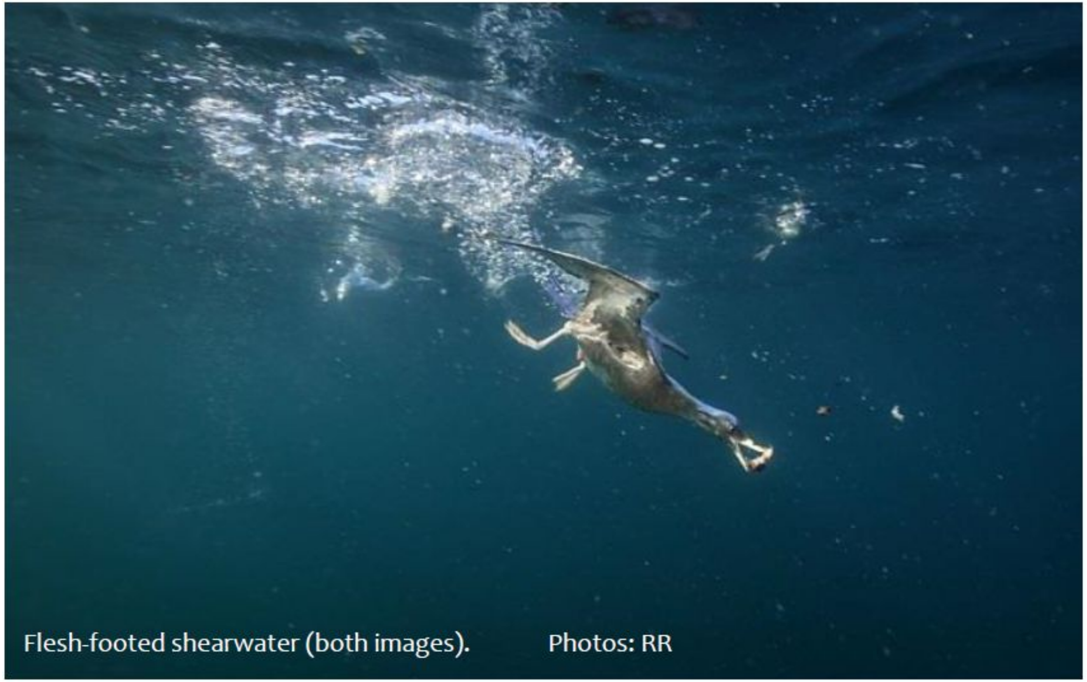
Small vessel surface (SLL) and bottom longline (BLL) fisheries pose a risk to several seabird species



MPI AEBAR 2019, Figure 8.7

Nature of the risk (1)

- Risk arises due to seabirds foraging on baited hooks, particularly during line setting
- Mitigation focuses on limiting seabird access to hooks within diving depths



From Friesen *et al.* 2017. Diving & foraging behaviour of petrels & shearwaters. Final report for CSP project INT2015-04.

Nature of the risk (2)

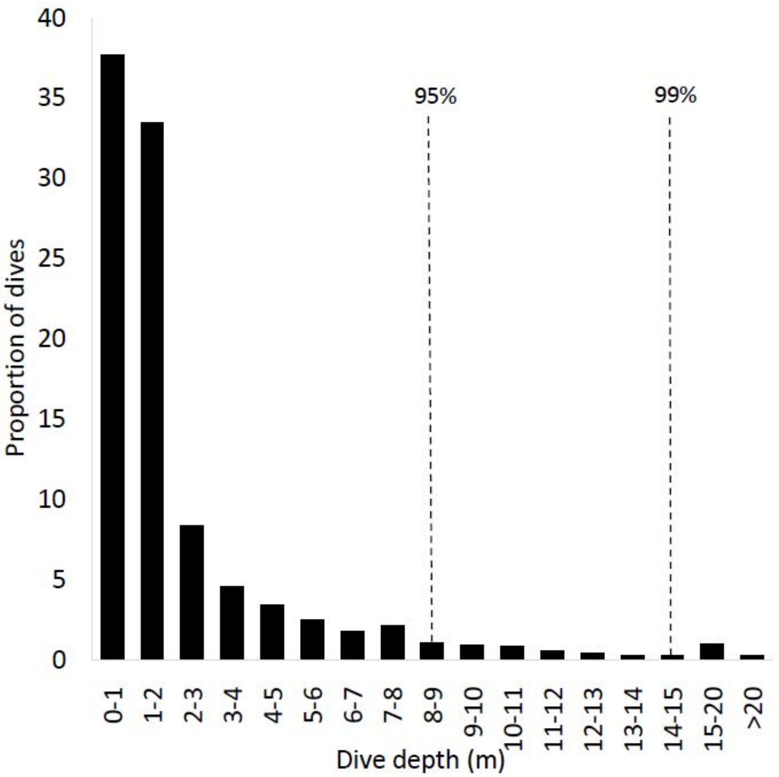
Potential exposure varies between taxa

Bentley et al. (2021) noted capillary depth gauges overestimate seabird dive depths. Using TDR data:

- small albatrosses undertake infrequent, short and shallow dives, reaching <1.5 m on average
- many shearwaters are proficient divers, attaining mean maximum depths of 10–20 m
- the *Procellaria* petrels are also proficient divers; with mean diving depths of around 3 m and maximum depths of 15–25 m

Nature of the risk (3)

- Deep dives are possible
  - e.g. Rayner et al recorded a maximum of 66.5m for flesh footed shearwaters
- But most dives are shallow
  - Bell (2016), 1673 dives of black petrels



From Bell, E.A. 2016. Diving behaviour of black petrels (*Procellaria parkinsoni*) in New Zealand waters and its relevance to fisheries interaction. *Notornis* 63 (2): 57-65.

NPOA Seabirds 2020

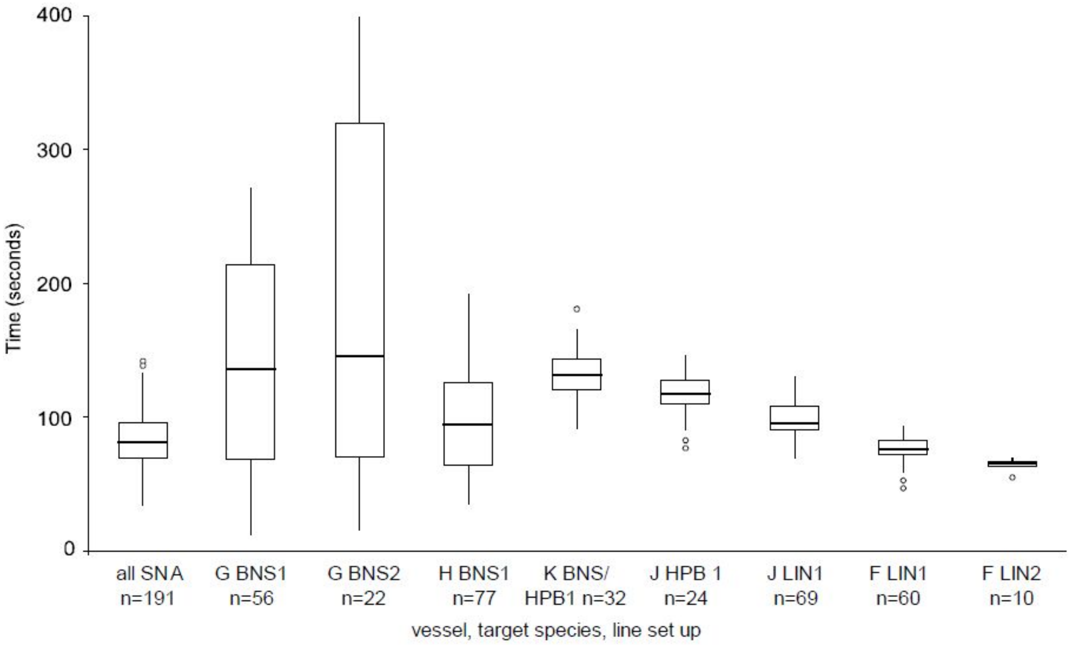
Seabird bycatch mitigation involves statutory and non-statutory approaches, applied on a vessel-specific basis

Statutory mitigation requirements

- Surface longline
  - Fisheries (Seabird Mitigation Measures – Surface Longlines) Circular 2019
  - Applies to any commercial fisher when setting surface longlines
  - Requires use of hook shielding devices or a streamer line, and either setting at night and/or use of a prescribed line weighting regime
  - Streamer line specifications vary depending on the length of the vessel
- Bottom longline
  - Fisheries (Seabird Mitigation Measures – Bottom Longlines) Circular 2020
  - Applies to commercial fishers using bottom longlines
  - Requires the use of a streamer line while setting on vessels >= 7 m overall length, line specifications that vary depending on the length of the vessel
  - Requires night setting unless a defined line weighting regime is followed
  - Restrictions on offal discharge

Longline sink rates

- Regulations specify a 'one size fits all' approach to weighting regimes
- Actual sink rates vary, e.g.:
  - Target species
  - Gear configuration
  - Oceanographic conditions
  - Setting speed



From Goad, D. 2011. Development of mitigation strategies: inshore fisheries. Final report for CSP project MIT2010-01

Mitigation standards

Aim to describe current “best practice”

Desired outcomes:

1. The discharge of fish waste from the vessel is managed so as not to attract seabirds to risk areas
2. Seabirds are not able to access baited hooks during setting
3. Seabird access to hooks during hauling is minimised
4. The risk of deck landings or impacts against the vessel is minimised

For BLL, the Standards have an outcome based approach, i.e. hooks protected by streamer line unit a specified depth is reached

Project goal

To provide fishers with ‘real time’ information on realised line sink rates to allow adaptive management of fishing practices to mitigate the risk to seabirds within a trip

Methodologies

Approach

- Routine deployment of time-depth recorders on longline sets
  - Zebra-Tech ‘Wet Tags’
- Collect data from a large number of sets to better understand variation
- Provide fishers with data on sink rates to facilitate on water adaptation

Original version

Revised version

Wet Tags

- Long battery life (> 5 years)
- Automatic recording when immersed (pressure sensor)
- Bluetooth data download
- 5 s sampling interval
- Original logging interval 1 to 24 hours (mean depth/temperature)
- Modified firmware:
  - Record at 5 s interval to depths of 20 m
  - Record at 1 min interval when deeper than 20 m
- Using 150 m maximum depth version to provide greatest resolution
- 1.5 m activation depth

Project progress (4 June 2020)

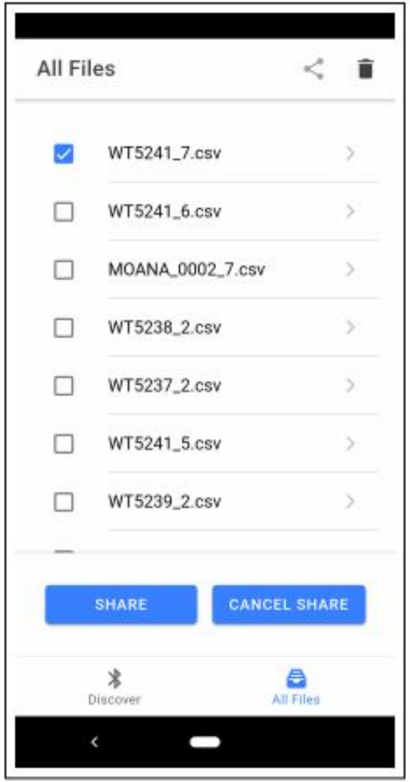
- 10 initial sensors with revised firmware
- Two test trips, ongoing use on one vessel
- Email data submission
- *Addressed issues with data download*
- Revised firmware, updated app
- Updated wet tags received for deployment on 9 BLL and 9 SLL vessels
- *COVID-19 hiatus*
- Dispatch to vessels
- **Routine data collection**
- **Adaptive management app**

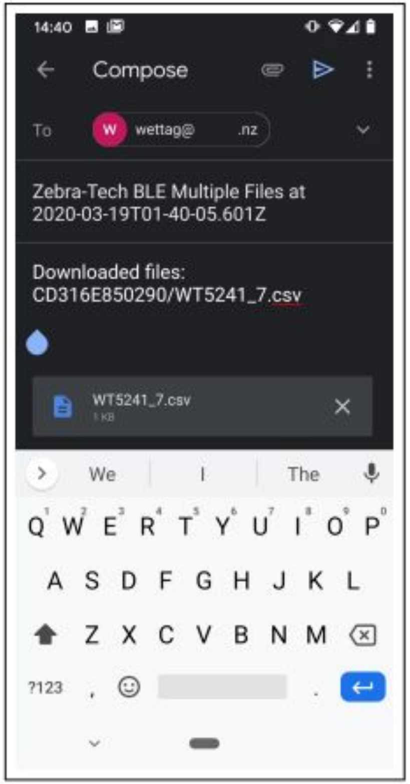
Bluetooth data download

Zebra-Tech BLE app

Moana project Deck Unit provide autonomous data download on one BLL vessel

Data submission by email

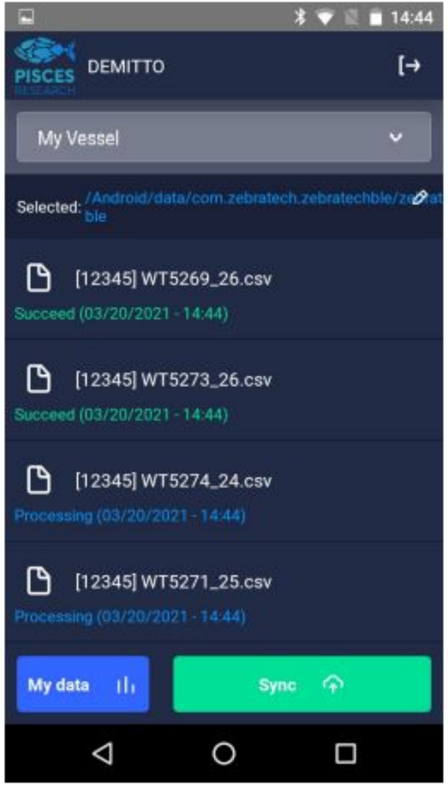


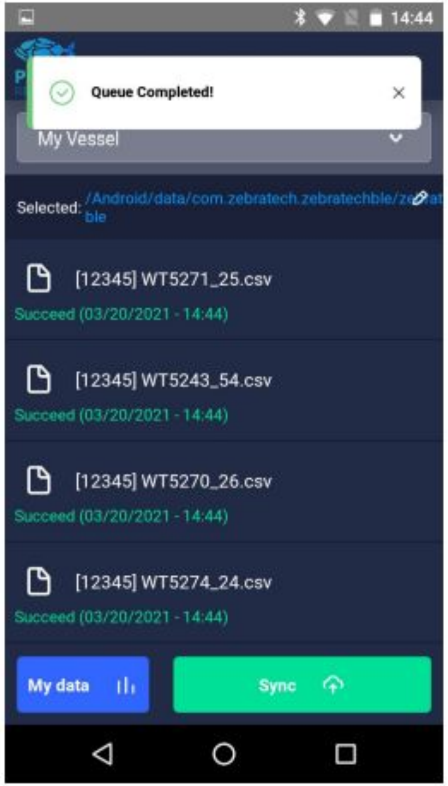


Demitto app - file discovery and sync

Multiple vessels >

Access results >

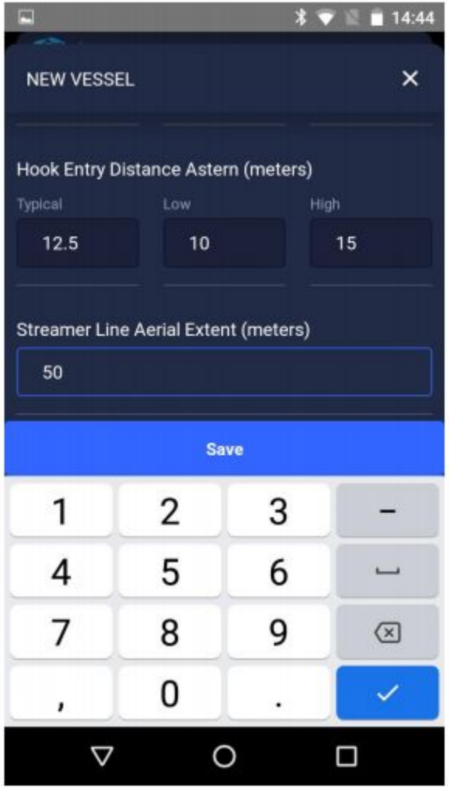


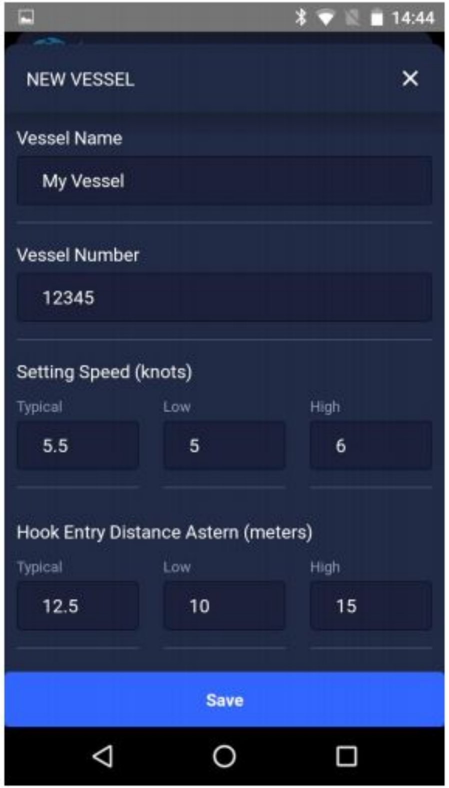


Demitto app - vessel parameters

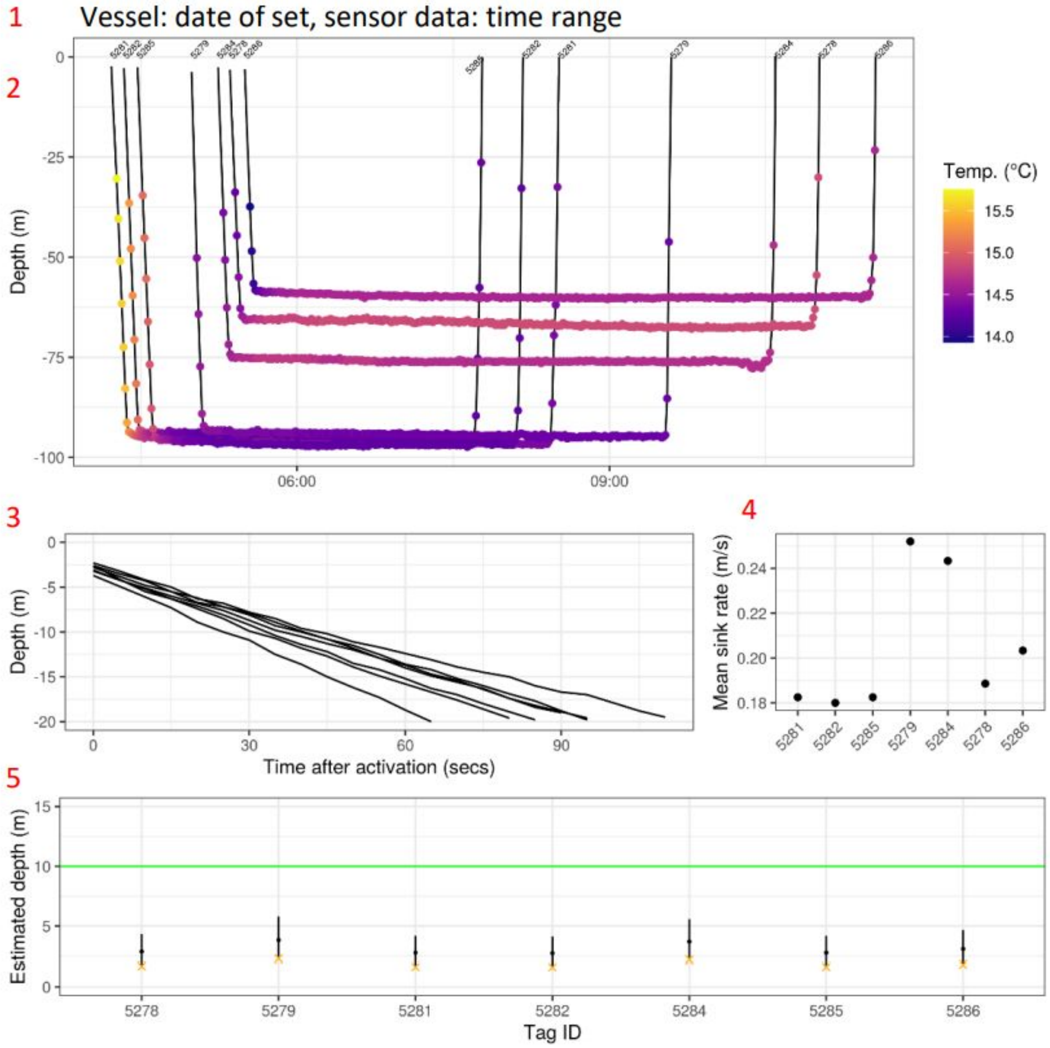
Required parameters:

- Setting speed (typical, low, high)
- Line entry astern (typical, low, high)
- Streamer line aerial extent

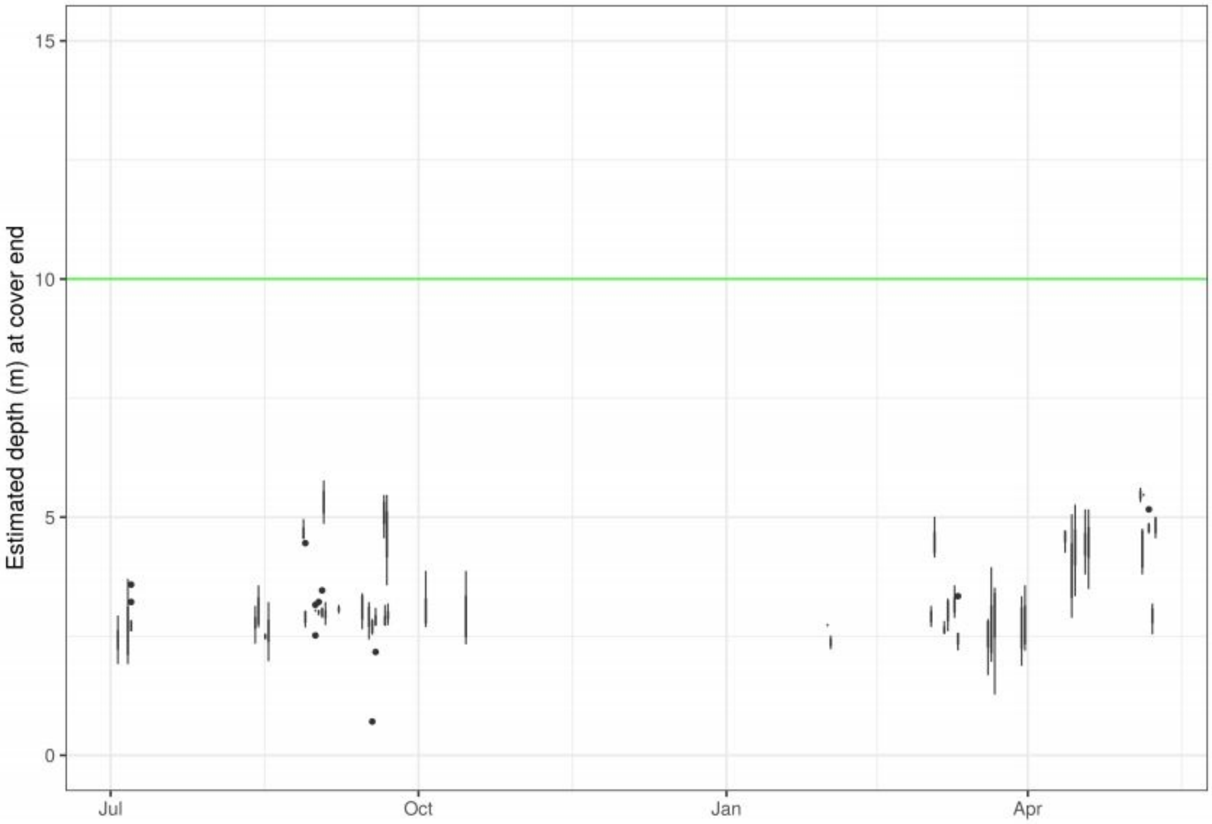




Demitto app - results



Vessel-specific trends over time



Data processing

1. Import CSV files; separate header block and data block
2. Link to vessel data and setting parameters
3. Identify tag deployments; retain “real” deployments (vs activation “dunks”)
4. Group overlapping deployments (i.e. sensors deployed on the same line)
5. Link deployment groups to statutory catch-effort data (provides information on target species etc.)

Estimating depth at streamer line extent

- Wet Tags do not record clip on event
  - tags are above water initially
  - activation takes some time (trigger settings to ensure tag does not activate on surface due to changes in atmospheric pressure)
  - first data point ~ 3 m
- Streamer lines provide coverage for a relatively short time
  - 50 m aerial extent
  - Setting at 5 kn (2.57 m/s)
  - Coverage for 19.4 s
  - If hooks enter water 5 m astern then have 17.5 s of sinking time

Estimating depth at streamer line extent

- Using Wet Tag data, estimate mean sink rate for period from activation to a depth of 10 m
- Covered period (secs), $c = (e - o) / v$, for
  - e = streamer line aerial extent (m)
  - o = hook entry distance behind vessel (m)
  - v = setting speed (m/s)
- Depth (m) at limit of streamer line, $d = c \cdot s$ where s is sink rate (m/s)

Results

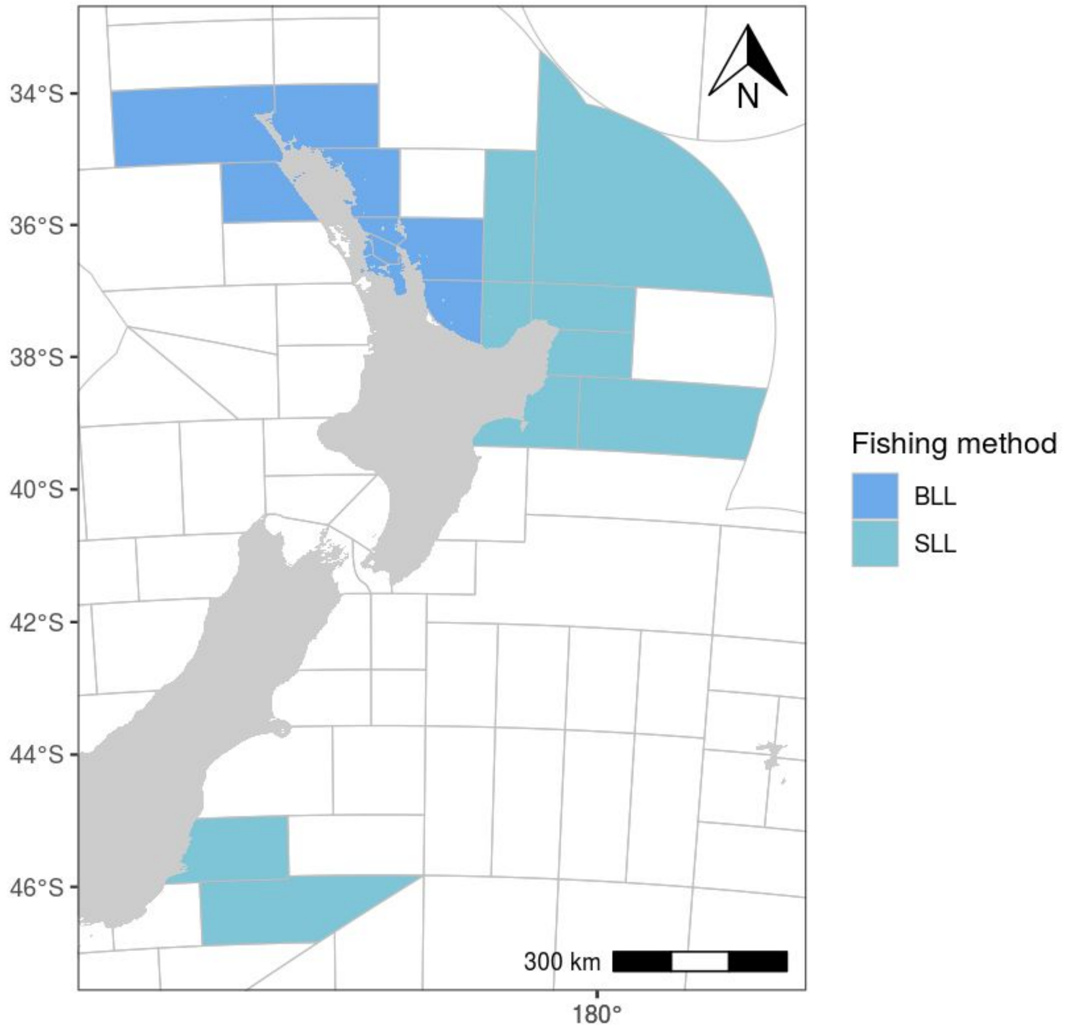
Uptake

Fishing method	Vessels returning data
BLL	6
SLL	2

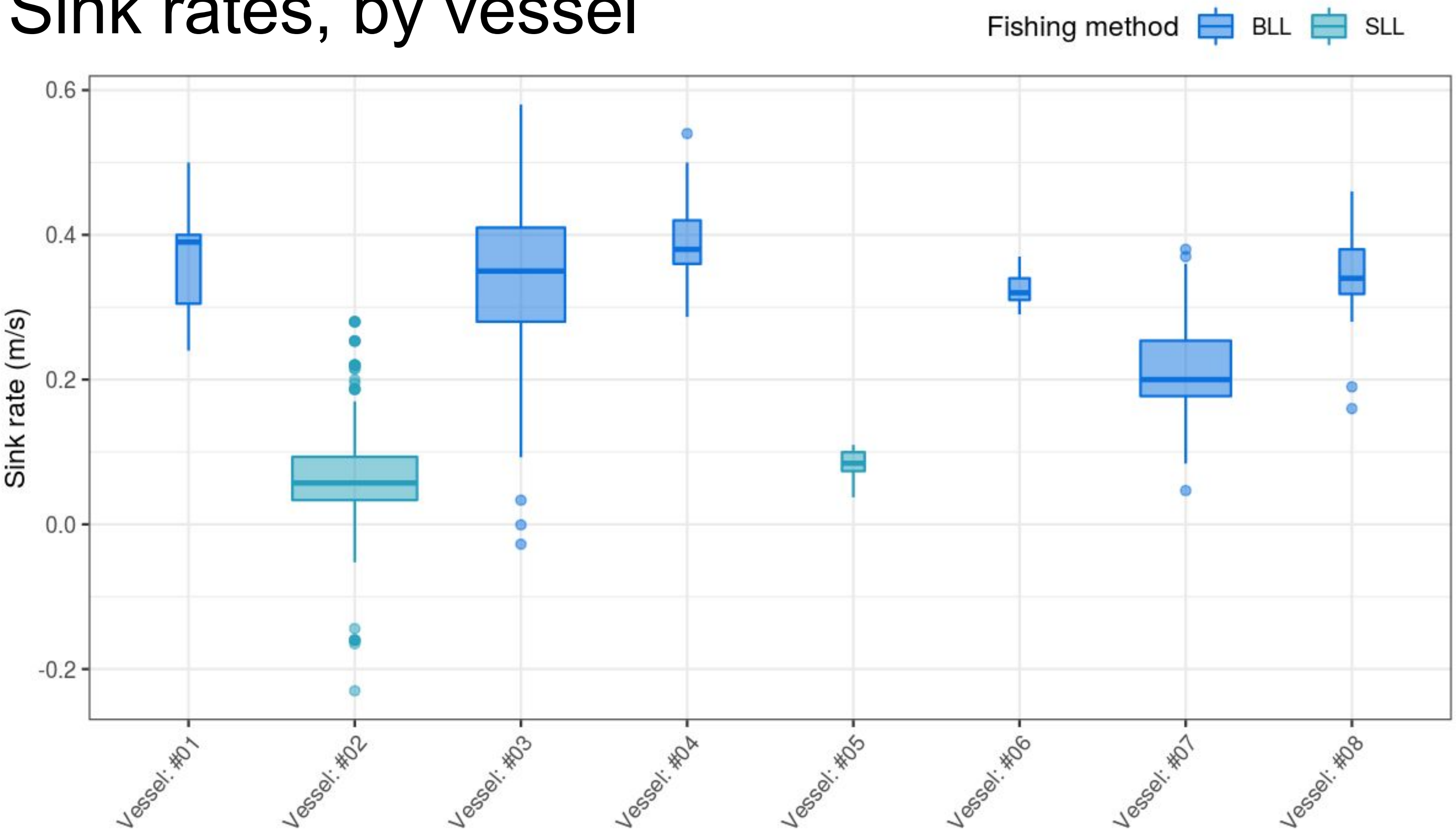
Fishing method	Target species	Number of sets
BLL	GUR	1
BLL	RSN	5
BLL	SNA	193
SLL	STN	62

Data received

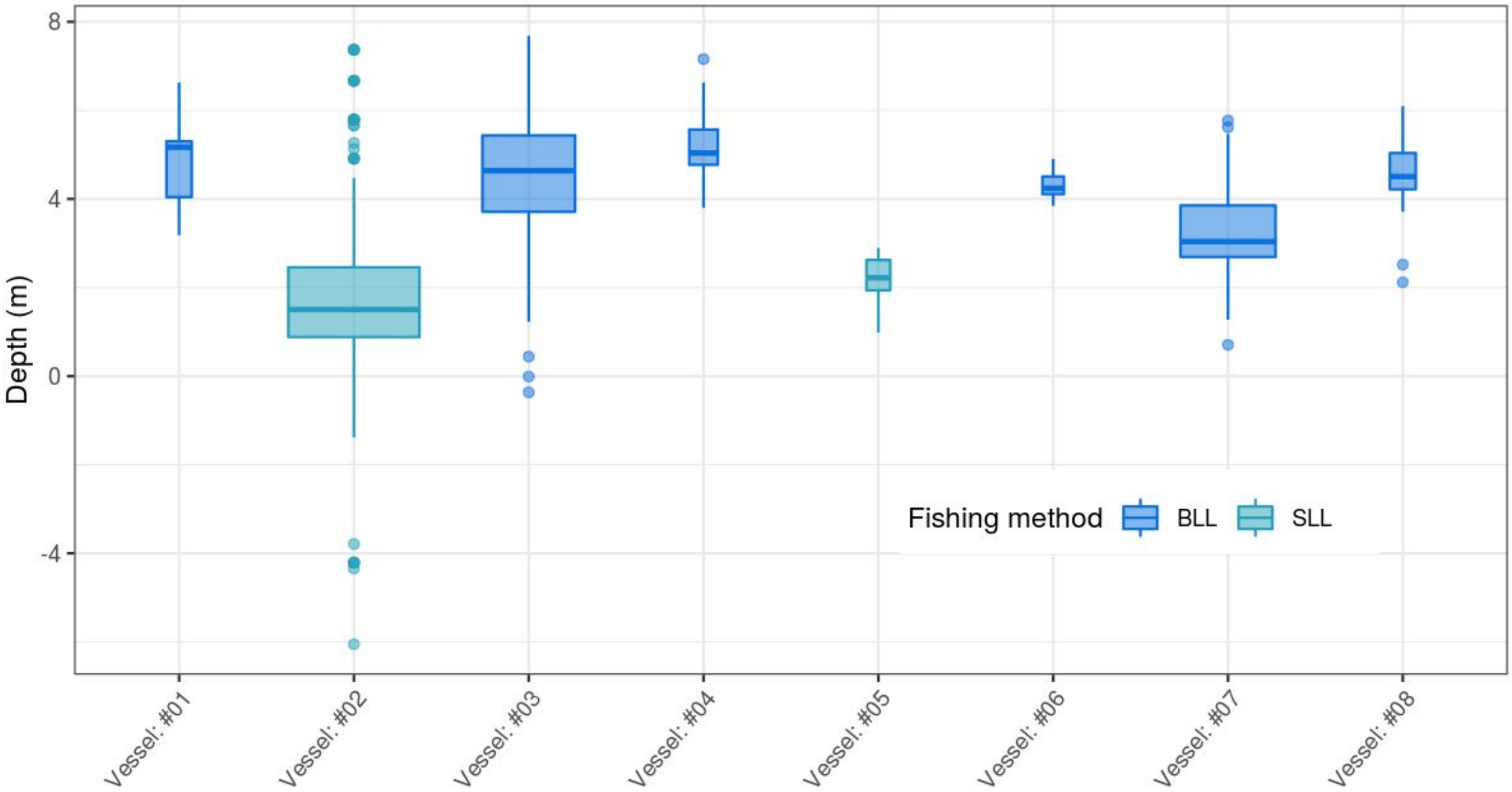
- 1034 deployments
- 288 sets
    - 264 matched to statutory catch effort data



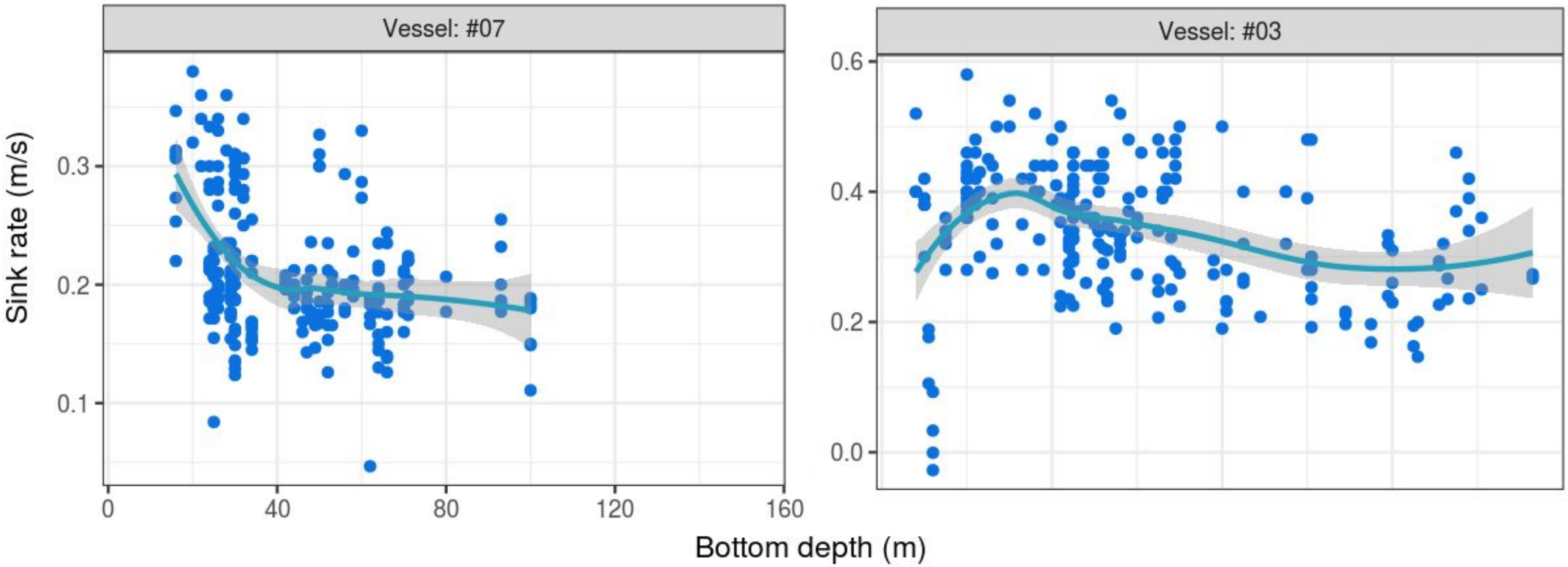
Sink rates, by vessel



Estimated depths at streamer line end



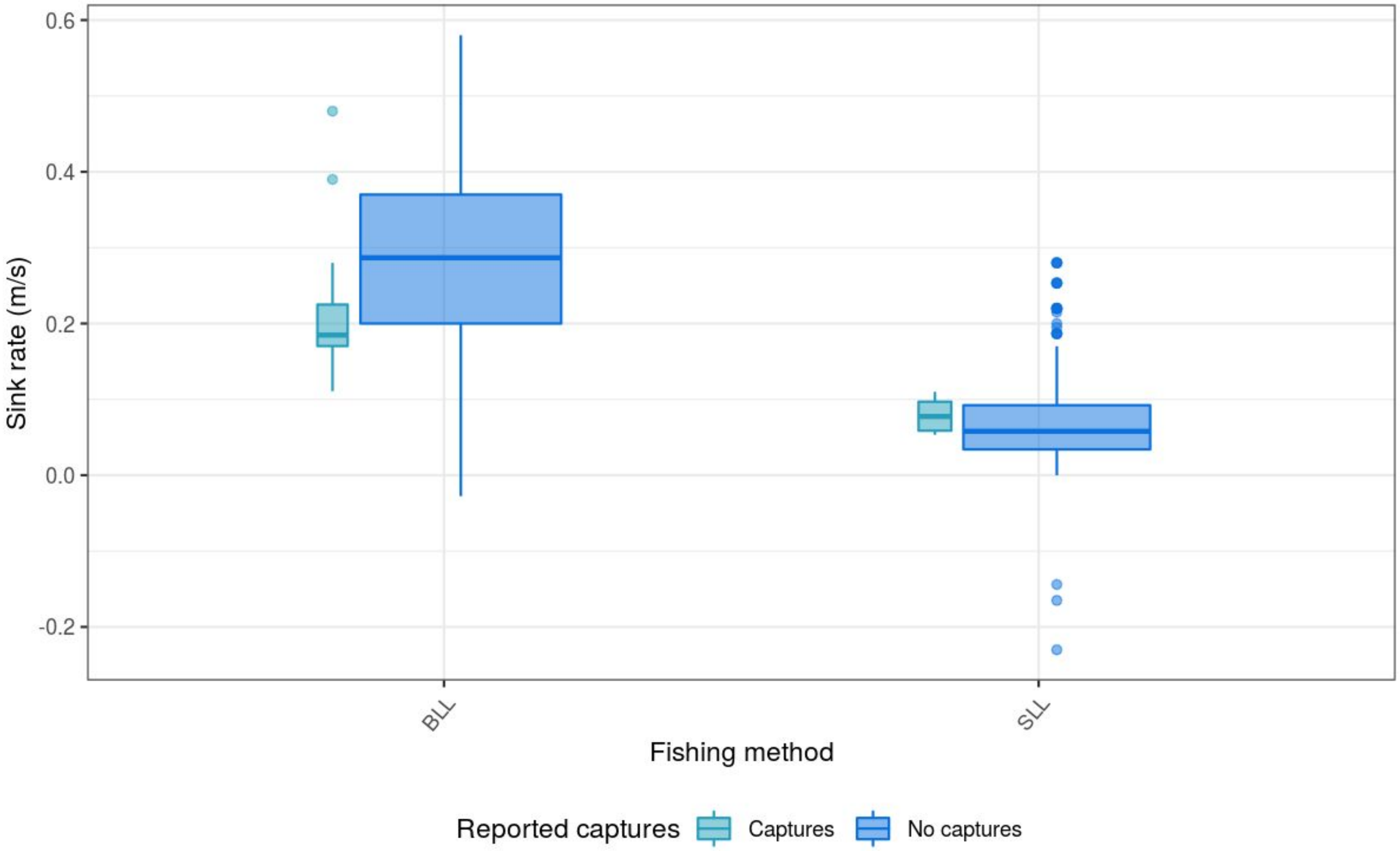
Relationship with bottom depth



Captures

Only 4 sets with fisher reported captures (3 x BLL, 1 x SLL)

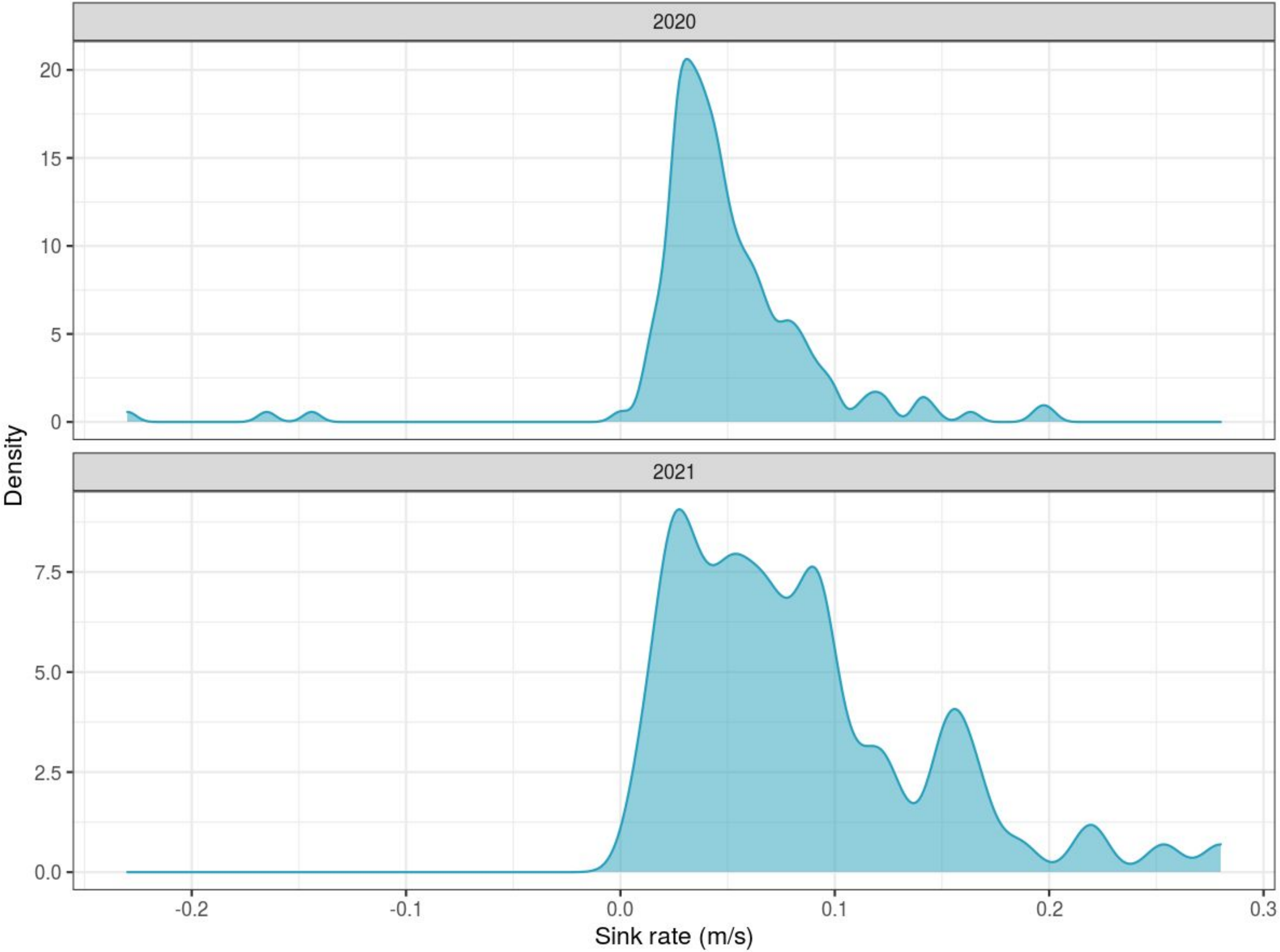
Hint that captures are associated with slower sink rates (for BLL)



SLL sink rate

2020 deployments on snoods without hooks

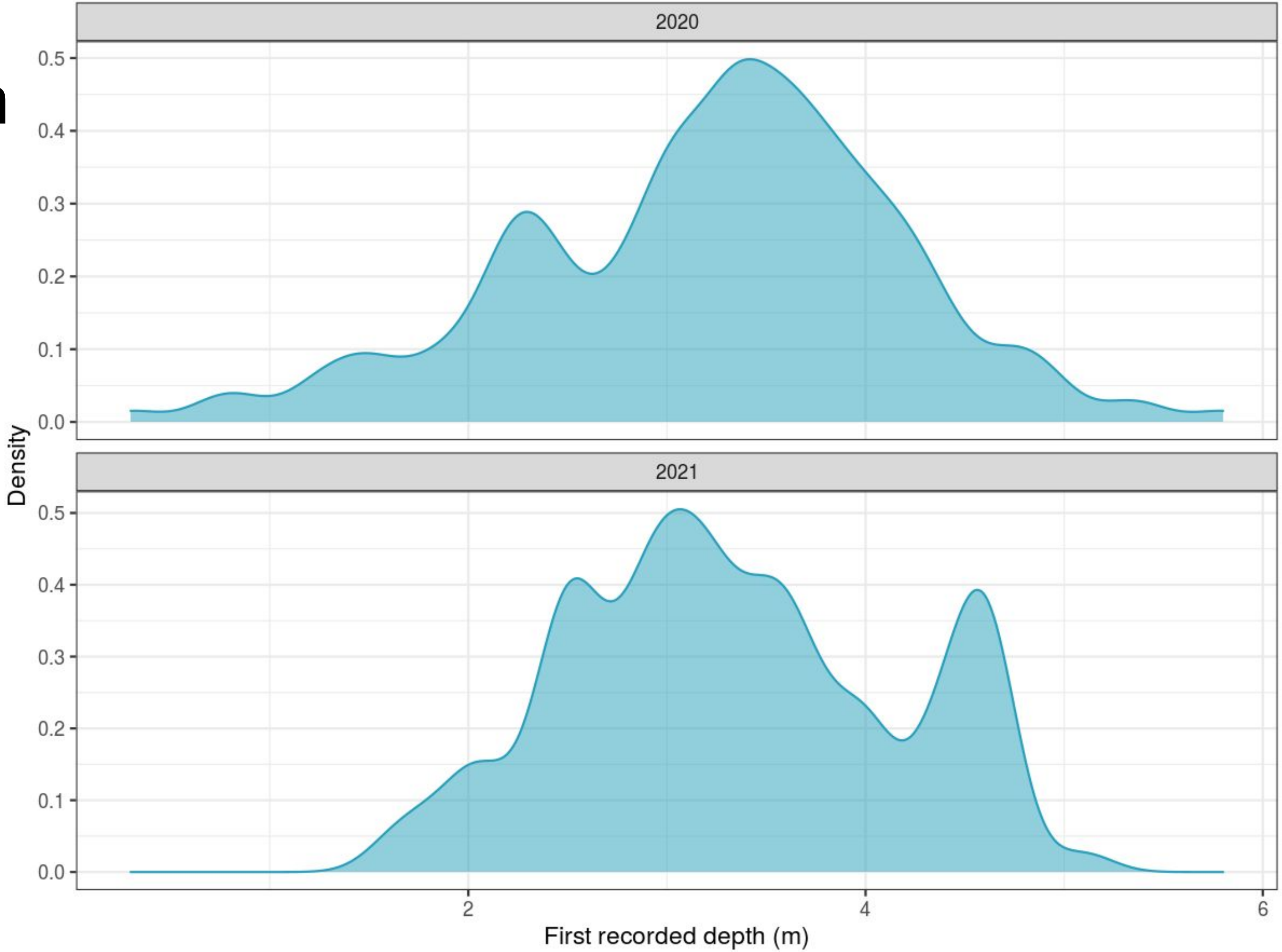
2021 deployments had a mix of no hooks and snoods with baited hooks



SLL first depth

Snoods with sensors only sink more slowly than baited hooks

Sensor loss is an issue with deployment on baited snoods

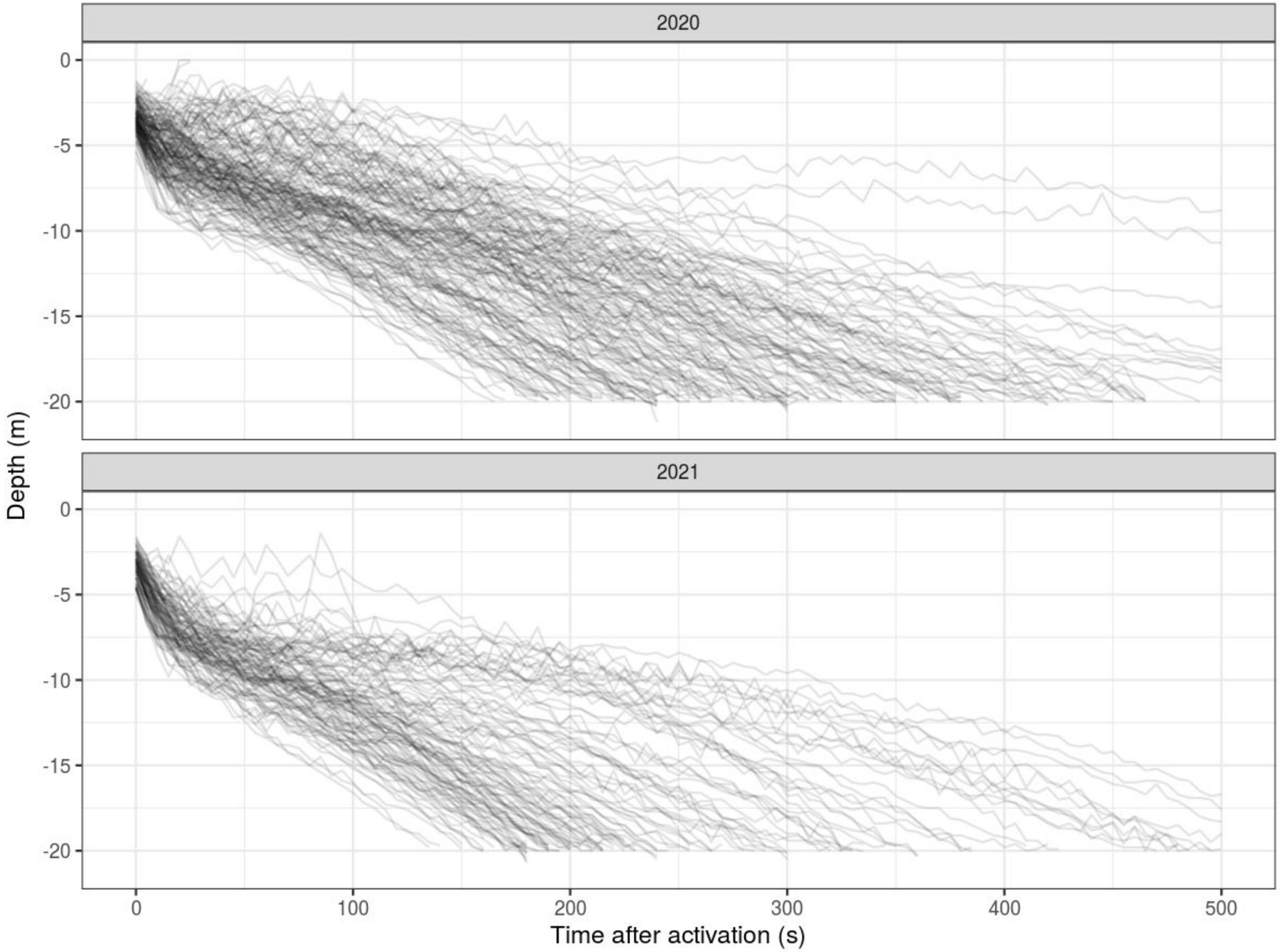


SLL profiles

Free-sink period is evident in aggregate data

Mean sink rate is underestimated

Overall initial rate appears to be 0.1 - 0.2 (m/s) (lower than free fall in calm conditions)



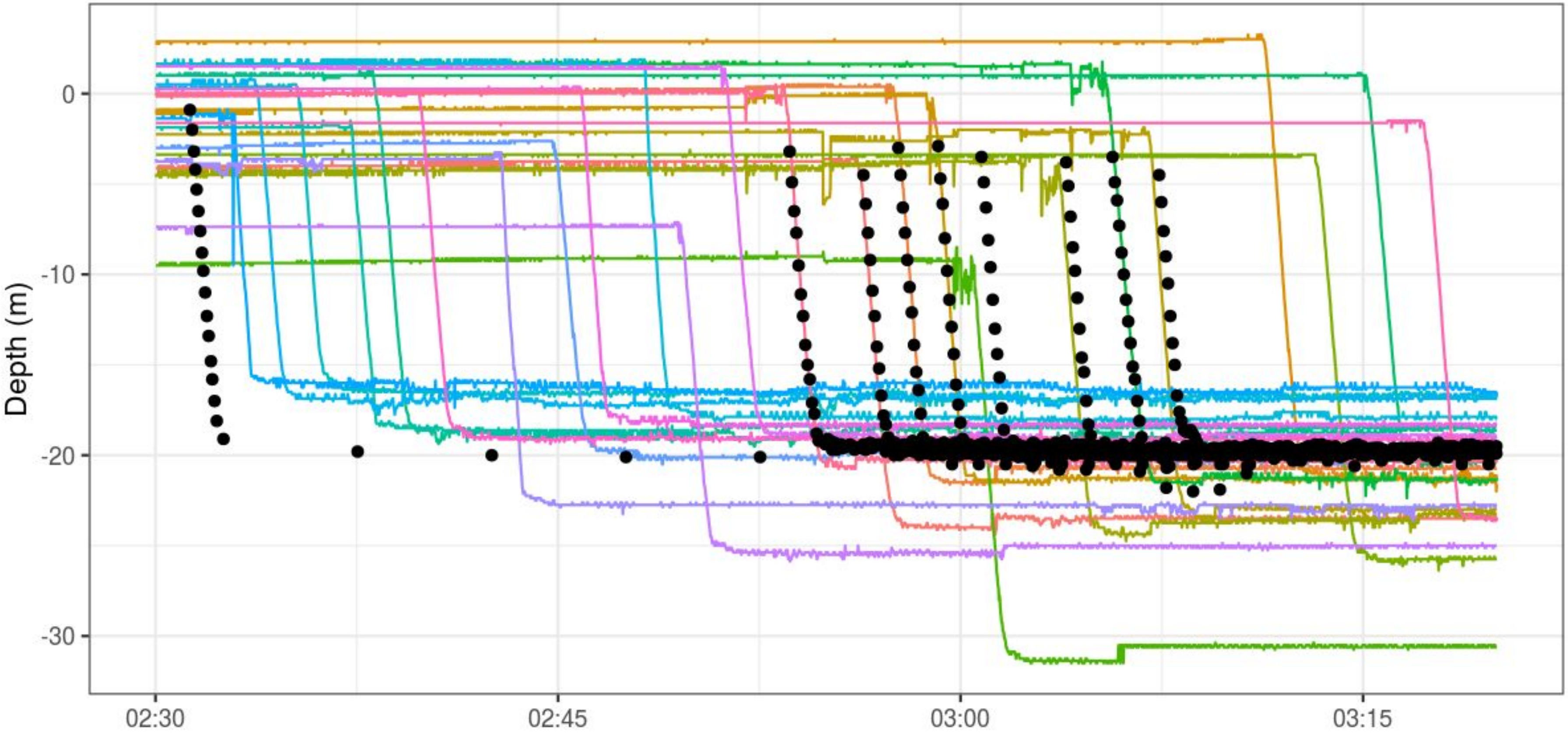
Paired tests - BLL

Paired deployments of CEFAS G5 TDRs and Wet Tags on 3 days of BLL fishing

Manual recording of clip on and water entry times

Pair	Speed	G5 tag	Wet Tag	Clip on	Water entry	Placement
1	6	A17237	5321	2021-05-07 02:53:20	2021-05-07 02:53:24	0.50
2	6	A17041	5322	2021-05-07 02:56:01	2021-05-07 02:56:06	0.75
3	6	A17042	5324	2021-05-07 02:57:22	2021-05-07 02:57:29	0.50
4	6	A17044	5320	2021-05-07 02:58:52	2021-05-07 02:58:57	0.75
5	6	A17050	5285	2021-05-07 03:00:16	2021-05-07 03:00:22	0.50
6	6	A17048	5280	2021-05-07 03:03:31	2021-05-07 03:03:37	0.75
7	6	A17046	5284	2021-05-07 03:05:15	2021-05-07 03:05:20	0.50
8	6	A17052	5279	2021-05-07 03:07:50	2021-05-07 03:07:57	0.75
9	4	A17046	5284	2021-05-08 04:03:17		0.00
10	4	A17048	5280	2021-05-08 04:04:29		0.00
11	4	A17052	5279	2021-05-08 04:06:10	2021-05-08 04:06:19	0.50
12	4	A17050	5285	2021-05-08 04:07:09		0.50
13	4	A17041	5322	2021-05-08 04:08:29	2021-05-08 04:08:36	0.75
14	4	A17044	5320	2021-05-08 04:09:36	2021-05-08 04:09:43	0.75
15	4	A17237	5321	2021-05-08 04:10:38	2021-05-08 04:10:48	0.75
16	4	A17042	5324	2021-05-08 04:11:32		0.50
17	6	A17046	5284	2021-05-09 02:48:32		0.00
18	6	A17048	5280	2021-05-09 02:49:47	2021-05-09 02:49:54	0.50
19	6	A17052	5279	2021-05-09 02:50:24		0.75
20	6	A17050	5285	2021-05-09 02:51:23	2021-05-09 02:51:24	0.00
21	6	A17041	5322	2021-05-09 02:52:12	2021-05-09 02:52:17	0.33
22	6	A17044	5320	2021-05-09 02:53:16	2021-05-09 02:53:21	0.75
23	6	A17237	5321	2021-05-09 02:56:37	2021-05-09 02:56:41	0.50
24	6	A17042	5324	2021-05-09 02:57:13	2021-05-09 02:57:19	0.75

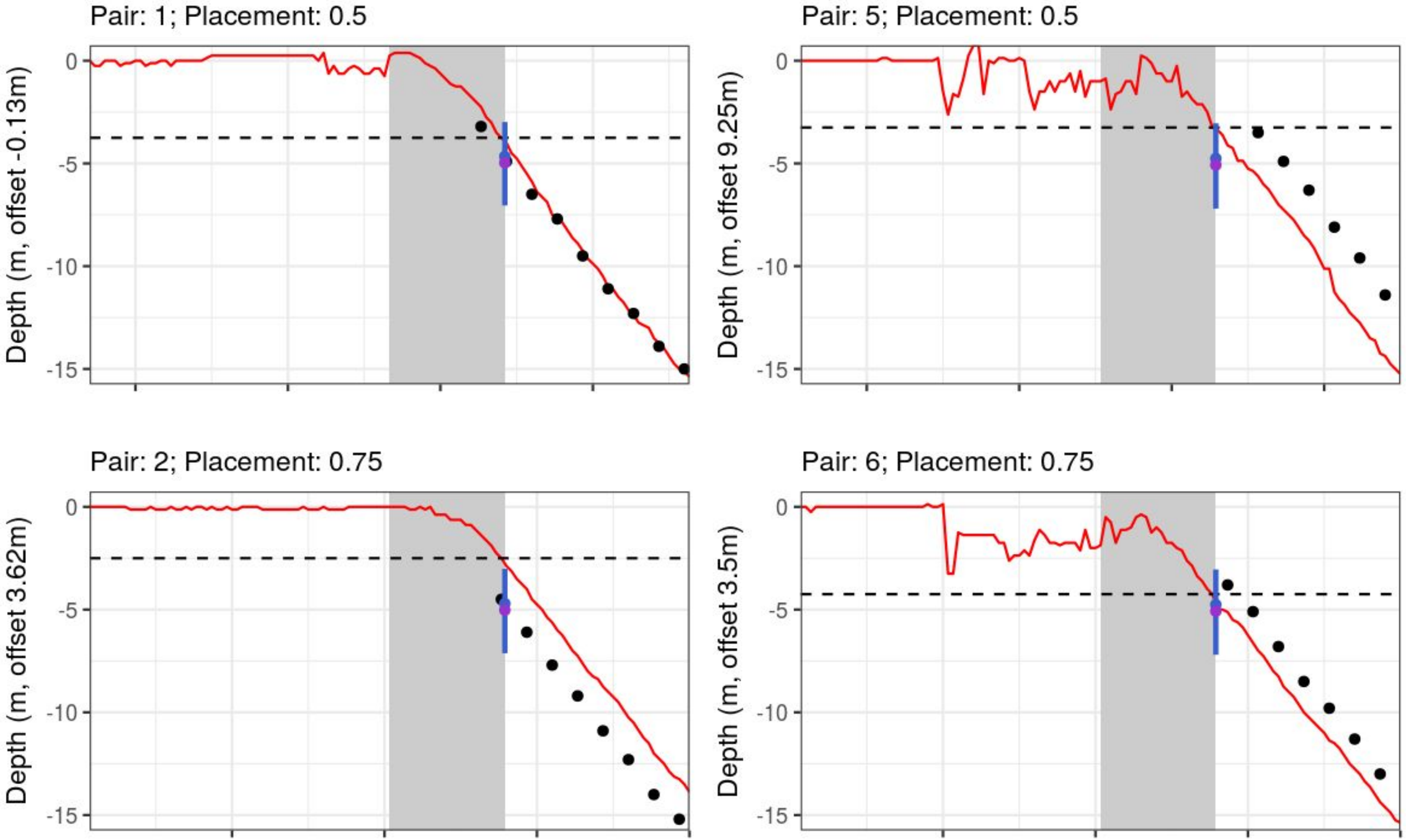
Paired tests - BLL



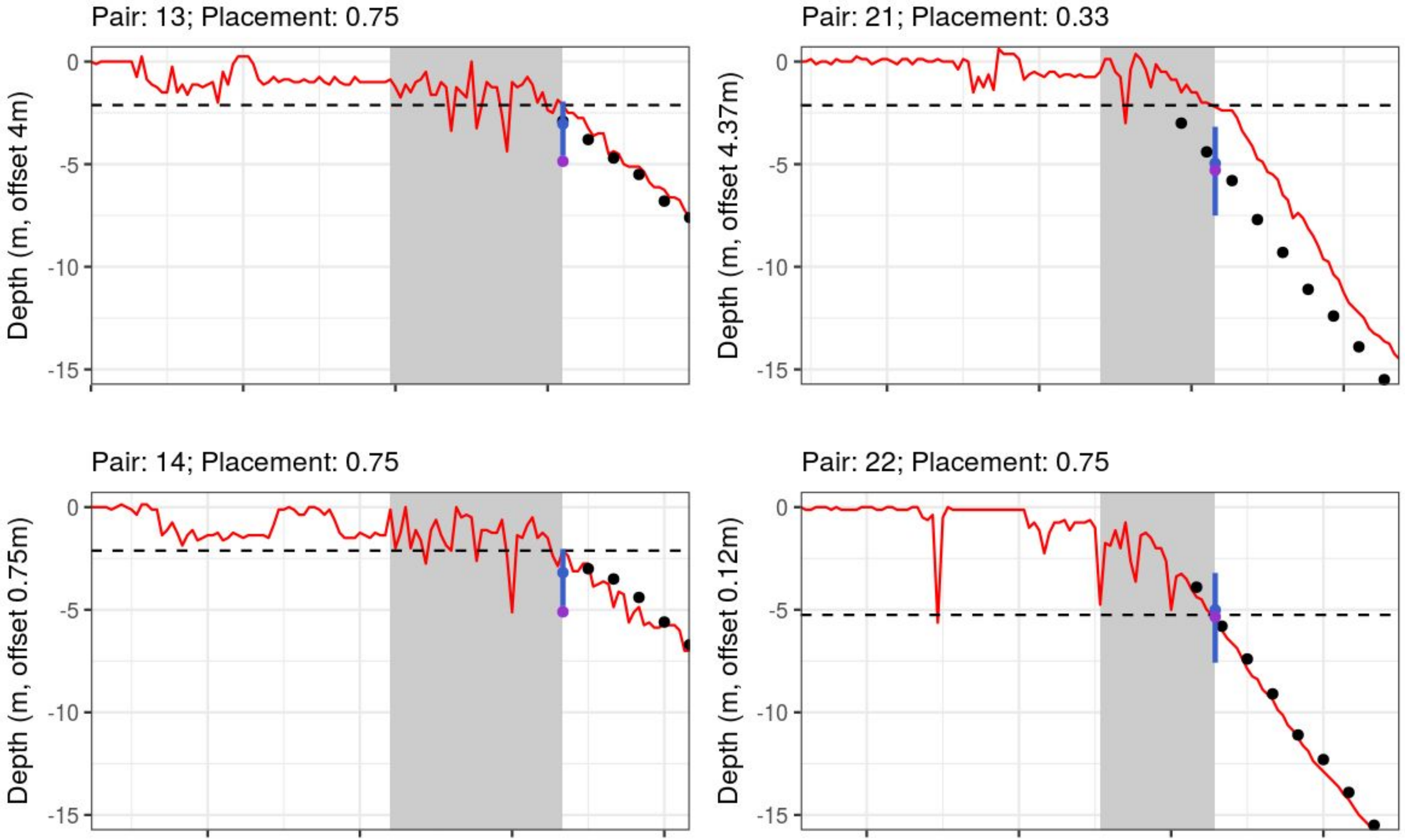
Paired tests - BLL

- Moana sensor data illustrates opportunity for faster start to data logging
  - Better tracking of changes in atmospheric pressure
- CEFAS sensors provide higher temporal resolution, but:
  - Poor pressure sensor calibration (need to offset depth data by sensor/deployment)
  - Noisy, especially at deployment

Paired tests - BLL



Paired tests - BLL

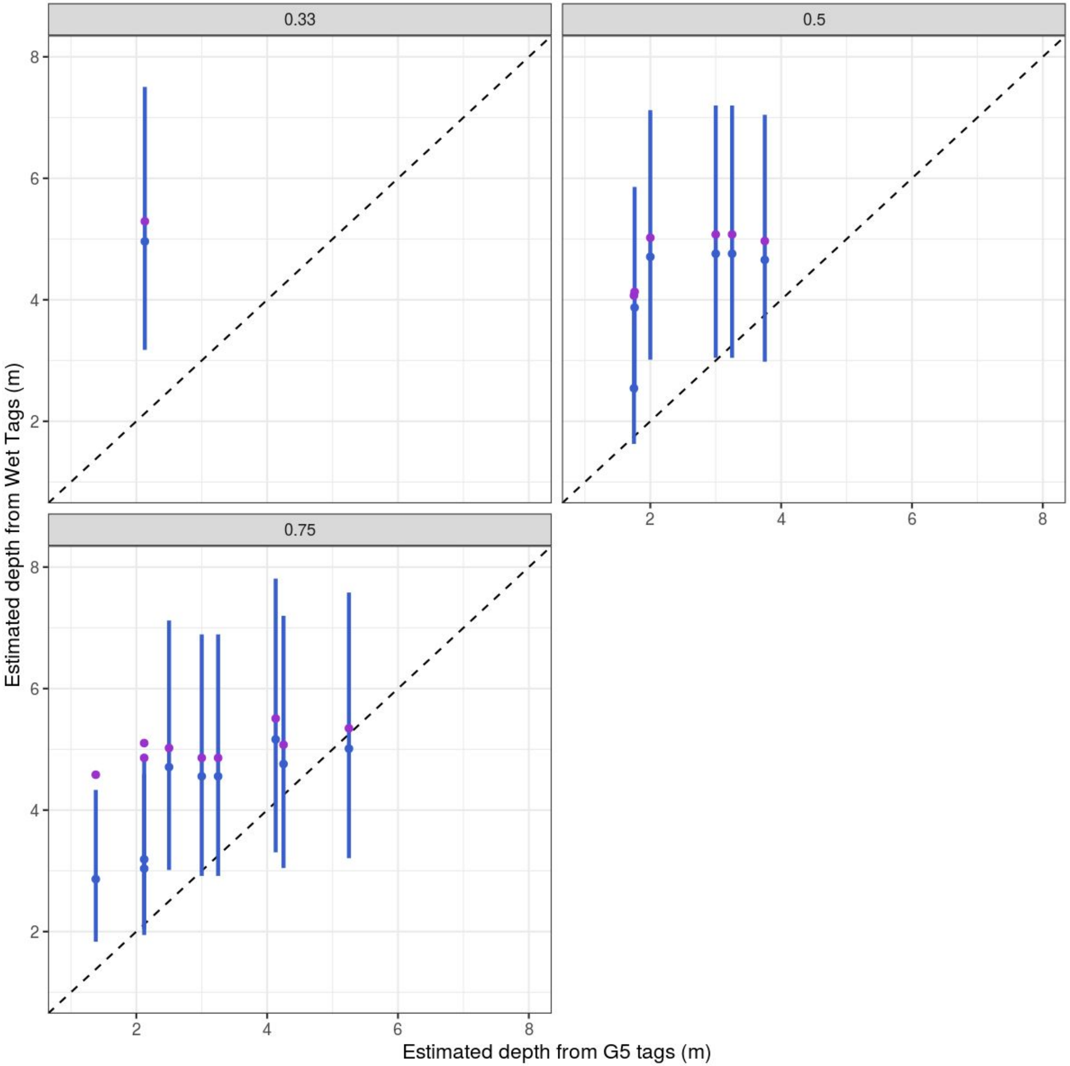


Depth estimates

CEFAS G5 estimates based on direct measurement (requires clip on time, speed and aerial extent)

Wet Tag estimates based on sink rate

Comparable estimates; verifies that Wet Tags pick up between-gear differences



Fisher feedback

- Active participants enthusiastic about the information from Wet Tags
  - No debriefs with fishers who received sensors but did not submit data
- Generally see the data as most useful for monitoring ongoing performance (e.g. checking that standards are not slipping) than making set-by-set adjustments
- Key frustration is around data download and submission; preference for autonomous and automatic process
- General support for continuing and expanding programme (subject to improving data transfer); interest in continuous improvement in data access - potential dashboards, alerts etc.

Conclusions and recommendations

Summary

- Wet Tag (or similar) devices are suitable for routine deployment in BLL and SLL fishing
- Potential for widespread adoption, although uptake in the project was challenging
  - COVID 19 complications
  - Probably needed a ramp-up approach that had a more refined proof-of-concept before attempting wider fleet uptake
  - Data transfer needs to be autonomous so participants can focus on the information
- Greater interest in longer term monitoring of performance, detecting slippage etc., than in set-by-set adaption; nevertheless interest in real-time, preemptive information on potential issues using a range of data

Summary

- Activation delay in data logging by Wet Tags presents challenges, but data are nevertheless useful
- Estimated depths at extent of streamer line coverage are likely more useful in indicating relative differences, rather than absolute verification of depth
- Potential for further refinement.
  - SLL: separate free sink phase; use free drop tests to determine differential sink rate due to baited hook, rather than deploying sensors on baited snoods?
  - BLL: accounting for distance astern is important, may be potential to refine estimates based on between-weight distances
  - Use GPR for vessel speed; consider measuring aerial extent (EARS?) etc.

Summary (drawing on paired tests)

- Zebra-Tech devices (i.e. Wet Tag and Moana sensor) give consistent depth readings; other devices have calibration issues and require post-processing
- Use of continuous logging/high resolution devices didn’t make identification of clip-on/in-water time much easier
    - RFID/NFC have potential but would need a proper test
- Earlier triggering of in-water logging is helpful

Recommendations

NB context is important; these recommendations are in the context of giving fishers information to make decisions that reduce seabird bycatch risk; a verification process would probably have different needs

- Continue the deployment of Wet Tags (or similar robust, fisher-friendly TDRs,ideally with reduced trigger delays) to provide vessel operators with ongoing information on line setting speeds.
- Hold method-specific fisher workshops to share results to-date and secure ongoing engagement, including from the sectors of the fleet that have not participated.

Recommendations

- Focus on autonomous data retrieval solutions for both current and additional participants.
- Consider use of statutory GPR data for estimating setting speeds on a set-by-set basis.
- Adopt standardised approaches for deployment of Wet Tags in BLL and SLL fisheries.
- Provide fishers with interactive tools for exploring the impacts of different parameters (i.e. sink rate, setting speed, distance astern, streamer line aerial extent, gear setup) on the hook depths achieved within the streamer line coverage.

Recommendations

- Further investigate the relationship between line entry point astern of the vessel and weighting regime
- Continue to work with fishers to refine the reporting of sink rate results in a manner that supports best practice vessel operations. Potentially include baseline gear testing and trip-by-trip monitoring for deviations from expected performance, rather than set-by-set feedback.

Acknowledgements

- Department of Conservation (funding, including additional comparative tests)
- Zebra-Tech Ltd (sensors, download app, hardware advice)
- xEquals (Demitto app)
- Participating fishers
- Moana project
- Dave Goad (Vita Maris) - comparative trials and useful discussions

Kahawai Collective

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