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# Assessing fish waste discharge management in the scampi fishery

David Middleton, Edward Abraham



# Purpose

- Review existing observer data with the aim of determining if an 'optimum' batch discharge interval can be identified for vessels targeting scampi

# Outline

- Background and context
- New Zealand scampi fisheries
- Vessel Management Plans
- Seabird captures and vessel attendance
- Conclusions and recommendations

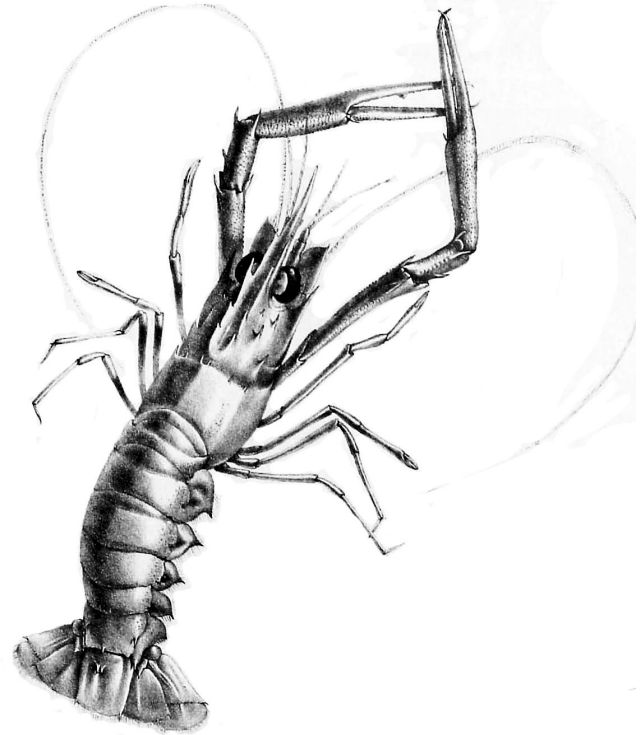


Illustration of *Metanephrops challengeri* from C. S. Bate's "Report on the Crustacea Macrura collected by H.M.S. Challenger during the Years 1873-1876."

# Background

- Fishing vessels provide foraging opportunities for seabirds
- Fishing gear (e.g. trawl warps, nets) presents a risk to seabirds



From: Ministry for the Environment & Stats NZ (2019). New Zealand's Environmental Reporting Series: Our marine environment 2019.

# Risk assessment

NPOA - Seabirds (2020) highlights the following risks to seabirds from scampi fisheries:

- Salvin's albatross and white-capped albatross, primarily on the Chatham Rise and in the subantarctic region (12% of the risk score for Salvin's albatross and 3% of the risk to white-capped albatross)
- flesh-footed shearwaters in the Bay of Plenty (6% of risk)
- white-chinned petrel in the subantarctic

# Context: mitigation of seabird captures

ACAP advice for reducing the impact trawl fisheries on seabirds ('best practice measures'):

- Measures to reduce general attractiveness to seabirds
- Measures to reduce cable strikes
- Measures to reduce net entanglement

# Measures to reduce general attractiveness to seabirds

1. Retention of waste
2. Mealing waste
3. **Batching waste**

*Proven and recommended as a mitigation method for both pelagic and demersal trawl fisheries where meal production and retention of offal and discards are impracticable*

4. Mincing waste

# Previous studies on batching

- NZ

- Abraham, E. R.; Pierre, J. P.; Middleton, D. A. J.; Cleal, J.; Walker, N. A., & Waugh, S. M. (2009). Effectiveness of fish waste management strategies in reducing seabird attendance at a trawl vessel. *Fisheries Research*, 95(2-3), 210–219
- Pierre, J. P.; Abraham, E. R.; Cleal, J., & Middleton, D. A. J. (2012a). Reducing effects of trawl fishing on seabirds by limiting foraging opportunities provided by fishery waste. *Emu*, 112(3), 244–254
- Pierre, J. P.; Abraham, E. R.; Middleton, D. A. J.; Cleal, J.; Bird, R.; Walker, N. A., & Waugh, S. M. (2010). Reducing interactions between seabirds and trawl fisheries: Responses to foraging patches provided by fish waste batches. *Biological Conservation*, 143, 2779–2788
- Pierre, J. P.; Abraham, E. R.; Richard, Y.; Cleal, J., & Middleton, D. A. J. (2012b). Controlling trawler waste discharge to reduce seabird mortality. *Fisheries Research*, 131–133, 30–38
- *Experimental approach: manipulation of batch interval, detailed observations of seabird attendance in response to batch event*



# Previous studies on batching

- Overseas
  - Kuepfer, A.; Gras, M., & Pompert, J. (2016). Discard management as a seabird by-catch mitigation tool: The effect of batch-discarding on seabird interactions in the Falkland Islands trawl fishery. ACAP Seabird Bycatch Working Group Information Paper SBWG7 Inf 25.
  - Kuepfer, A. & Pompert, J. (2017). Discard management as a seabird bycatch mitigation tool: Results from further batch-discard trials in the Falkland Islands trawl fishery. ACAP Seabird Bycatch Working Group Information Paper SBWG8 Inf 16

# Previous studies on batching

- Conclusions (Pierre, 2012b):

Second to holding waste for discharge when fishing gear is out of the water, discharging waste rapidly in maximally large batches, as infrequently as possible, is the recommended practice for reduction of seabird interactions **with trawl warps**.

- Holding waste for 30 min can reduce the abundance of small species of seabirds attending vessels. However, holding periods of up to 8 h may be required.
- Holding waste for 2 h can reduce the abundance of large seabird species at vessels. However, holding periods of 4 h may be required.
- Eight-hour holding periods are preferable to 4-h holding periods, to further reduce seabird abundance at vessels.

# Previous studies on scampi mitigation

Pierre et al. (2013):

- net captures were the prevalent cause of seabird interactions with the scampi fishery
- improving batch discharge regimes to ensure discharge is held on board during shooting and hauling should generally reduce vessel attendance by seabirds and so reduce the risk of net captures



# TEN COMMANDMENTS

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## FOR SCAMPI VESSELS

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- 1.** Ensure your vessel has the current Scampi Fisheries Operational Procedures (OPs) on board.
- 2.** Ensure crew understand and follow the OPs and your Vessel Management Plan (VMP).
- 3.** Have a well-managed fish waste control system that ensures no continuous or ad-hoc discharge occurs when towing.
- 4.** Ensure all fish waste, discards and offal are held during shooting and hauling.
- 5.** Always deploy fit-for-purpose seabird mitigation devices as risk dictates.
- 6.** For triple rig trawlers, if there's a risk of multiple captures or the DWG Trigger Point has been reached for net captures, fit net restrictors. If captures continue, remove centre net until risk reduces.

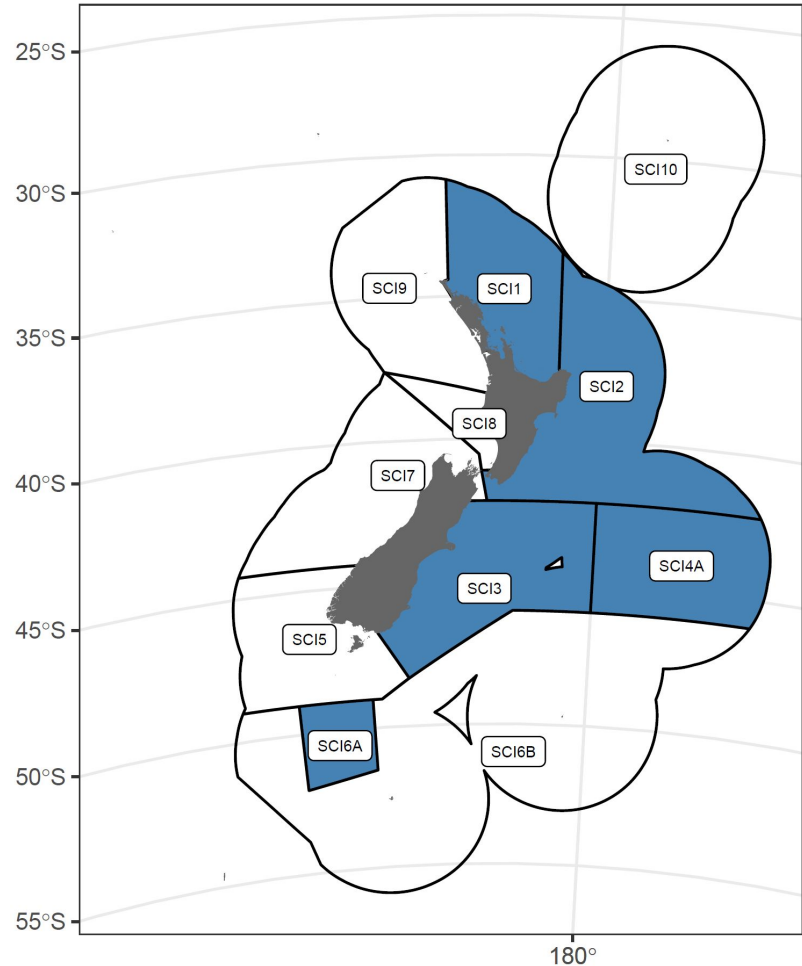
# Discharge management in small-vessel fisheries

Rexer-Huber and Parker (2019):

- reviewed information from fisheries observers on discharge management in small-vessel (< 28 m) trawl and longline fisheries in New Zealand
- recommended further testing of the effectiveness of batch discharging for bycatch reduction, including the influence of holding duration, discharge duration and discharge timing

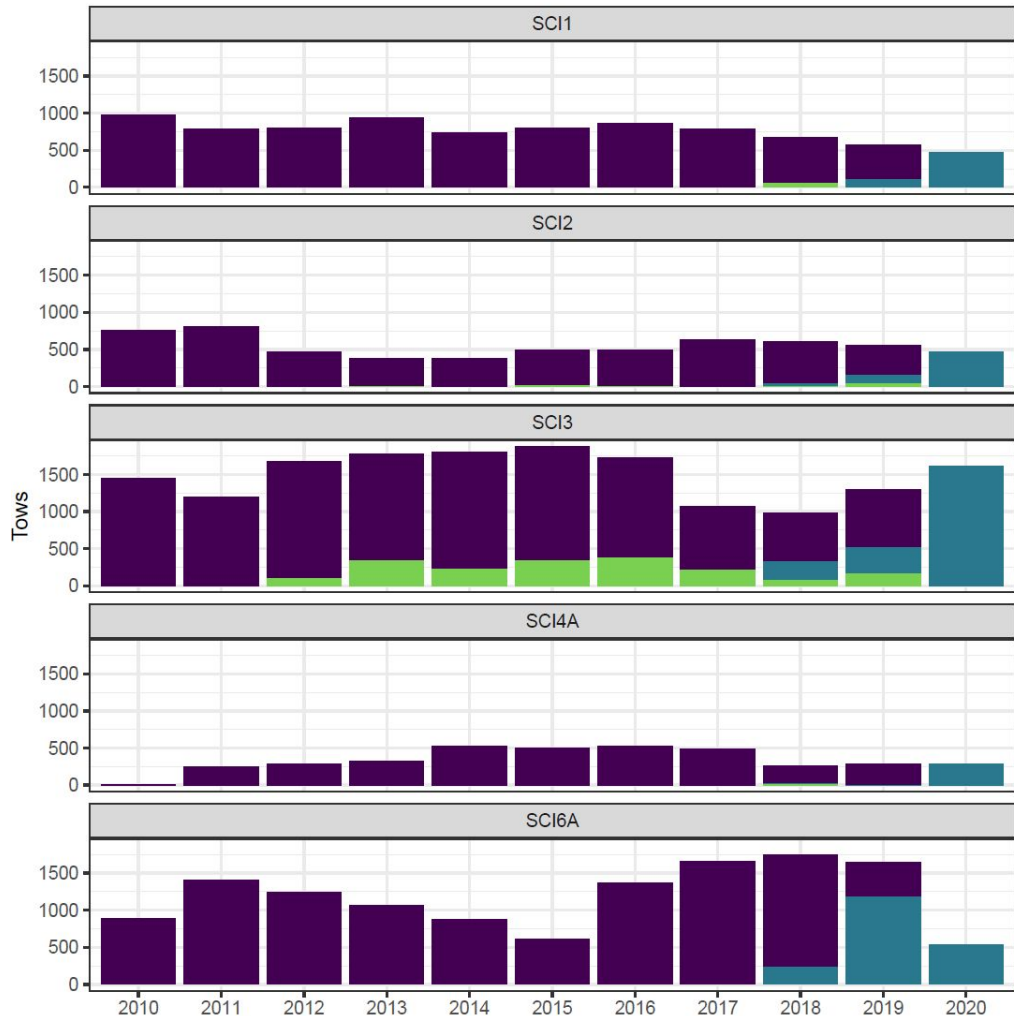
# New Zealand scampi fishery

- QMS from 1 Oct 2004
- 5 key fisheries
- Target bottom trawl (99.6% of catch)
- Specialised gear (low headline, multiple nets)

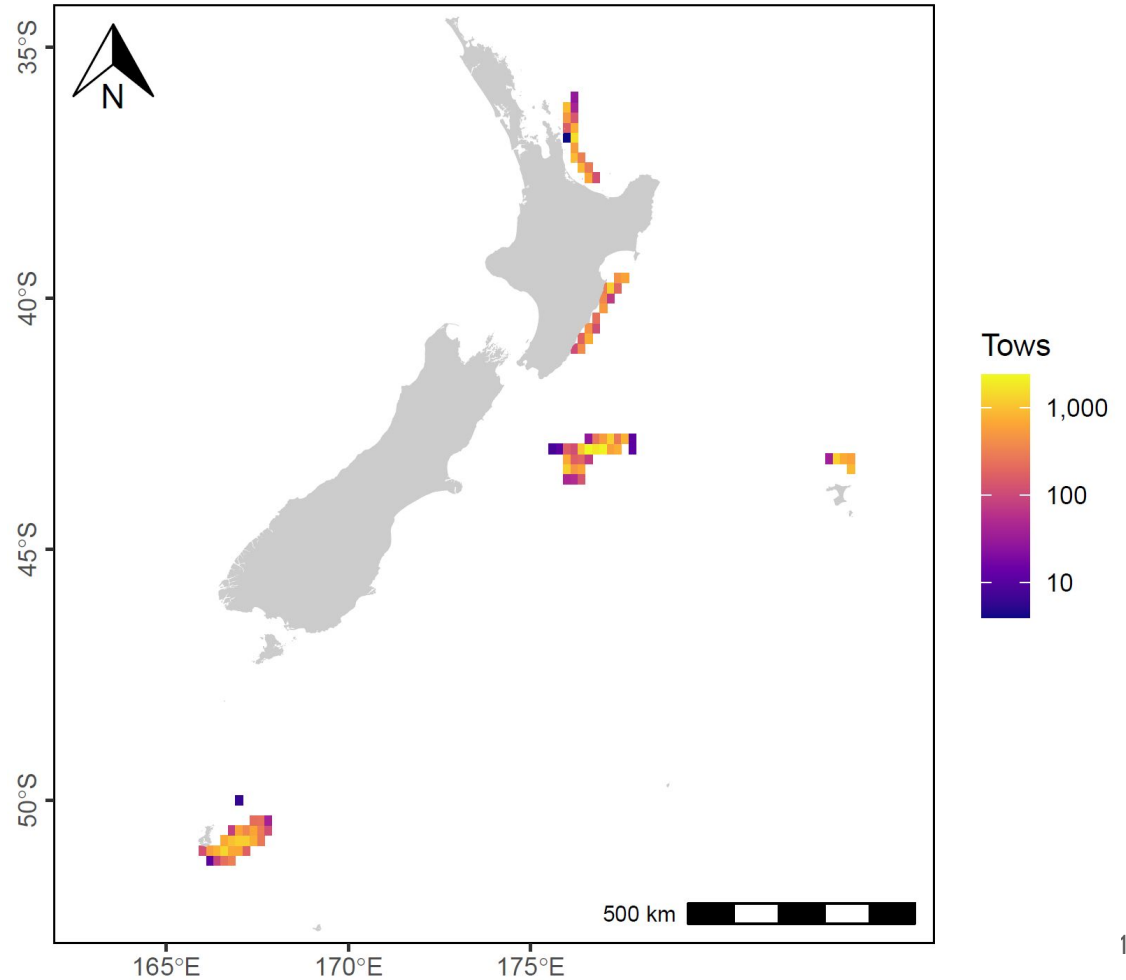


# Statutory reporting: effort

Form type

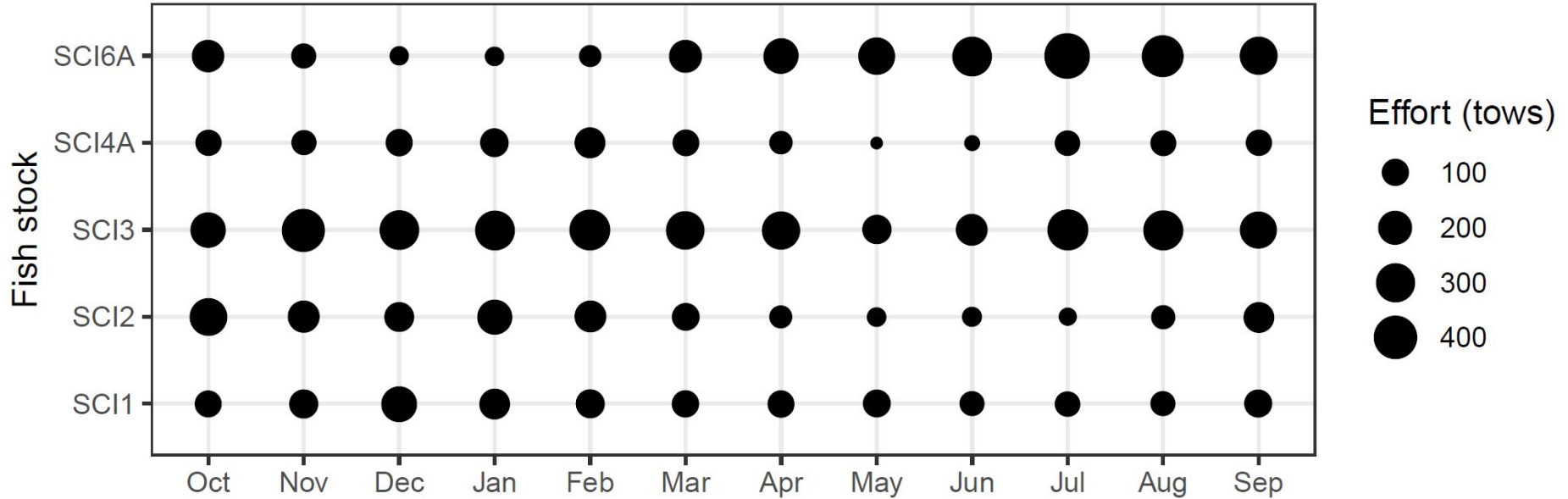


# Spatial distribution of effort

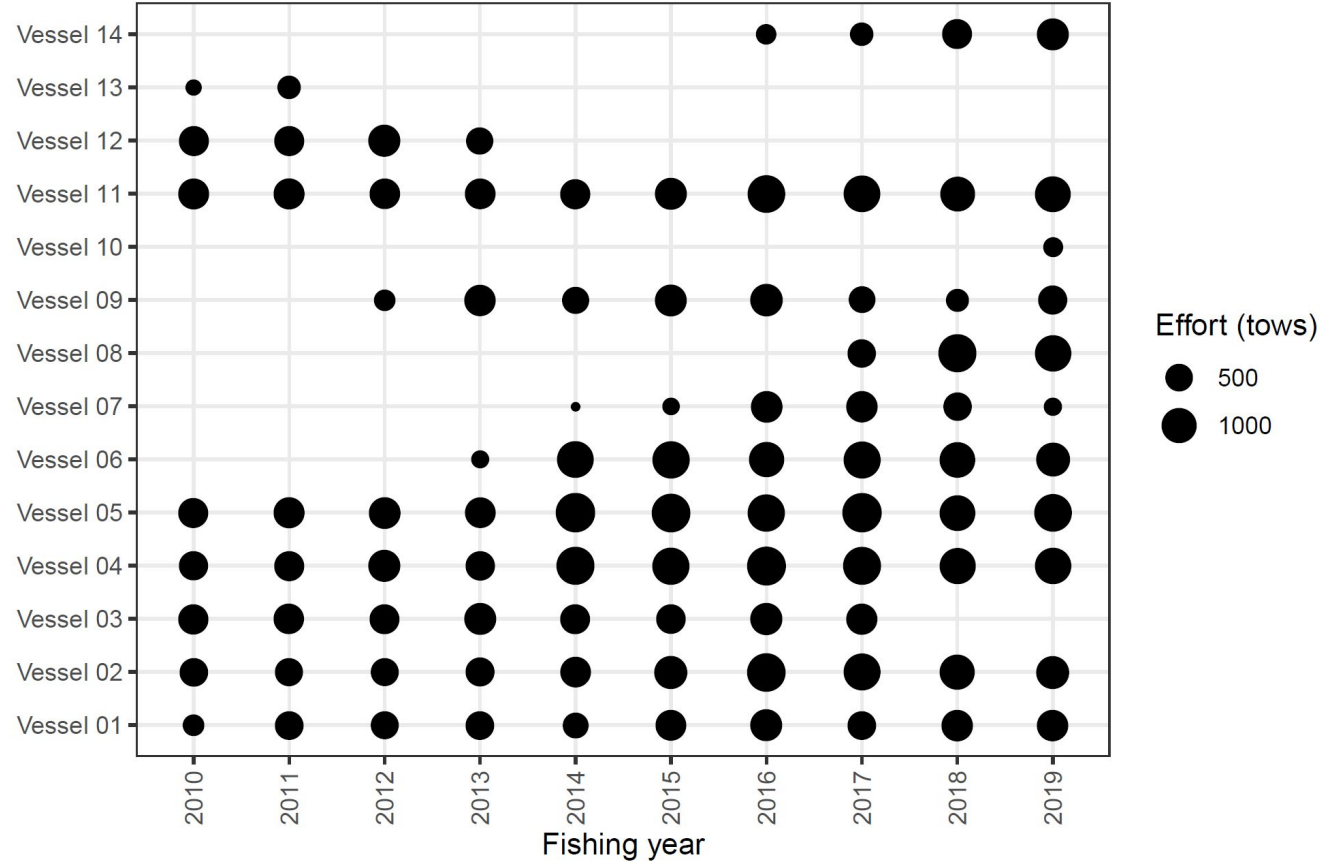




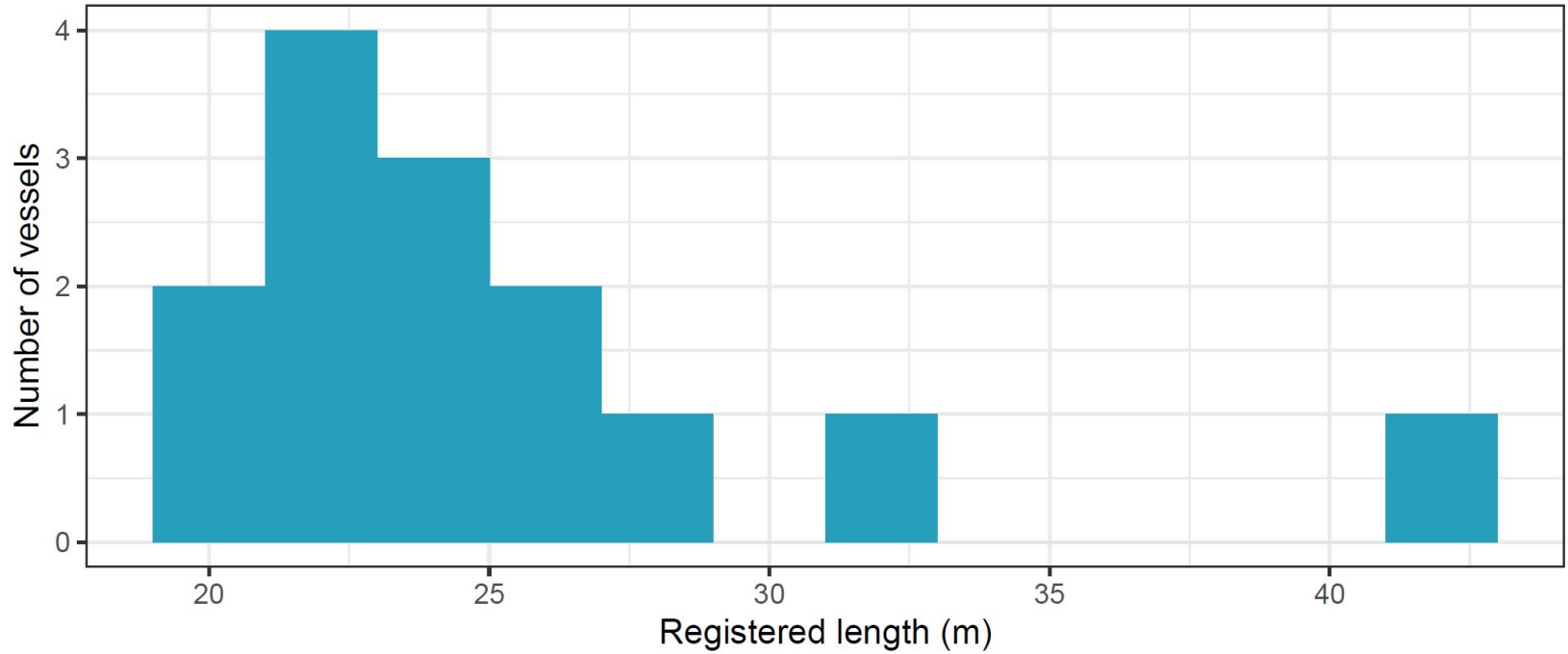
# Temporal distribution of effort



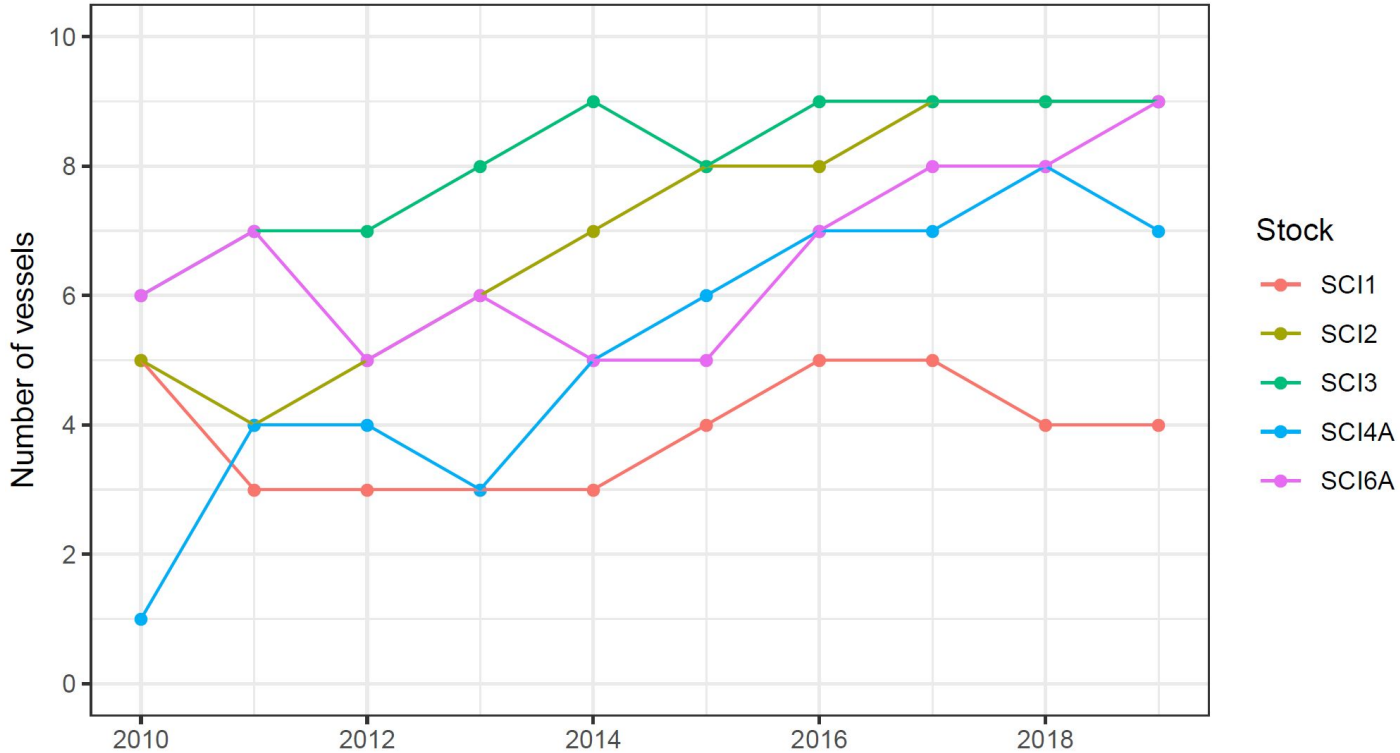
# Sacmpi fleet



# Vessel size



# Regional fleet size



# Discarding and catch processing

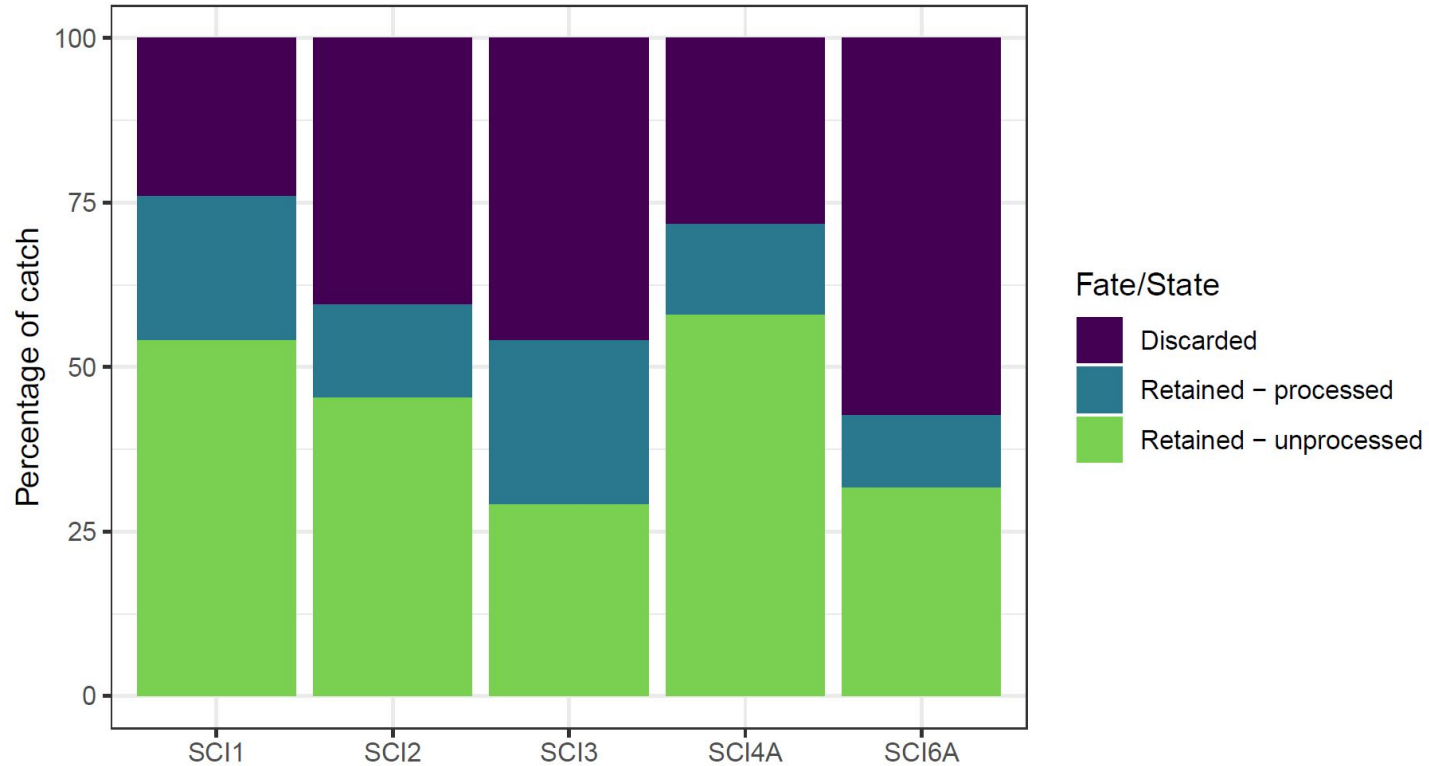
Anderson & Edwards (2018):

- Scampi comprise 19% of catch of SCI BT fishing
  - vs squid, which comprises 79% of catch by SQU BT
- Key non-scampi catch: javelinfish (18%), other rattails (12%), sea perch (10%), hoki (5%), ling (4%), ghost shark (3%)
- Non QMS bycatch often discarded: 95% of javelinfish, 91% of rattails
- Used observer data

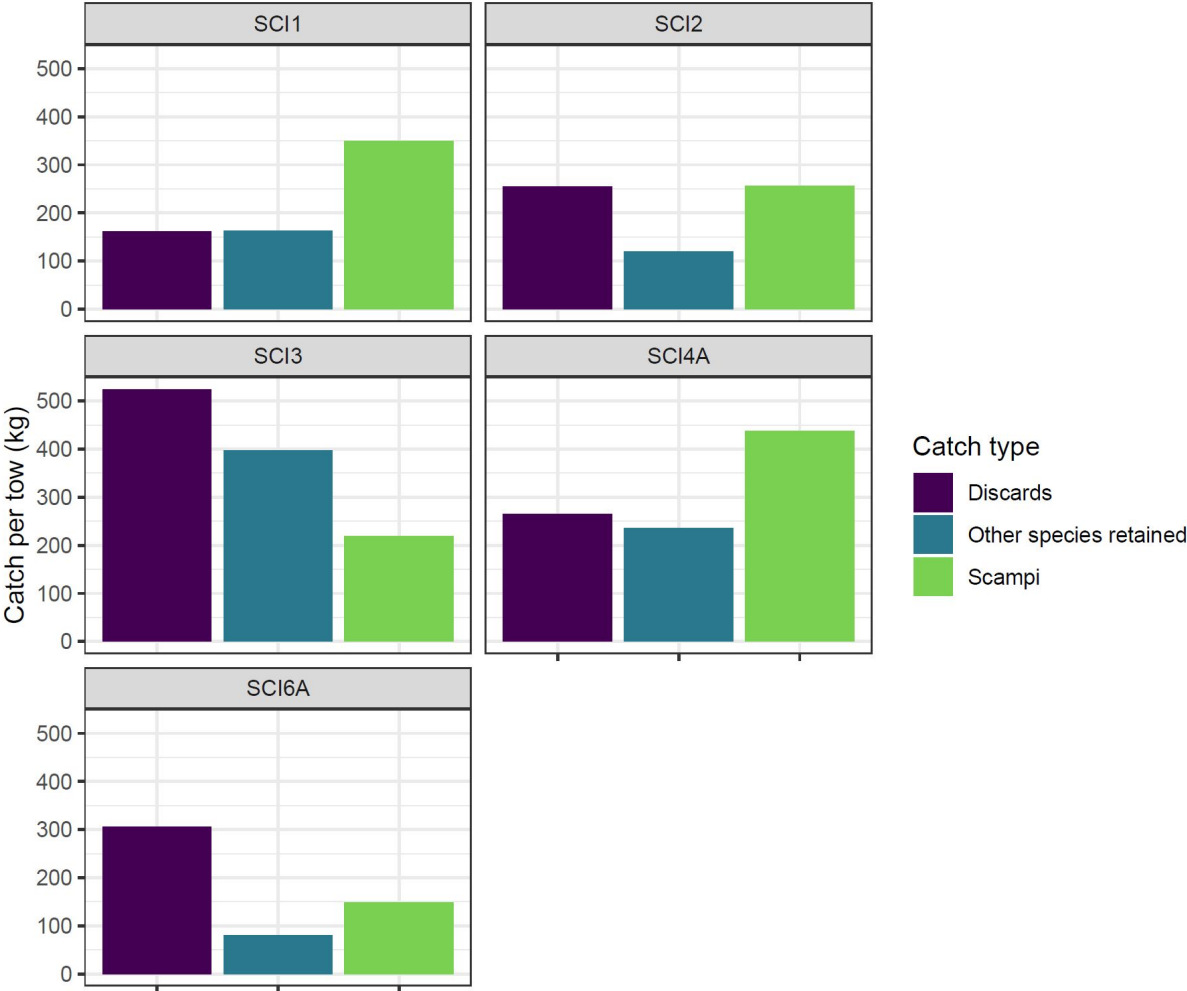
ER regime provides comprehensive reporting of discards:

- Preliminary, used all ER data (2018-2020, but no complete fishing year)

# Fate of catch



# Catch per tow



# Towing characteristics

Scampi stock	Tows per day	Fishing duration (hrs)
SCI1	2.6	18.3
SCI2	2.5	17.7
SCI3	2.4	17.0
SCI4A	2.0	13.7
SCI6A	2.5	18.0



# Scampi Vessel Management Plans (VMPs)

- VMPs introduced by DWG in 2008, including on Sanford's scampi vessels
- Scampi-specific VMP template introduced in 2014 and extended to whole scampi fleet, individual VMPs
  - High capture event 2011
  - Focus on centre net mitigation, net restrictor (Pierre et al. 2013)
- Update in 2018, separation of fleet-wide operational procedures from individual vessel-specific plans
- VMPs supplied for project by DWG
  - Focus on meeting OP requirements, generally don't provide details of batching regime

# Observer information on fish waste management

- VMP review form
  - Introduced in 2011
  - Three versions, latest update 2018
  - Data are not captured in Centralised Observer Database (COD)
- Summaries of waste management procedures
- Both provide trip level information

# Vessel Management Plan/Marine Mammal Operating Procedure

## Observer reviews (Version 4 - Jun 2011)

1. Write the trip number  start date of trip  /  /

and vessel name



2. If any of items 1-10 are "U" or "N" then a comment is required in section 5: Y/N/U

- Item 1. Did the vessel have a copy of the Marine Mammal Operating Procedure?.....
- Item 2. Was a Vessel Management Plan onboard and was it specific to this vessel?.....
- Item 3. Were key crew members familiar with the contents of the above documents?.....
- Item 4. Did the crew clear the net of "stickers" before shooting?.....
- Item 5. Did the vessel attempt to minimise the amount of time the net spent on the surface?.....
- Item 6. Did the vessel refrain from discarding plastic or netting?.....
- Item 7. Did the vessel use mechanisms or procedures that reduced accidental discharge of floor offal and fish to the sea (e.g. grates)?.....
- Item 8. Did the vessel steam away from large congregations of marine mammals?.....
- Item 9. Did the vessel refrain from setting gear when dolphins were nearby?.....
- Item 10. Was there a designated crew member looking for marine mammal captures?.....

3. Items 11-13 use "Y" to indicate which options were present:

- Item 11. The seabird scaring devices available during this trip were:  
 None  Tori Line  Bird Baffle  Warp Scarer  Other
- Item 12. The most regularly used seabird scaring device was:  
 None  Tori Line  Bird Baffle  Warp Scarer  Other
- Item 13. The main offal management strategy employed during this trip was:  
 Meal  Held  Batch  Mince  Other

4. If any of items 14-20 are "Y" or "U" then a comment is required in section 5: Y/N/U

- Item 14. When targeting JMA, was there evidence to suggest that the net was shot or retrieved between 2:30am and 4:30am (Only applies north of 40 deg 30 mins S).....
- Item 15. Was offal or fish discharged during net shooting or net retrieval periods?.....
- Item 16. Was an additional seabird mitigation device(s) deployed during this trip?.....
- Item 17. During turns, were the doors ever fully submerged with a headline depth of less than 50m?.....
- Item 18. Were any marine mammal or seabird 'trigger' points activated during this trip?.....
- Item 19. Were there equipment failures that increased seabird/marine mammal capture risk?.....
- Item 20. Were there any other notable seabird or marine mammal related events during this trip?.....

# Deepwater Trawl VMP & MMOP

## Fisheries New Zealand observer review form



Trip Number	Vessel Name	FMA's fished	Trip start date	Trip end date
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Target species		Observer name	Tows observed	

Record Yes (Y), No (N), Unknown (U) or Not Applicable (N/A) in the box provided. If you answer N or U to any questions, or Y for items 3, 4 or 19, then please make detailed comments on the reverse.

- Item 1. Were copies of the DWG vessel specific *Vessel Management Plan (VMP)* and *Marine Mammal Operating Procedures (MMOP)* carried on board and made available upon request?
- Item 2. Were the senior crew familiar with and have access to the above documents?
- Item 3. Were any seabird, marine mammal or protected shark 'trigger-points' activated during the trip? (if Y record details of the triggers and the action taken by the vessel)
- Item 4. Did a gear or equipment failure event occur that increased the risk of seabird or marine mammal captures? (if Y detail the event and the action taken by the vessel)
- Item 5. Were there any changes in crew behaviour, fishing activity, mitigation devices or gear used following 'trigger-point' events or during high risk periods?

### Seabird/Marine Mammal Mitigation Devices

Item 6. Record what mitigation devices were carried by the vessel and when they were utilised

	Carried on board	Deployed all tows	Deployed some tows	Not deployed
Bird Baffle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tori line	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SLED	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (describe on reverse)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Item 7. Was an additional seabird mitigation device deployed when required by the VMP?
- Item 8. Was a Dolphin Dissuasive Device deployed on every JMA7 night tow (JMA7 only)?
- Item 9. Were net restrictors fitted into the centre net of a triple-rig configuration when required? (SCI only) (i.e. once a 'trigger point' was reached)

### Fish Waste Management:

- Item 10. Was the discharge of fish waste from the vessel managed as per the VMP?
- Item 11. Were there any periods of continuous fish waste discharge during the tow (apart from minced offal)
- Item 12. Was all fish waste (including offal and whole fish) held on board during shooting and hauling?
- Item 13. Was the net cleared, as practicable, of all stickers prior to shooting?
- Item 14. Was a grating or trap system used to prevent fish or offal accidentally lost to the factory floor or deck from being discharged overboard via scuppers or sump-pumps (whilst still allowing the free egress of water)

### General Procedures:

- Item 15. Were all plastics and netting retained on board?
- Item 16. Was shooting fishing gear near congregations of marine mammals avoided?
- Item 17. Was the amount of time the net spent on the surface minimised as much as practicable?
- Item 18. Were any turns conducted with the doors fully submerged and a headline depth of less than 50 m?
- Item 19. Were all seabird, marine mammal or protected shark captures reported by the vessel?
- Item 20. Were all seabirds, marine mammals or protected sharks released alive handled with due care?
- Item 21. Was gear shot between 02:30 and 04:30 (NZST) when targeting JMA North of 40.30° S? (JMA7 only)

Record Yes (Y), No (N), Unknown (U) or Not Applicable (N/A) in the box provided. If you answer N or U to any questions, or Y for items 3, 4 or 19, then please make detailed comments on the reverse.

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(if Y record details of the triggers and the action taken by the vessel)

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Item 5. Were there any changes in crew behaviour, fishing activity, mitigation devices or gear used following 'trigger-point' events or during high risk periods?

**Seabird/Marine Mammal Mitigation Devices**

Item 6. Record what mitigation devices were carried by the vessel and when they were utilised

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Bird Baffler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tori line	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SLED	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (describe on reverse)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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# VMP review form data

- 45 trips 2011 - 2020
  - v3 x 1, v4 x 31, v5 x 13
- 95.2% of trips had a VMP
  - crew familiar with content on 97.5% of these trips
- Fish waste held during shooting and hauling on 85.7% of trips
- Systems to catch processing waste (e.g. grating) on 66.7% of trips
  - Some inconsistency within vessels over time - real?
- Stickers removed 51.1% of trips
  - 'as practicable' - trade off with minimising time net spent on surface

# VMP review form data

- Net time on surface `minimised' on 90.9% of trips
- Gear failures occurred 15.6% of trips
- Net restrictor use only recorded on v5 form
  - Used on 2 of 5 trips, where use recorded
- Managing waste in accordance with VMP on 100% of trips (v5 form only)
  - But one recorded as having continuous discharge
- Missing vs Unknown vs Not Applicable (v5 only)



# Post-trip summaries

- Put together by FNZ, provided to DWG to assist in VMP implementation management

h	2019/20	Batch discharged. Fish waste would accumulate in batching tank during sorting and be discharged when crew thought a sufficient amount had accumulated. No grating on scuppers however crew would take to ensure fish did not fall to the deck with only small quantities (estimated at a couple of kgs per sort) discharged through the scuppers. Crew did not remove stickers as this would increase the amount of time the net spent on the surface.
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# Post-trip summaries

k	2017/18	Discarding of whole fish and offal was completed in batches. Discarding never occurred during shooting or hauling operations and the crew ensured the winches had stopped before commencing in batch discarding.
a	2017/18	Fish and offal were held in a batch tank and discarded after birds were showing less interest in the vessel. This was generally a few hours after processing was completed.



# Post-trip summaries

j	2018/19	Continuous discharge of whole fish during sorting (up to 15-20 minutes for the biggest catches). During this time the remaining cod ends would be under the surface or on deck (un-tipped). Either two or three periods of fish discharge each haul (depending on the number of codends). All processing offal (from bycatch) was discharged whilst net was on board.
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# Post-trip summaries

e	2018/19	<p>Fish waste would be stored in a discharge hopper during sorting and batch discharged when full. Between three and four discharge events per haul. On one occasion the hopper overfilled resulting in small amounts of fish waste being discharged overboard. Skipper spoke to crew and reminded them to empty hopper when full. On one occasion during hauling the crew were observed to be washing down the deck resulting in small amounts of fish waste being discharged through the grates. Skipper spoke to the crew and told them not to do this during hauling.</p>
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# Post-trip summaries

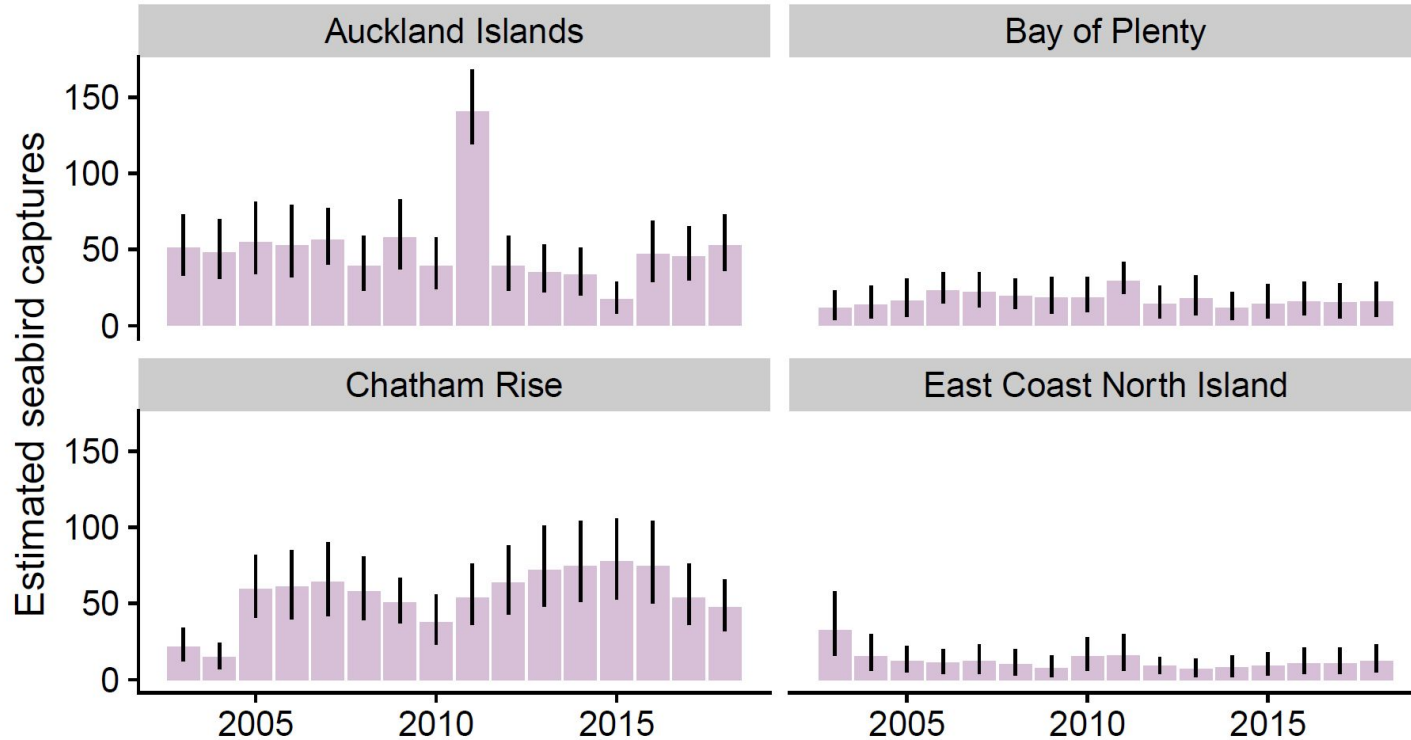
i	2017/18	Offal was discarded from the vessel. Discards happened when doors were below the surface. When discarding, the vessel would turn to port while the discard occurred through the starboard side discard chute, so as to reduce the chance of bird captures.
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# Observer data - seabirds

Two types of data:

- Seabird captures
  - Captured in COD database
  - Scaled up to fleet-wide estimates via modelling
    - Standard areas (e.g. Chatham Rise includes CSI 3 and SCI 4A)
    - Model for <28m vessels does not have inter-annual variation
- Seabird sightings
  - Compiled infrequently: Richard et al 2011, 2020
  - Counts of seabirds in the vicinity of fishing vessels
  - Daily forms or use of NOMAD devices (somewhat different protocols)

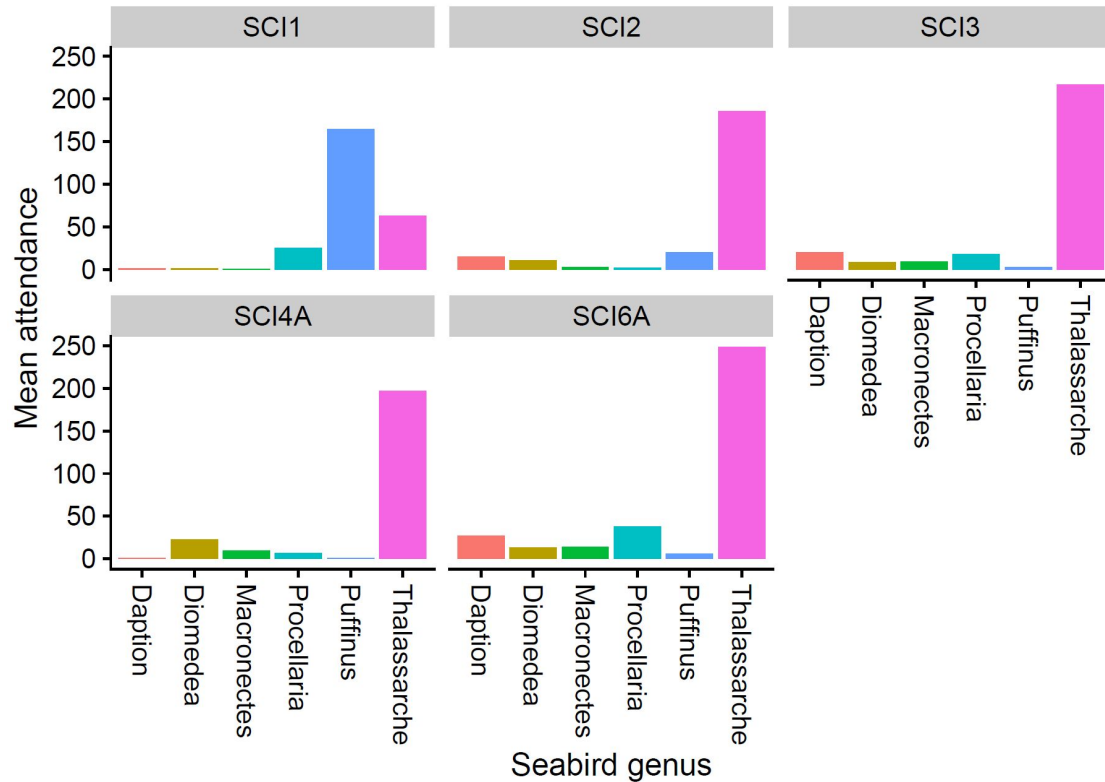
# Estimated seabird captures in scampi fisheries



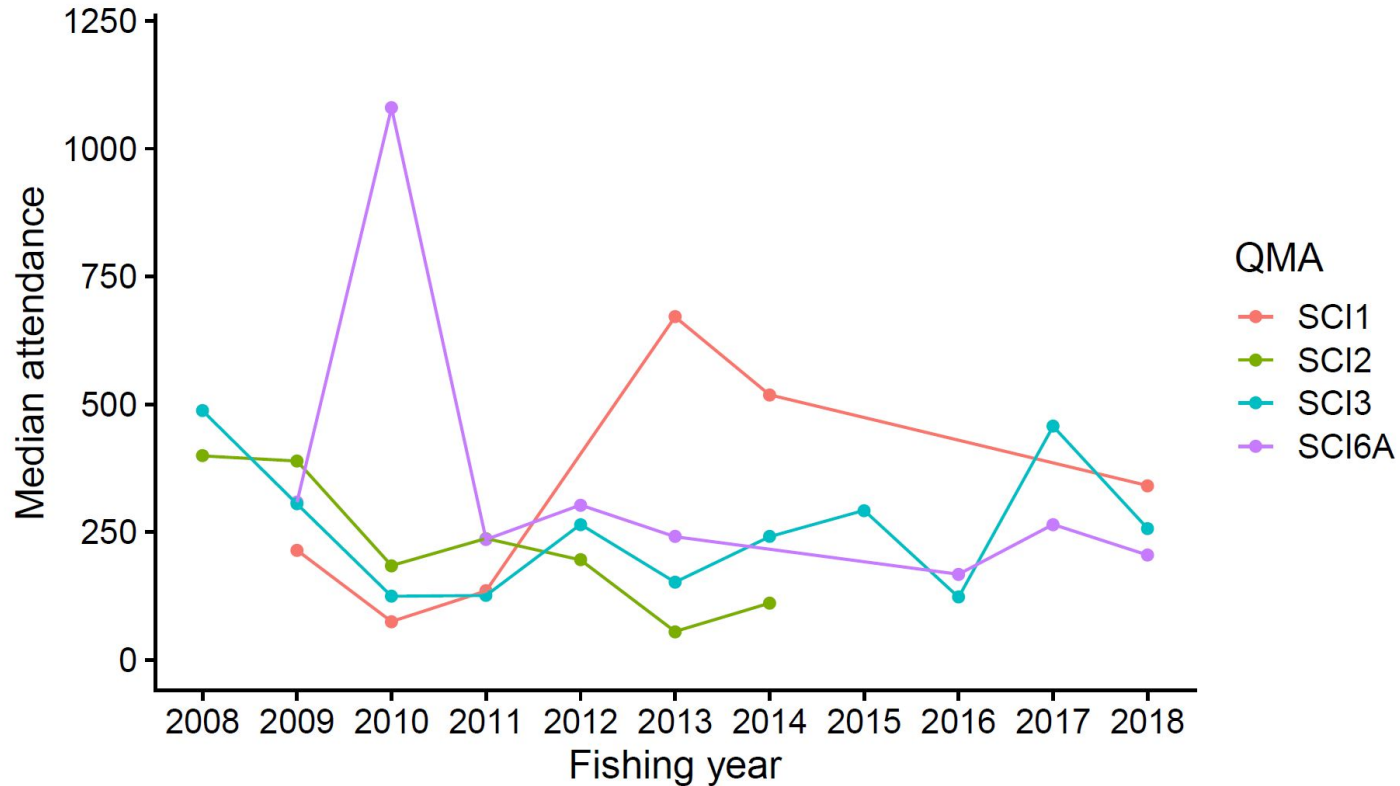
# Estimated seabird captures in scampi fisheries

Area	Captures per 100 tows
Auckland Islands	3.05
Bay of Plenty	2.27
Chatham Rise	3.80
East Coast North Island	2.06

# Seabird counts

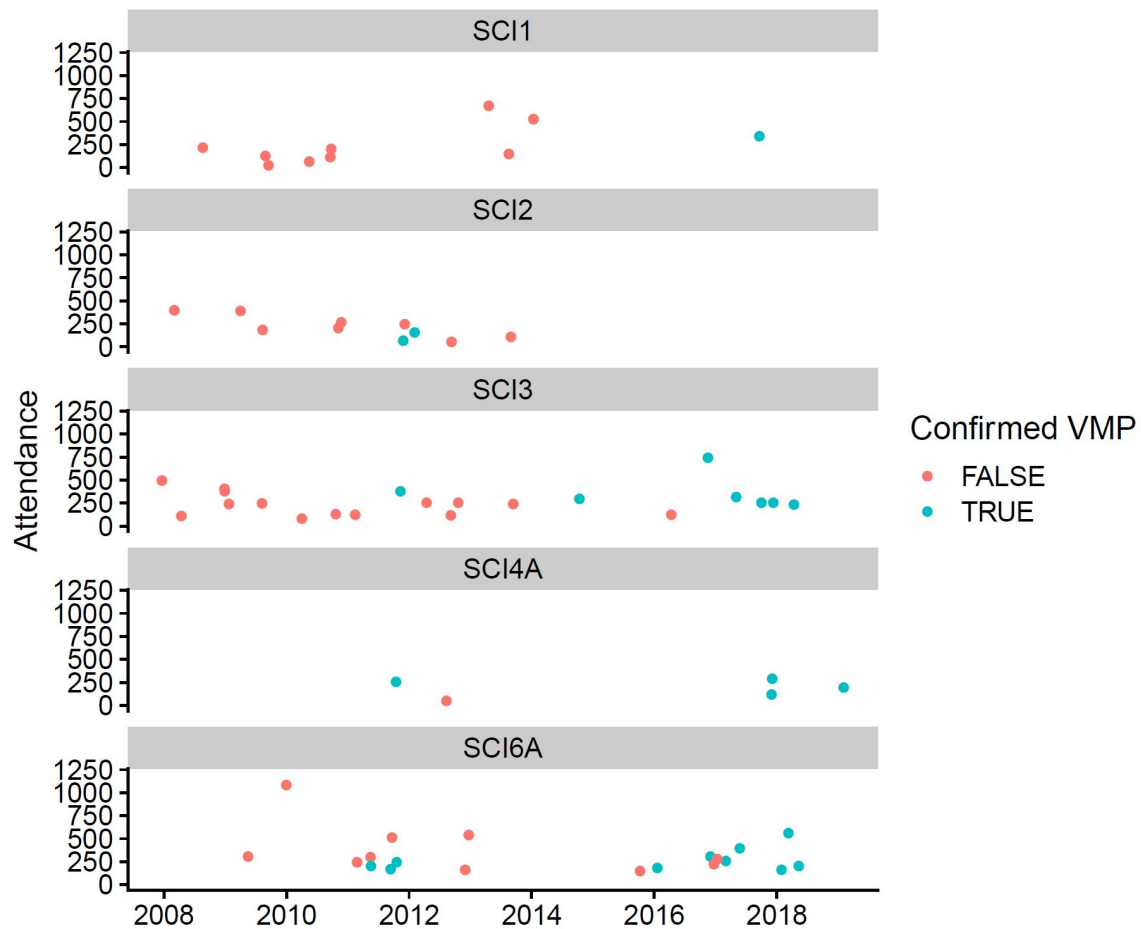


# Seabird counts





# Seabird counts



# Conclusions - information on waste management

- Trip level, primarily qualitative
- Informative
- Management process focussed
- Good evidence that VMPs are in place, and that their implementation is being monitored
  - But limited value for quantitative analyses of variation in discarding
  - 'Incident' identification vs general relationships

# Conclusions - captures and abundance

- Estimated captures and capture rates are higher in SCI 3 and SCI 6A than SCI 1, SCI2
- With the notable exception of 2011 in SCI 6A, captures are rare in SCI fishing (so little signal, incident management rather than potential for big gains)
- Average seabird attendance at vessels is similar in the different areas
- No clear evidence of an impact of VMPs on seabird attendance (but no recurrence of 2011 event!)

# Recommendations

- If a better understanding of the influence of batching parameters (intervals, volumes, discharge duration) is required, an experimental approach is recommended
  - Allows variables of interest to be manipulated while other covariates are held constant
  - Data collection would be onerous for routine observer coverage
- Technology could potentially assist in data collection:
  - Snapshots of batches just prior to discharge could give information on discharge timing/volume
  - Potential to use video footage to quantify patterns in seabird attendance at vessels

# Acknowledgements

- Funding: DOC CSP (cost recovered from SCI quota owners)
- Data: Fisheries New Zealand (Daniel Kerrigan, William Gibson, RDM team)
- VMP access: Deepwater Group and scampi vessel operators
- Review: Karen Middlemiss, [CSP TWG]