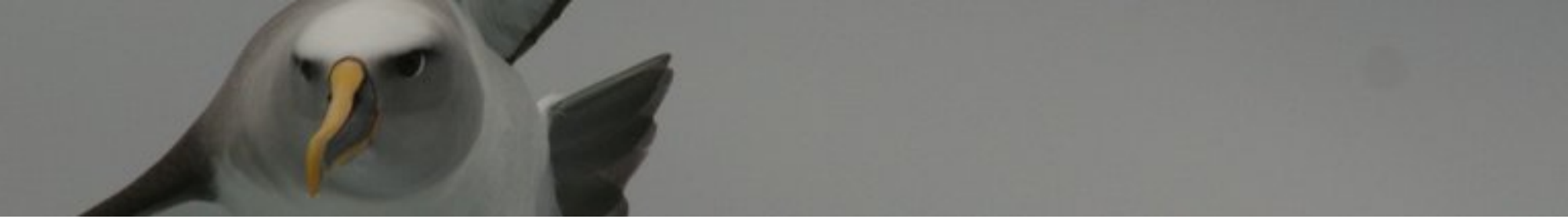

Mincing offal to reduce seabird attendance at trawl vessels

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Dragonfly

Conservation Services Programme
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Introduction

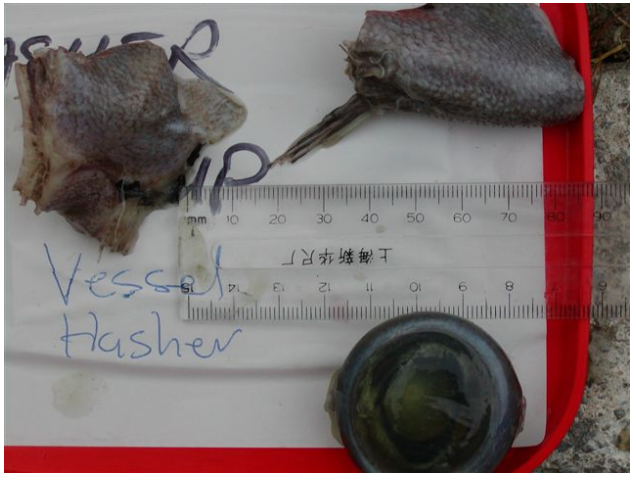
- Mincing offal has been proposed as a measure to reduce interactions between seabirds and trawlers.
- Experiments carried out on two trips during 2008.
- Seabirds were counted during the discharge of offal, hashed material, and minced material.
- In this analysis we look at whether different discharge types are associated with different seabird counts.

Outline

1. Experiment summary
2. Data grooming
3. Bird count data
4. Models
5. Results

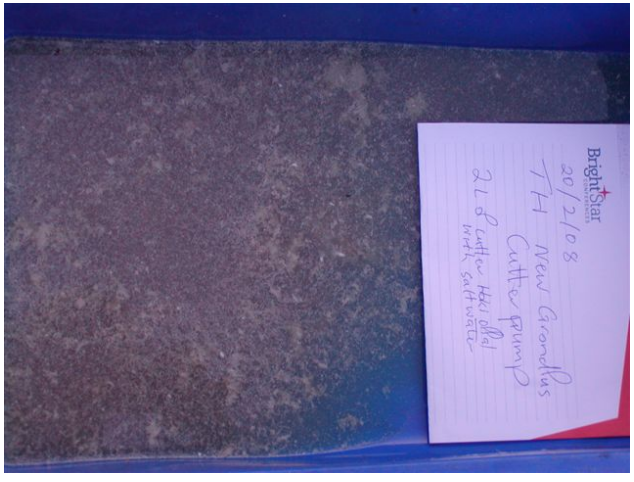
Offal treatments

- Hasher pump cut offal into chunks.
- Most of hashed sample was in chunks 30 mm to 60 mm in size.



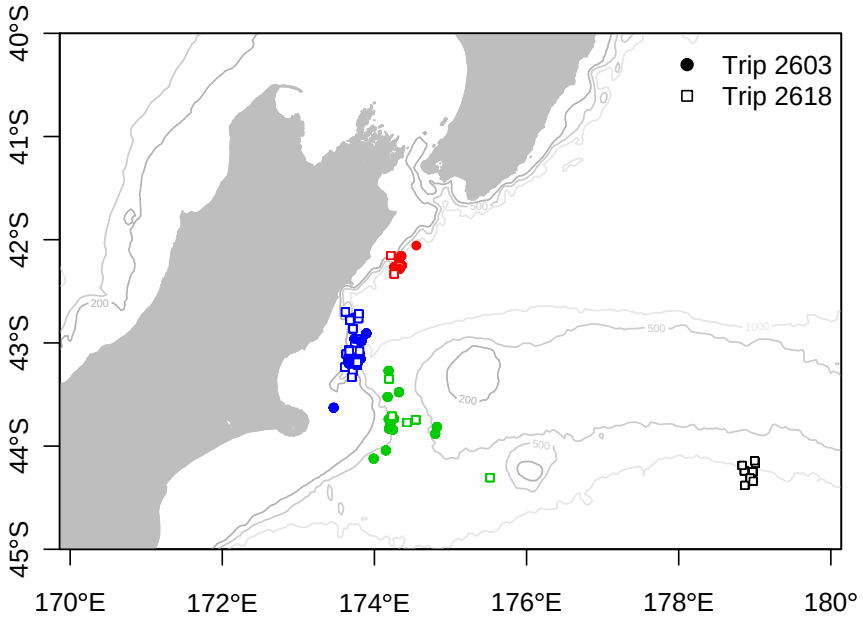
Offal treatments

- Cutter pump was put through hasher and then through a cutter pump in a recirculating tank.
- Most of sample was in a slurry, with 25% in pieces with a size of around 20 mm.
- Cutter pump pieces were in strips, rather than chunks.



Trip summary

- Two trips, targeting hoki, silver warehou and oreo on the east coast of the South Island.
- First trip (2603) was from 17 April 2008 to 1 May 2008.
- Second trip (2618) was from 14 March 2008 to 26 March 2008.



Offal treatments

- Three offal treatments (Unprocessed, Cutter, Hasher) were used on a day at a time.
- A randomised block design was used (trip 2618: CUH CHU HUC UCH CHU).
- Hasher broke down for a few hours on one day, otherwise the observer considered that the treatments were followed throughout the two trips.

Discharge was recorded of Sump, Mince/Cutter, Offal, and Discards was recorded. For each discharge type the discharge rate was characterised as None, Negligible, Intermittent or Continuous.

Bird groups

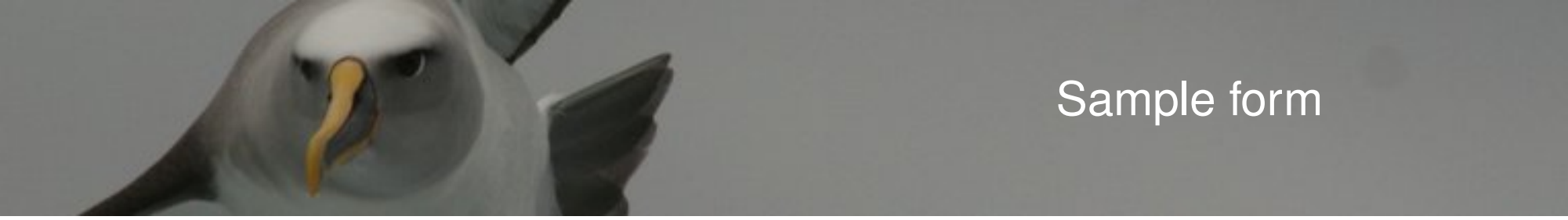
Counts were made within semicircles of 40 m and 10 m radius, of the following bird groups:

- Large albatross. Royal and wandering albatross (*Diomedea*).
- Small albatross. Other albatross species (*Thalassarche*) and giant petrels (*Macronectes*).
- Cape petrel. *Daption capense*.
- Other procellarids.

Separate counts made of birds on the water and birds in the air.

Sampling strategy

- Experimental treatment was followed for a day at a time (midnight to midnight).
- During each sampling period, the observer made up to 10 sets of bird counts, with each set of counts being 5 minutes apart.
- Observer was asked to complete at least 5 sampling periods each day.



Sample form

Seabird observation form
Mincing trials

Date observations started (ddmmyy): 2|2|0|3|0|8

Sample identification

Trip number: 5|6|7|8

Tow number (if towing): 0|0|2|3

Treatment

- [x] Offal chute
- [ ] Cutter pump
- [ ] Hasher pump

Background information (record before first observation)

Vessel speed (knots): 4·6

Swell height (metres): 3

Observation			1	2	3	4	5	6	7	8	9	10
Time	Hour		13	13	13	13	13	13	13	13	13	13
	Minute		06	11	15	20	25	30	35	40	45	55
Wind strength			3	3	3	3	4	4	4	4	4	4
Wind direction			8	8	7	7	7	7	7	6	6	5
Tow stage			F	F	F	F	F	F	F	F	F	F
# vessels visible			0	0	0	0	0	0	1	1	1	1
Discharge	Sump		2	2	2	2	2	2	2	2	2	2
	Mince/Cutter		0	0	0	0	0	0	0	0	0	0
	Offal		1	2	2	2	1	0	0	1	1	2
	Discards		0	0	0	0	1	1	0	0	0	1
Large albatross	40m	Air	7	5	5	8	7	3	2	1	0	0
		Water	5	8	12	6	10	12	8	6	4	2
	10m	Air	0	2	3	0	1	6	4	1	0	0
		Water	1	2	0	0	0	1	4	2	3	0

Observations by discharge

The number of observations made for different rates of discharge of offal (including discards) and pump material.

First trip:

Pump	Offal			
	None	Neg.	Int.	Con.
None	110	2	8	62
Negligible	0	0	0	0
Intermittent	27	0	0	0
Continuous	94	0	5	6

Second trip:

Pump	Offal			
	None	Neg.	Int.	Con.
None	88	0	0	86
Negligible	7	0	20	0
Intermittent	0	13	0	0
Continuous	156	0	0	0

- Made pump, offal, sump and no discharge groups.
- Pump discharge was assigned to cutter or hasher, based on the nominal treatment.
- Observations without offal or pump discharge were assigned to no discharge or sump groups, based on sump discharge.
- Dropped observations with mixed offal and pump discharge.

Treatment and actual discharge

Discharge	Treatment			
	Offal	None	Cutter	Hasher
Offal	156	0	0	0
None	0	15	0	2
Sump	11	89	13	60
Cutter	0	0	188	0
Hasher	0	0	0	97
Mixed	0	0	3	4

- Removed 39 observations with offal discharge during the pump treatments, and 7 observations were the recorded discharge and the recorded treatment didn't match.
- The 'None' treatment are whole sets of observations made without any discharge.
- There are still many observations with sump discharge.

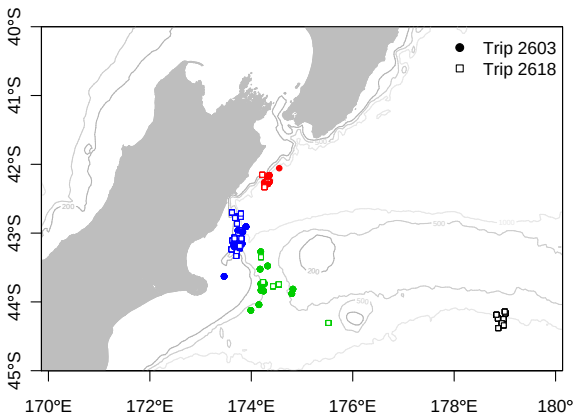
Sheltering on the bridge

- In the second trip, the observer sometimes made observations from the bridge of the vessel during rough weather.
- This was recorded in the comments form.
- There were 110 observations in the groomed data that were made from the bridge, out of a total of 343.
- Bird counts were generally lower during these observations.
- Removed these observations from the dataset.

Bird counts

Median bird count during offal discharge varies between trips and between locations. Table gives the total birds (in air and on water) within 40m of the stern.

	Trip 2603			Trip 2618	
	West	South	North	West	East
Large albatross	4	2	8	15	6
Small albatross	30	48	80	90	28
Cape petrel	0	0	0	115	40
Other petrel	120	110	29	55	75



Bird counts

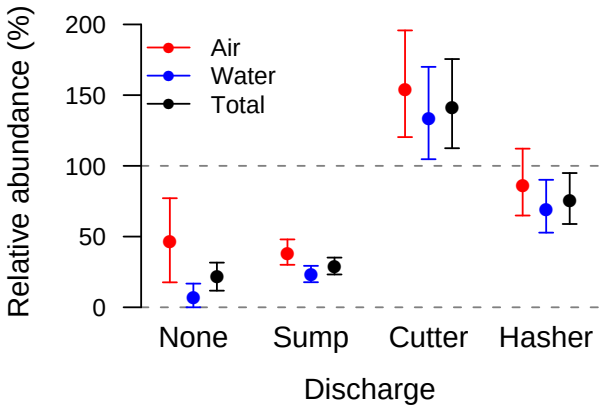
Average bird numbers during offal discharge, in both of the sweeps, in the air and on the water.

	40 m		10m	
	Air	Water	Air	Water
Large albatross	2.5	4.1	0.4	0.5
Small albatross	21.4	34.2	5.7	5.8
Cape petrel	13.4	26.1	6.9	10.9
Other petrel	37.0	56.5	9.5	8.7

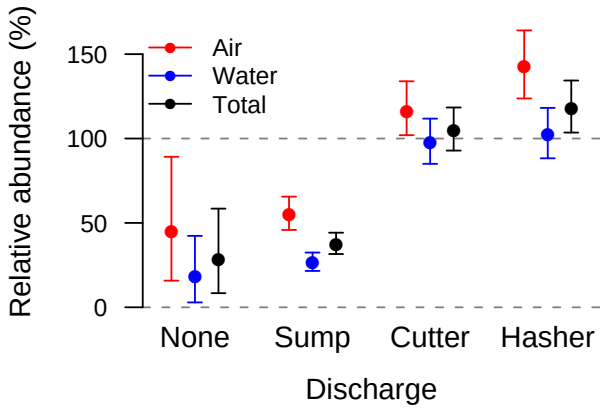
Relative counts

Mean counts relative to during offal discharge

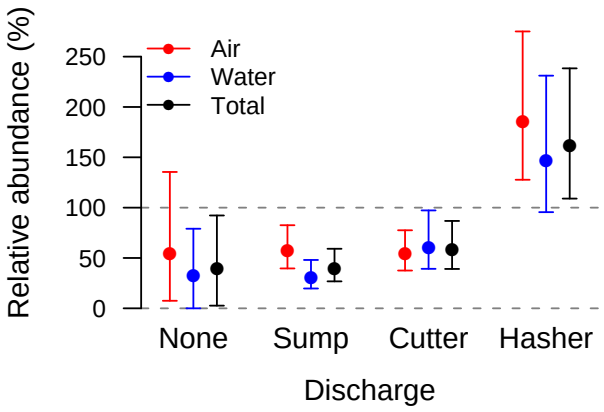
Large albatross, 40m



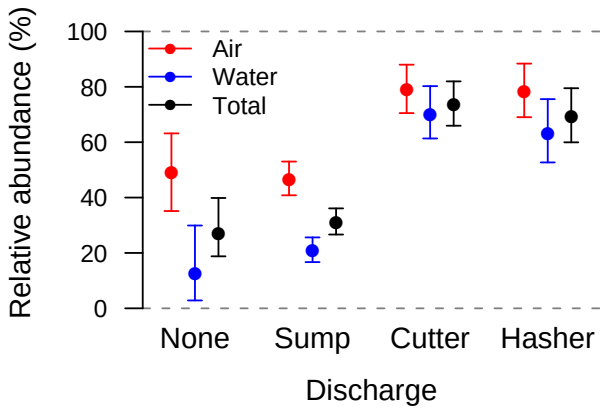
Small albatross, 40m



Cape petrel, 40m



Other petrel, 40m



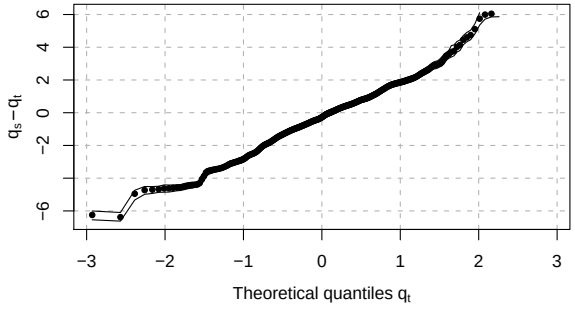
Models

- Want to determine the influence of discharge on the bird counts.
- Raw data does not show a clear treatment effect.
- Despite the experimental design, treatments were not evenly distributed between locations, or trips. The form design also means that sequential counts are not independent.
- Statistical modelling allows for the influence of other effects on the bird counts to be accounted for.
- Build independent models for each bird group, for each distance and for in the air, on the water and total counts (24 models).

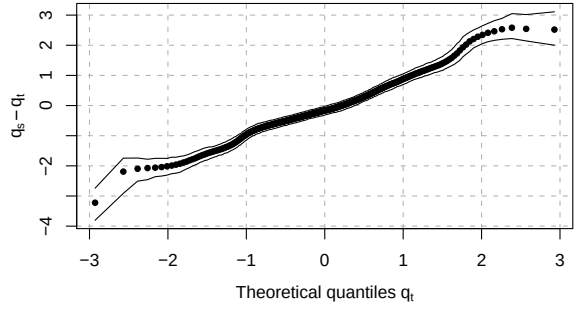
Model structure

- Generalized linear model.
- Covariates derived from collected data, including discharge.
- Include a tow level random effect, that allows variation from tow to tow that is not explained by the covariates and reflects the sampling design.
- Allow for overdispersion.
- Pick covariates from a maximum likelihood model.
- Fit the whole caboodle using Bayesian methods.

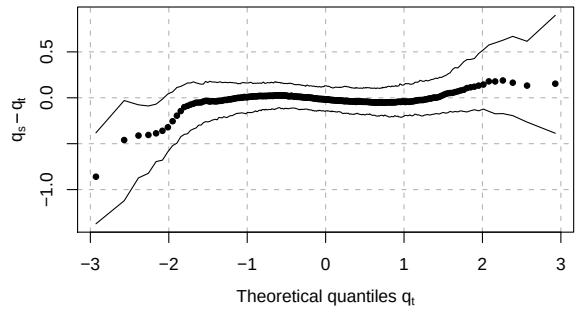
Poisson:



Random effects:



RE and overdispersion:



Covariate selection

Potential covariates include:

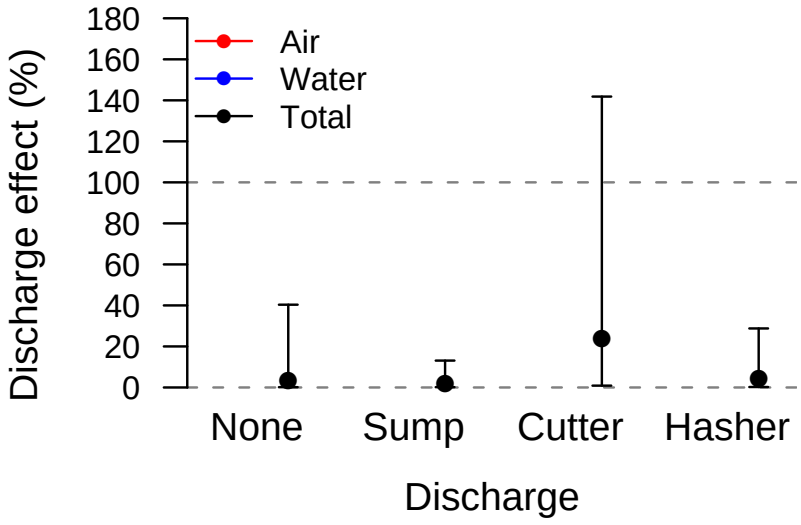
- Location (Four areas)
- Trip (Two trips)
- Swell height (log(swell+1))
- Wind speed (log(wind+1))
- Vessels visible (log(visible+1))
- Time of day (sin(time $\times$ π/12), cos(time $\times$ π/12)

An automated model step routine was used to select the covariates, with the requirement that they explain at least 2% of the remaining deviance.

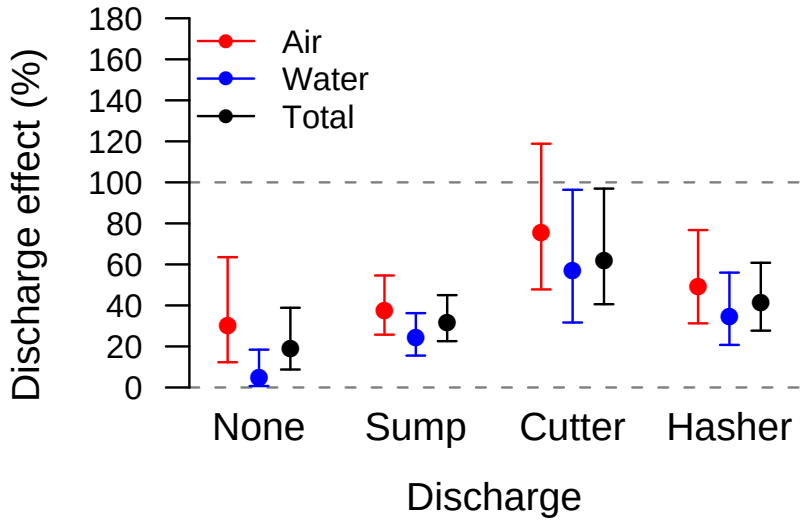
All covariates were selected in some models. Location and trip were most frequently selected and explained a high percentage of the deviance. The number of vessels visible was not often included and only explained a small amount of the deviance.

Results - Large albatross

10m:



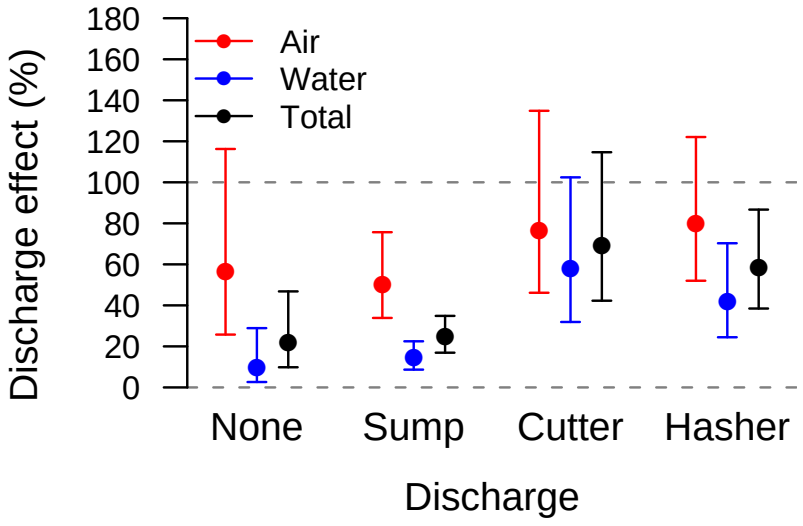
40m:



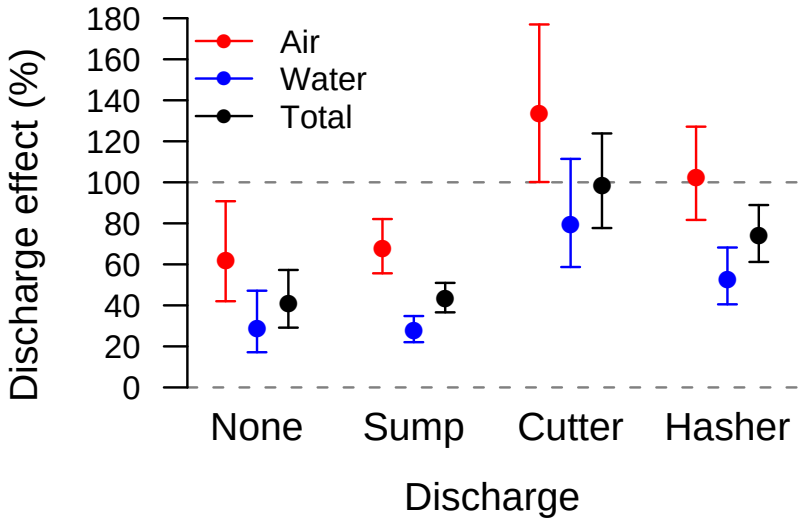
- Models did not converge for 10m air or water counts.
- Hasher and cutter pump discharge associated with a significant reduction in total numbers.
- Similar patterns for numbers of birds in air and on the water.

Results - Small albatross

10m:



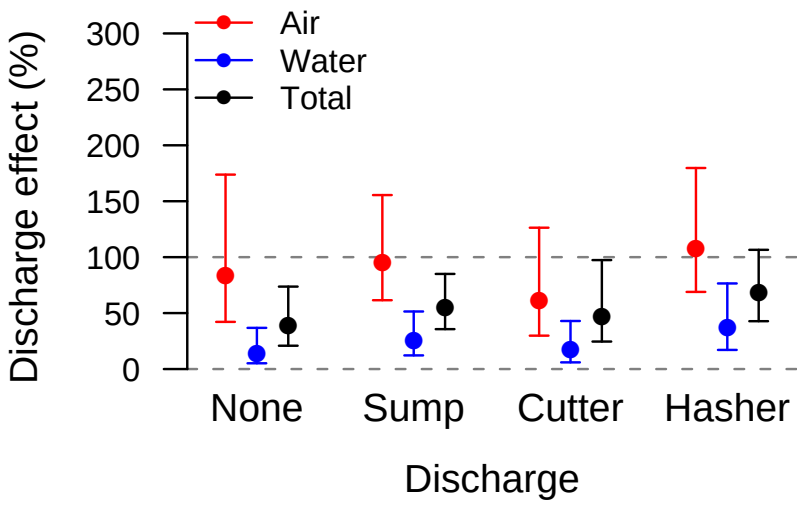
40m:



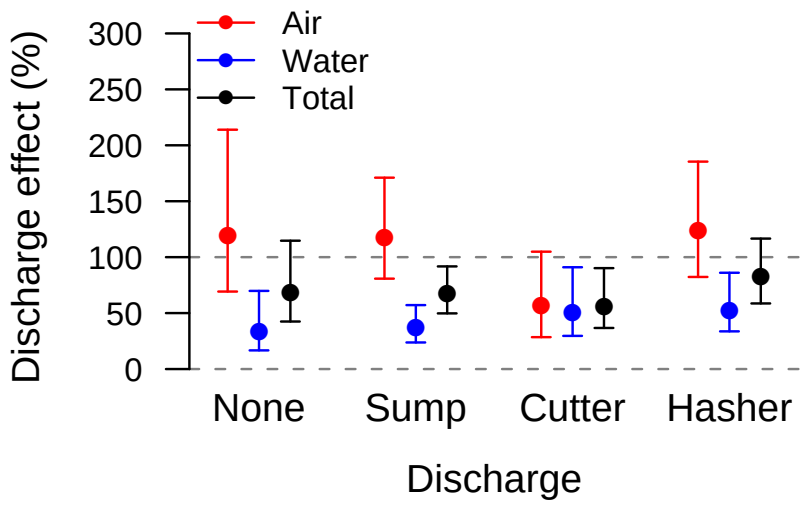
- Limited evidence of a treatment effect for the 40m counts, but median suggests a reduction in the 10m counts.
- Less effect on counts of birds in the air.

Results - Cape petrel

10m:



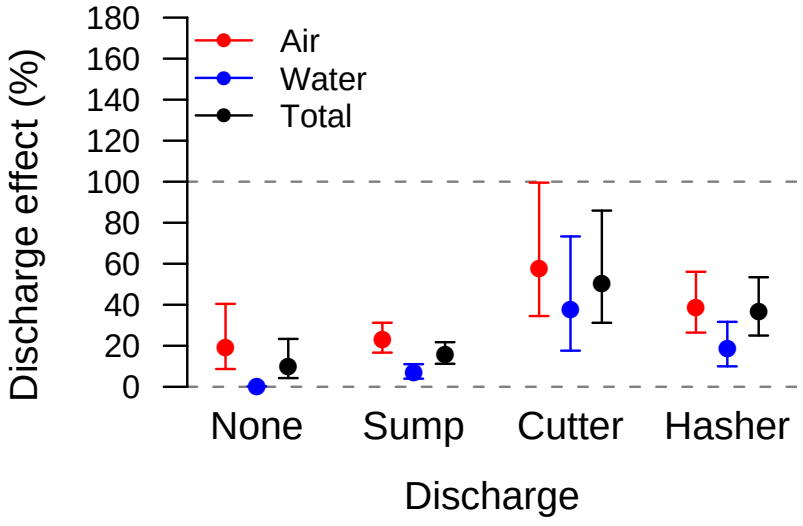
40m:



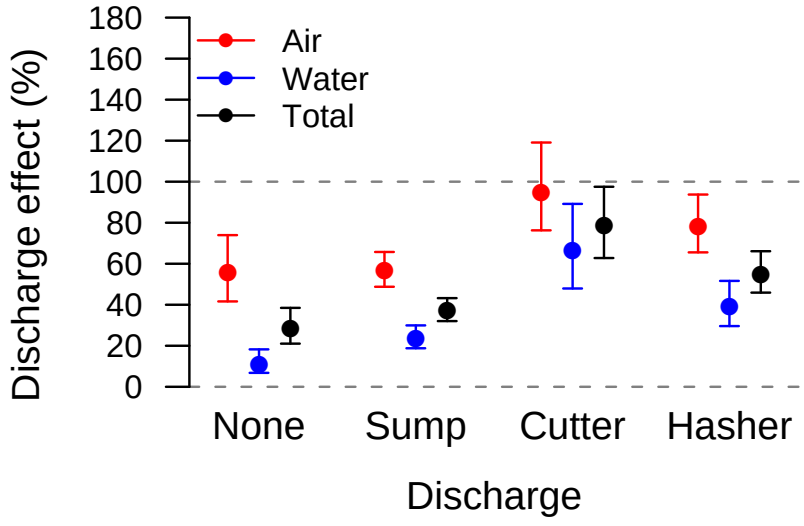
- Discharge does not appear to affect numbers of cape petrel in the air.
- Hasher and cutter pump discharge associated with a reduction of birds on the water within both the 40m and 10m sweeps.

Results - Other petrel

10m:



40m:



- Hasher and cutter pump discharge associated with a significant reduction in bird counts in (almost) all categories.
- Strong reduction in 10m counts for hasher discharge (less than 50%).

Summary

- Despite the raw data (!), the models show a reduction in counts when discharge is processed.
- Less effect on counts of birds in the air.
- Generally there is a stronger effect on the 10m counts than the 40m counts.