Examination of effectiveness of seabird bycatch mitigation measures for small-scale longline vessels fishing north of 23°N specified in CMM 2015-03

N. Katsumata, K. Okamoto, D. Ochi, Y. Inoue, H. Matsunaga, H. Minami and * K. Oshima

National Research Institute of Far Seas Fisheries, 5-7-1 Shimizu-Orido, Shizuoka 424-8633, Japan

Introduction

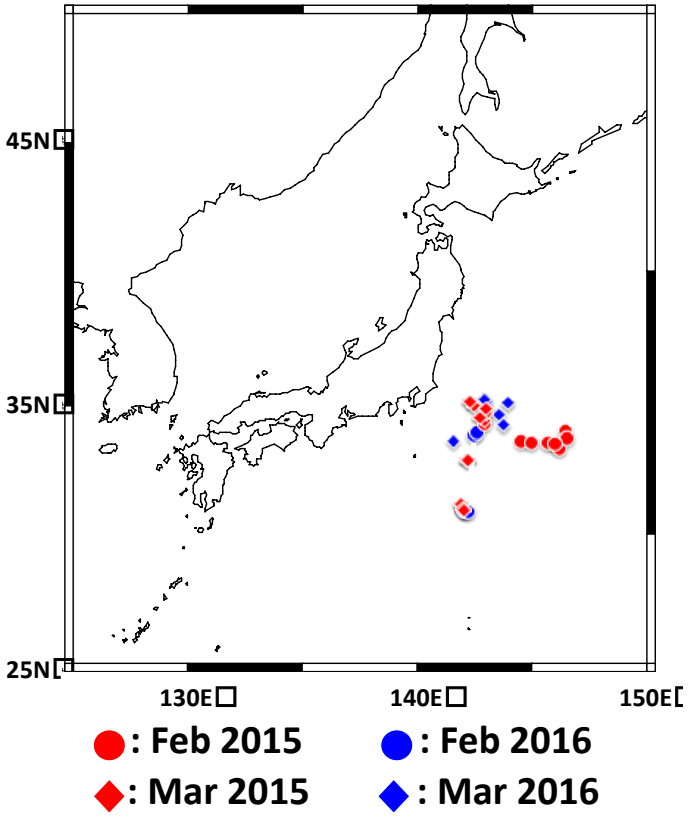
- Japan submitted documents on development of seabird bycatch mitigation measures, especially tori line for Japanese small LL vessels fishing north of 23°N to past SCs
  - Ochi et al. (2013) showed that single use of tori line dramatically reduce albatross bycatch in the pelagic longline fisheries in the NPO.
  - Ochi et al. (2014) interviewed fishing masters of small LL vessels operated in the NPO. Fishing masters had concerns about usage of long streamers, double tori line and towing devices because of risk of entanglements with fishing gears.
  - Katsumata et al. (2015) reported results of examination on the effectiveness of tori line without streamer substantially reduced seabird bycatch.

Objective

- To examine the effectiveness of tori line for small LL vessels fishing north of 23°N based on results from on-board researches conducted in 2015 and 2016.

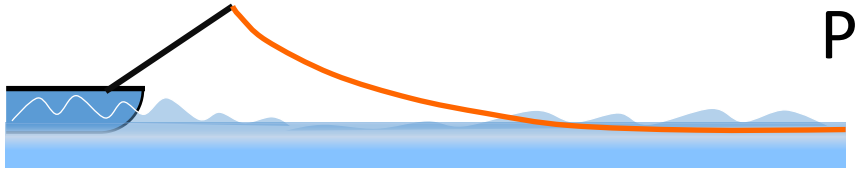
Methods

- RV — Han-ei-maru No. 188 (19GRT, <24 m in length)
- Survey period — Feb-Mar
- Area — Selected high density area of seabirds
- LL gear config. — Targeting BET (deeper set)
- Length of branch line — 23m
- No. of Hooks — 1536
- Baits
  - 2015 — Clupeid fish
  - 2016 — Japanese sardine
- Total no. of operation
  - 2015 — 18 (one operation was excluded for analysis)
  - 2016 — 17

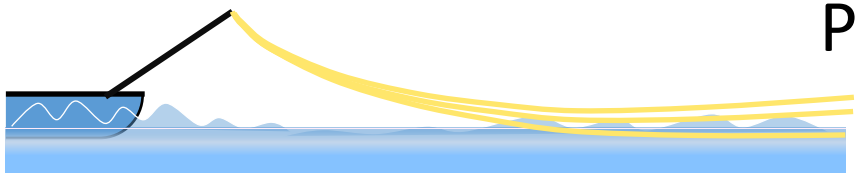


Methods: Experiment design

Segment A) tori-line without streamer

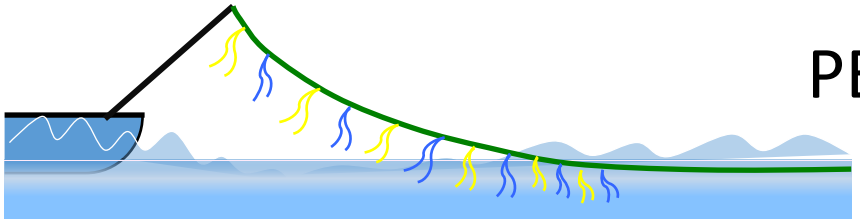


Segment B) bundled 3 polypropylene bands

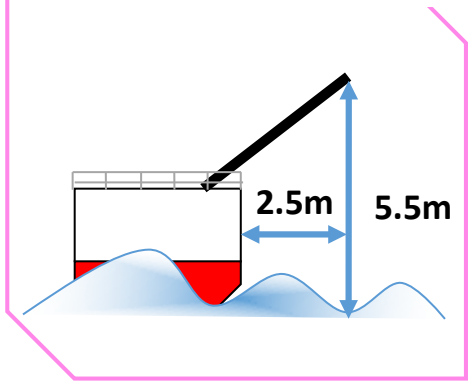


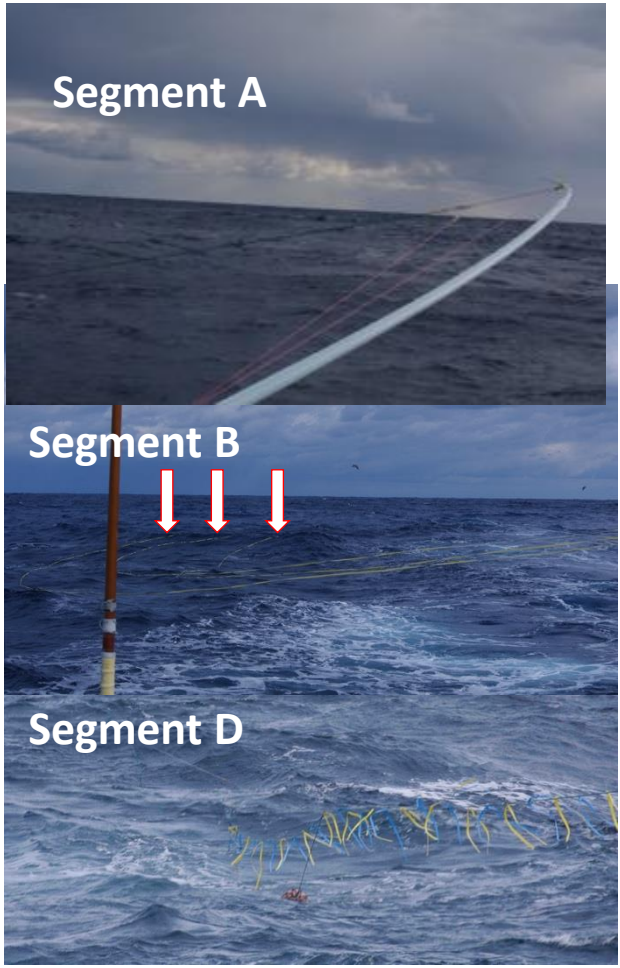
Segment C) Without tori-line

Segment D) tori-line with streamer



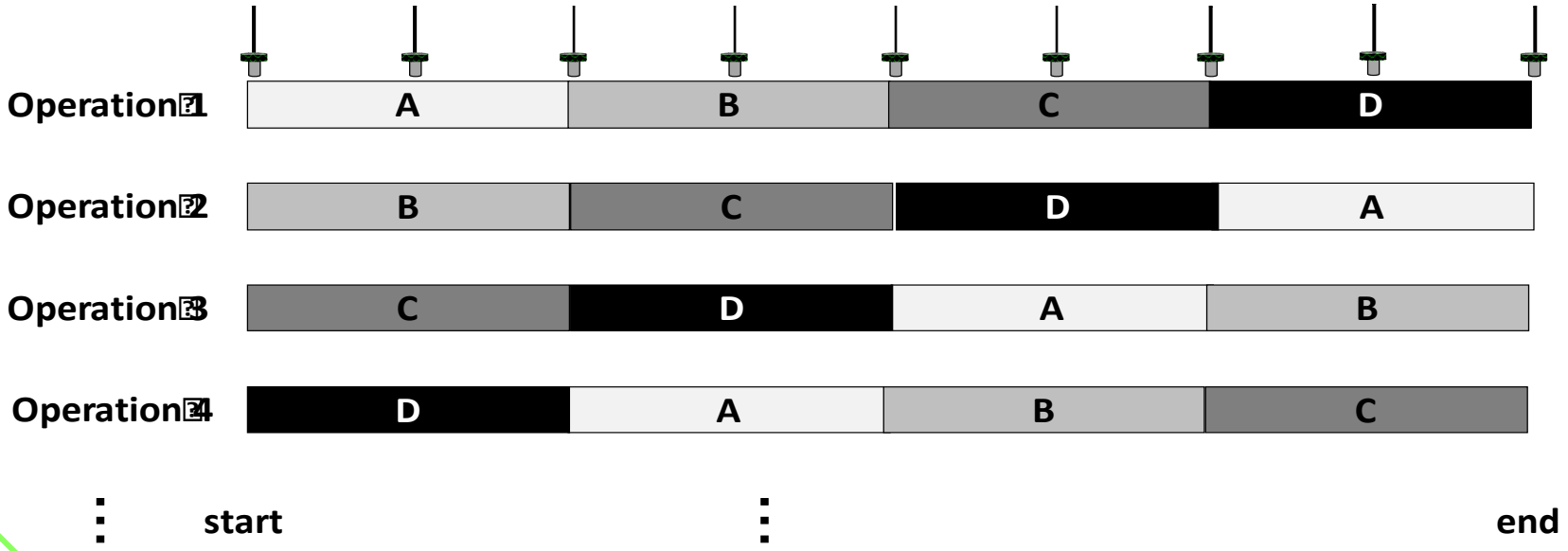
Installation position





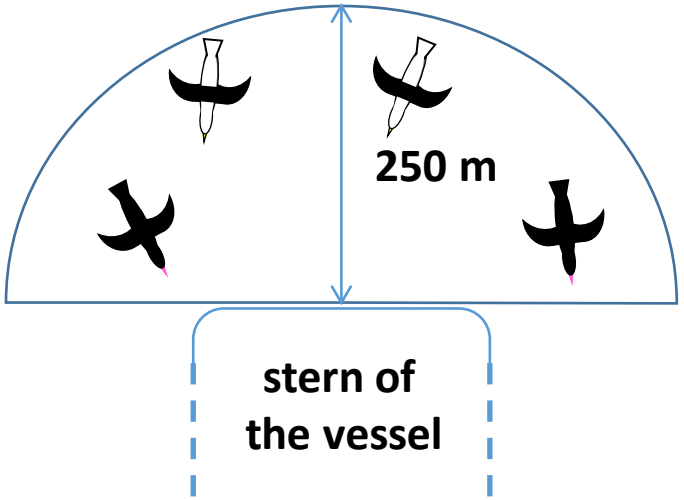
Methods: Experiment design

Experimental rotation

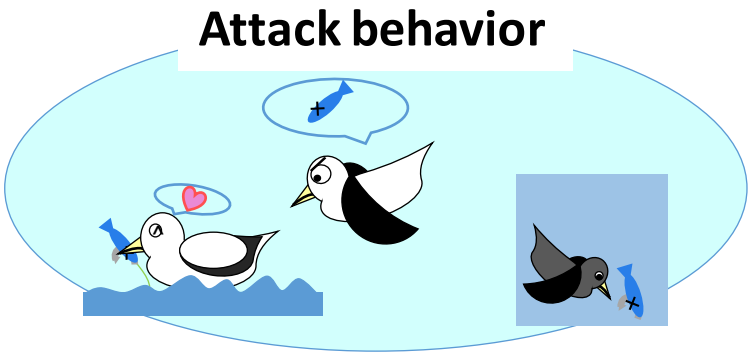


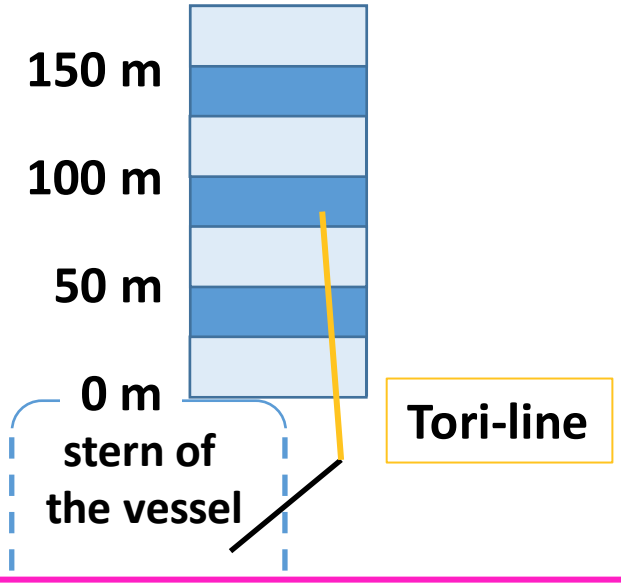
Observation: 20-25 minutes observation session (Melvin et al., 2013)

5 min: species identify & counting number



15-20 min: counting attack behavior





Result

Seabird abundance during line setting

Species	Sceintific name	No. of seabirds observred	Average birds of obs. mean	Average birds of obs. S.D.	Attack rate (/min) mean	Attack rate (/min) S.D.
Streaked shearwater	*Calonectris leucomelas*	5422	19.50	26.80	0.070	0.337
Laysan albatross	*Phoebastria immutabilis*	1899	6.83	8.23	0.016	0.097
black-footed albatross	*Phoebastria nigripes*	704	2.53	3.06	0.006	0.031
Large gull sp.	*Larus sp.*	109	0.39	1.33	0.001	0.024
Northern fulmar	*Fulmarus glacialis*	83	0.30	1.05	0.002	0.021
Small gull sp.	*Larus sp.*	59	0.21	0.75	0.001	0.029
Strom petrel sp.	*Oceanodroma sp.*	12	0.04	0.25		
short-tailed shearwater	Puffinus tenuirostris	2	0.01	0.08		
Unknown shearwater sp.	*Puffnus sp.*	2	0.01	0.12	0.0001	0.0016
Unknown strom petrel sp.	*Oceanodroma sp.*	2	0.01	0.08		
Petrel sp.	*Pterodroma sp.*	1	0.004	0.06		
Unknown					0.001	0.007
Total					0.098	0.362

Laysan albatross

black-footed albatross

streaked shearwater

Results

Number of hooks by segment

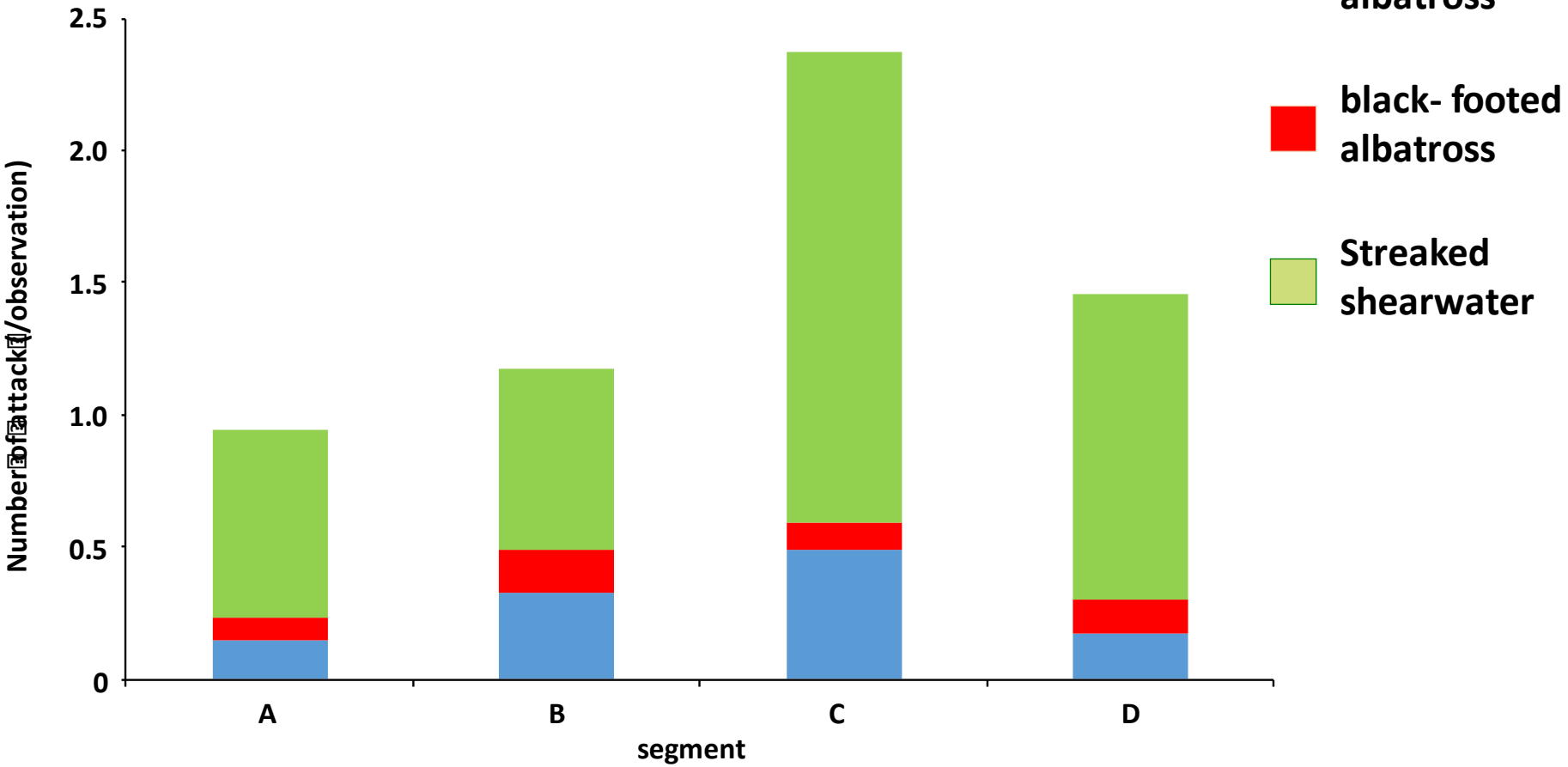
Year	Segment				Total
	A	B	C	D	
2015	6528	6528	6528	6528	26112
2016	6528	6528	6528	6528	26112

Aerial extent of each tori line

- Segment A (without streamer) 42.2 ± 8.7 m
- Segment B (3 bundled line without streamer) 43.8 ± 10.7 m
- Segment D (with streamer) 39.5 ± 9.2 m

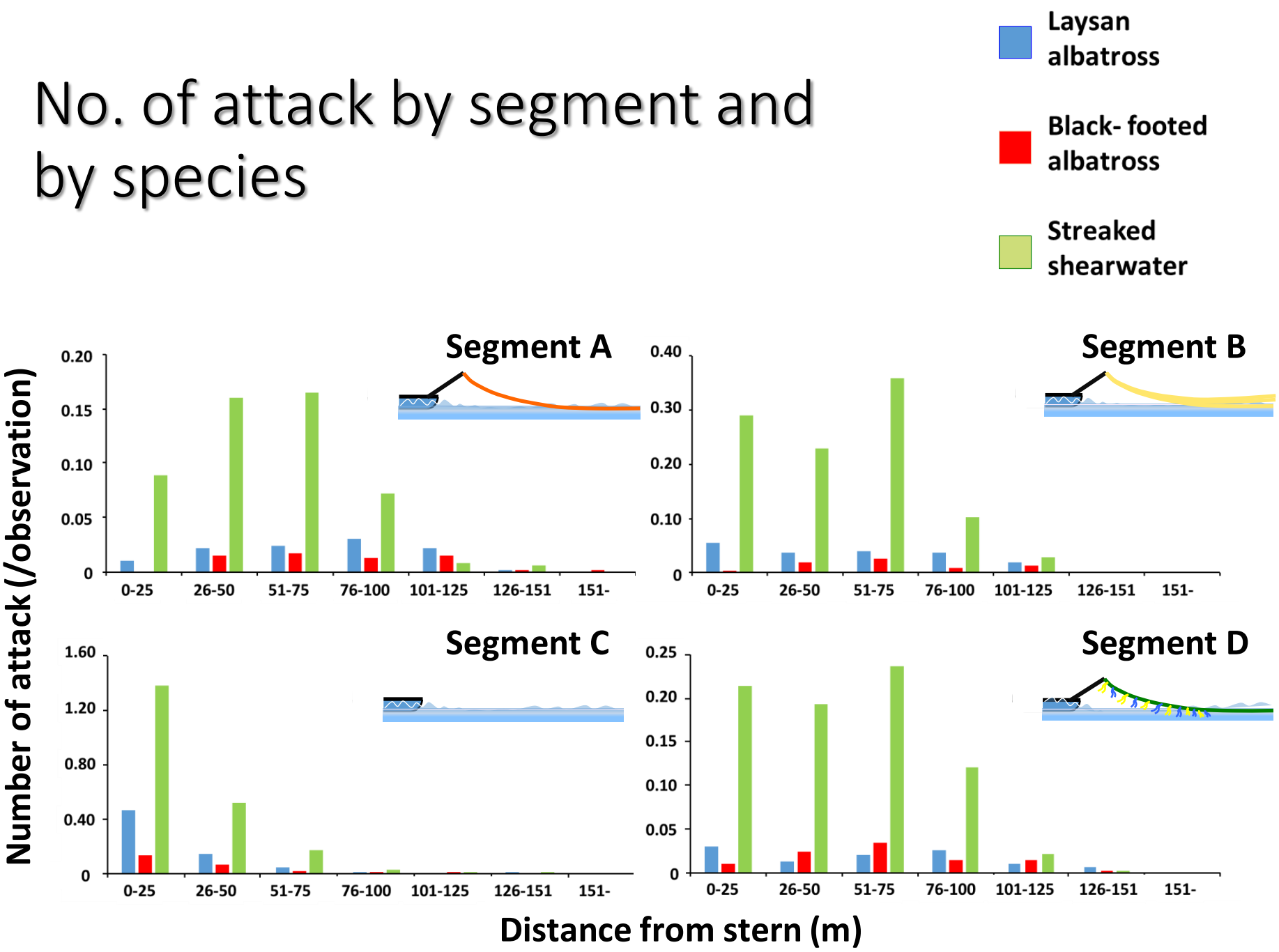
Results

Number of attacks by segment by species

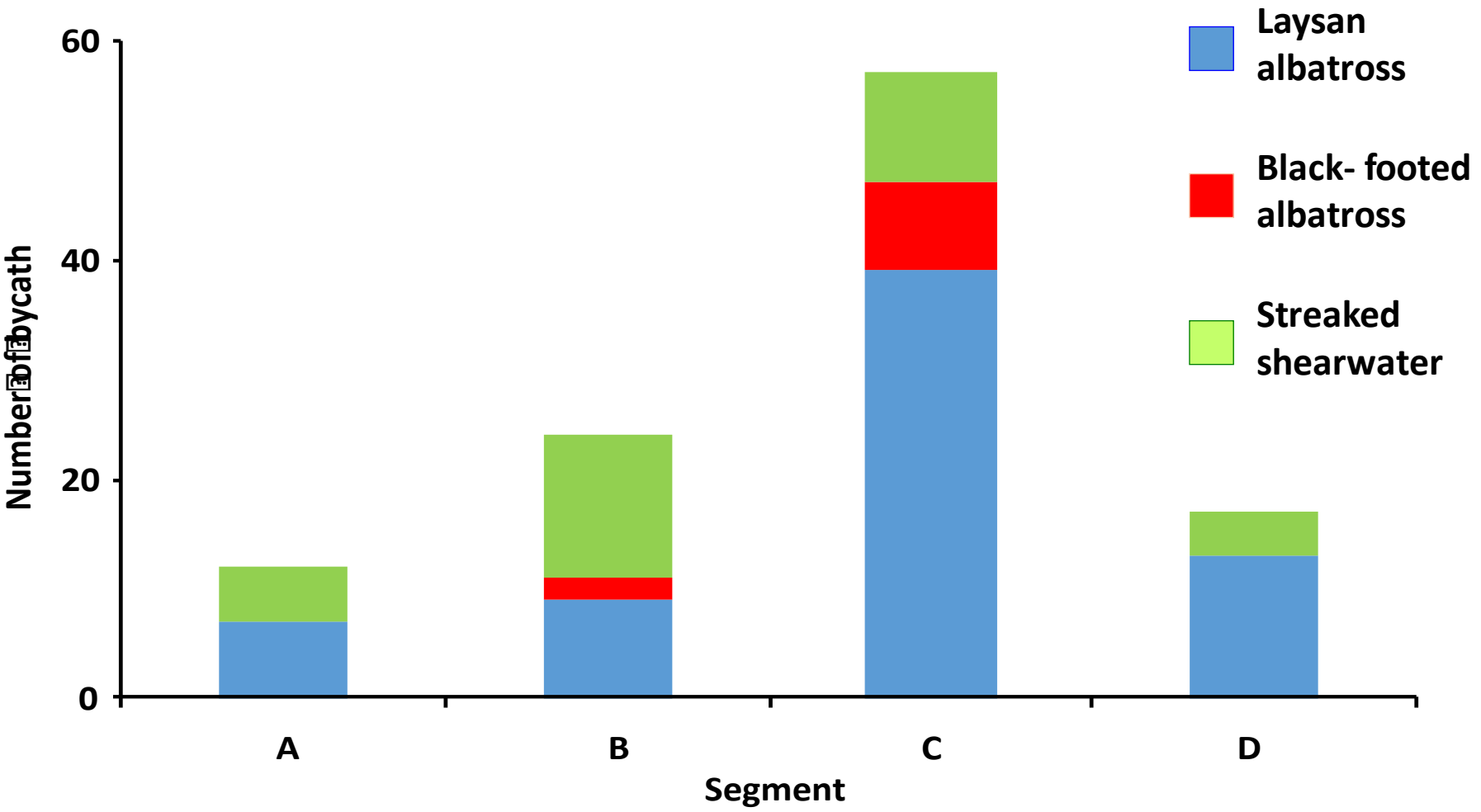


Attack numbers: Segment A < Segment B < Segment C < Segment D

No. of attack by segment and by species



No. of seabirds bycatch by segment



Tori-line(s) effectively reduced seabird bycatch

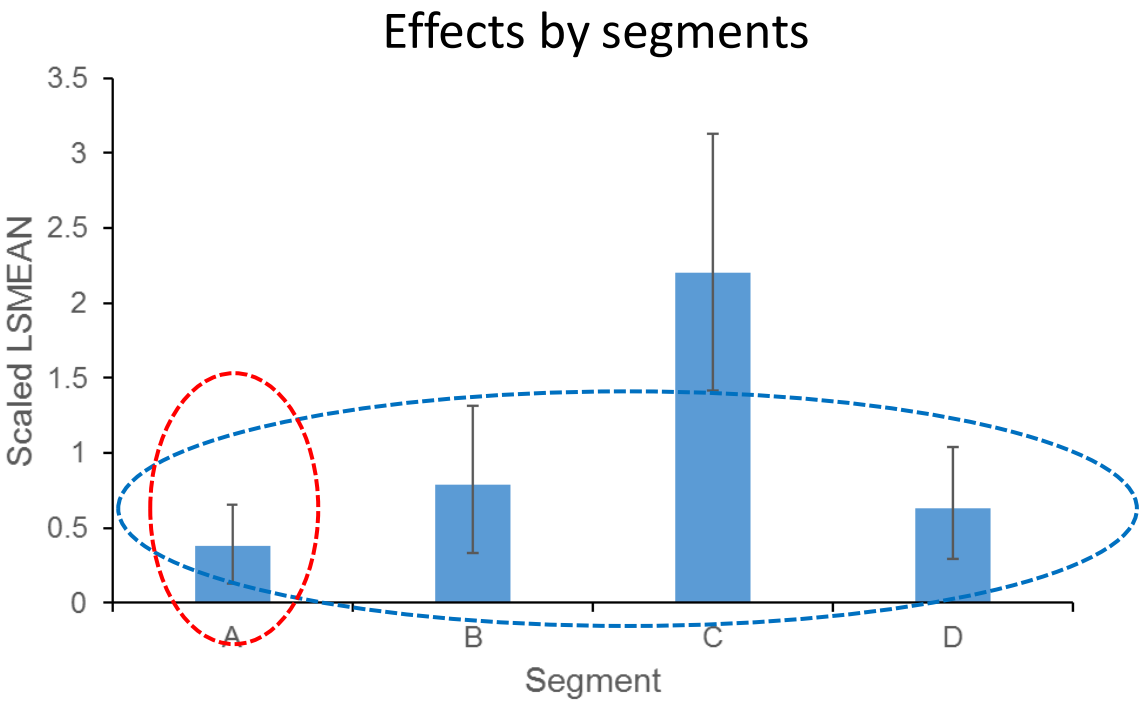
Statistical analysis for number of seabird bycatch

Generalized linear model (log-link function, negative binomial)

Model selection: AIC

Initial model: bycatch number ~ Segment + Year + Segment*Year

Final model: bycatch number ~ Segment + Year



Discussion
Why high BPUE?

BPUE (bycatch number / 1000 hooks)			
Segment A	Segment B	Segment C	Segment D
0.91 (12)	1.79 (24)	4.30 (57)	1.28 (17)

Reasons

- Fishing trials were conducted in waters where a good deal of seabirds were found, especially in 2016.
- Season and area were limited.
  - Commercial small LL vessels operated year round.
  - Commercial small LL vessels spread widely in the Northwest Pacific Ocean.
- No. of trials was not so high (35 operations).

Effectiveness of tori line

Attack numbers

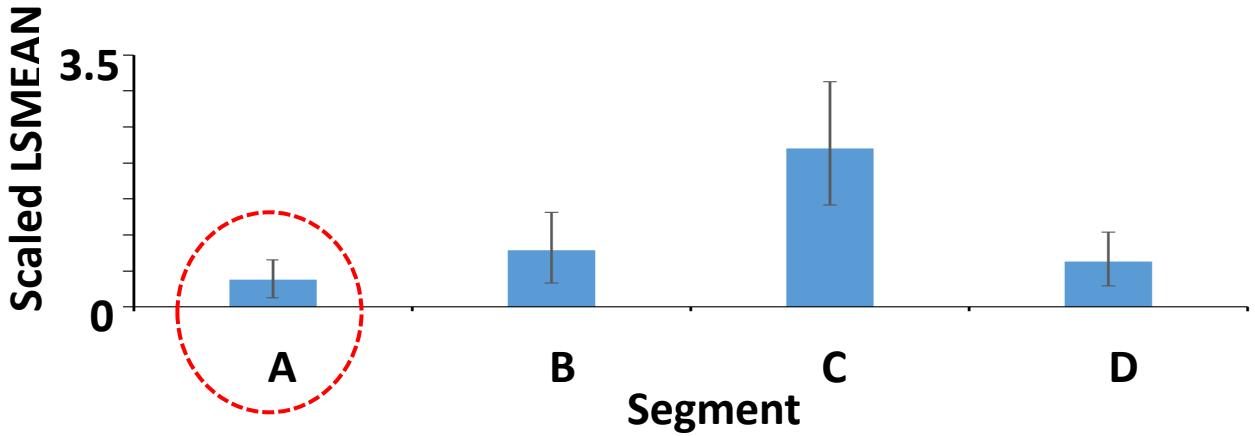
Tori lines Segment A, B and D	<	No tori lines Segment C

Bycatch numbers

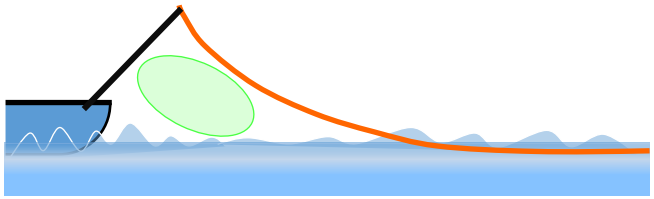
Tori lines Segment A, B and D	<	No tori lines Segment C

Tori line much reduced no. of attacks and seabird bycatch compared to no tori line case.

Why tori line without streamer showed best performance?



Reasons



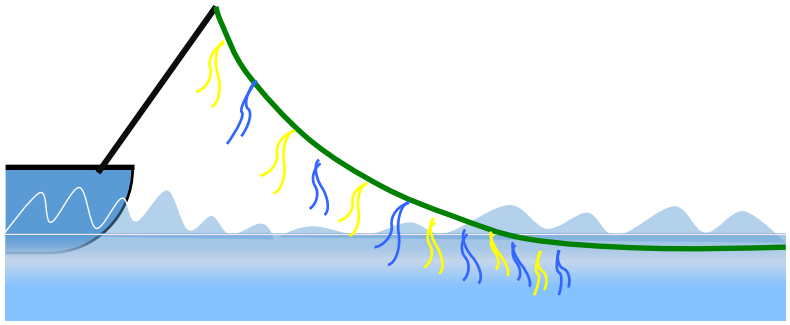
- **Narrow space under tori line**

  -> Seabirds cannot approach

- **Gliding flight of albatrosses**

  -> They cannot turn in a small radius

Entanglement of a light streamer tori line with gear



Entanglement occurred under ordinary marine condition

Wind speed: 9m/s (average: 8.0±3.6m/s)
Wave height:1.5m (average:1.7±0.5m)

- Small vessels is instable for wind and wave.
- Commercial operation will be done under worse environment.
- Towing device of underwater segment easily cause entanglement (Sato et al. 2014).

Application of a light streamer tori line has a potential

✓ to caused of operational troubles for small LL vessels

✓ to increase risk of crews during line setting

Small working space of Japanese small LL vessel

Line setting at stern

Line hauling

Conclusions

- Tori line without streamer has good performance in reduction of seabird bycatch for Japanese small longline vessels fishing north of 23°N.
- Tori line with streamer has potential to increase risk for crews due to entanglement with gear during line settings.
- Not only performance in mitigation but also safety of crews should be considered, when mitigation measures are examined.