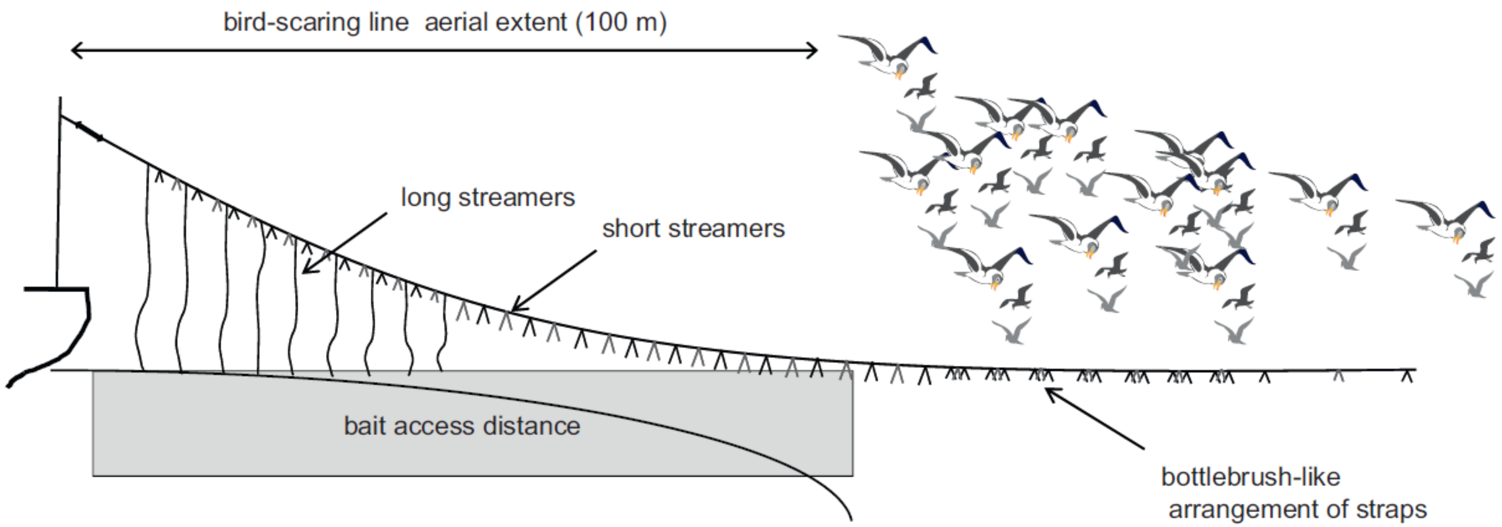
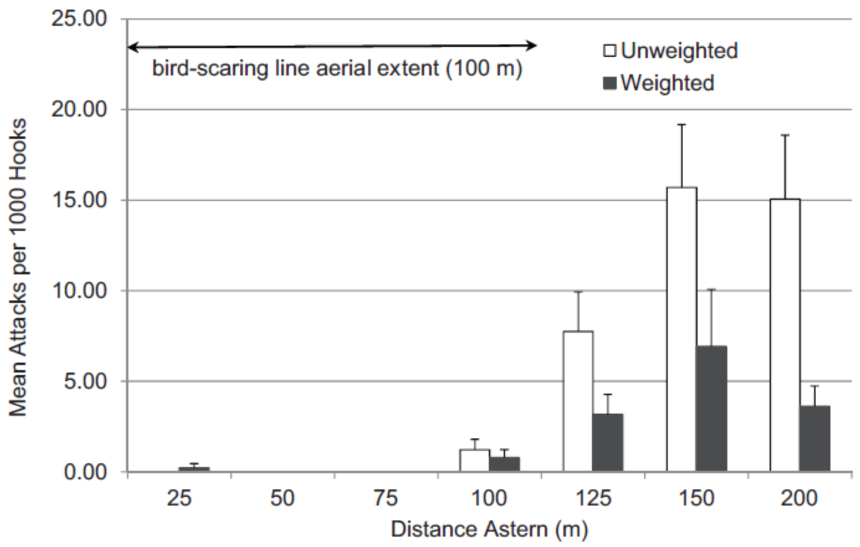
Tori (bird scaring) lines:
specifications and efficacy



20 Feb 2024

Tori (bird scaring) lines





Melvin et al. 2014

Tori lines:

- Are a key seabird bycatching mitigation method
- prevent seabird from accessing hooks during the set
- Are a key component of CMM 2018-03 in both hemispheres
- Come in different configurations and with different specifications

Tori (bird scaring) lines

Pierre 2023

Target species	Effect size (%)	Location	Source
Swordfish	+32	Brazil	Mancini et al. 2009
Blue shark	+15		
Other elasmobranchs	+17		
Other teleost fishes	+16		
Tuna	+1	Southern Ocean	Brothers 1991

All evidence illustrates that tori lines do not decrease target catch, and in fact may increase target catch rates.

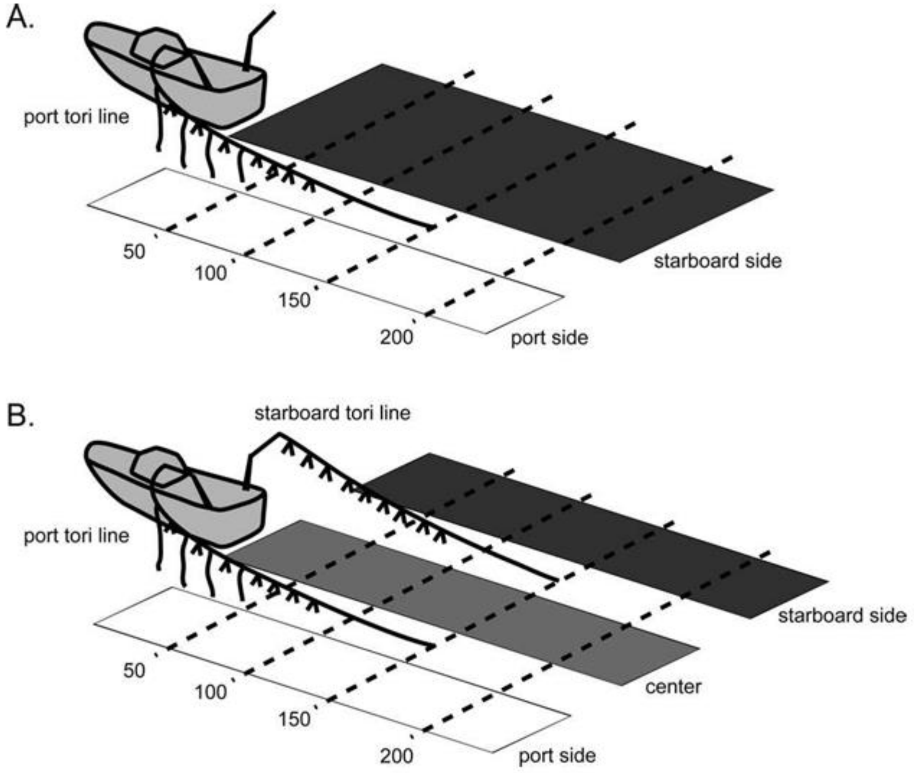
Tori (bird scaring) lines

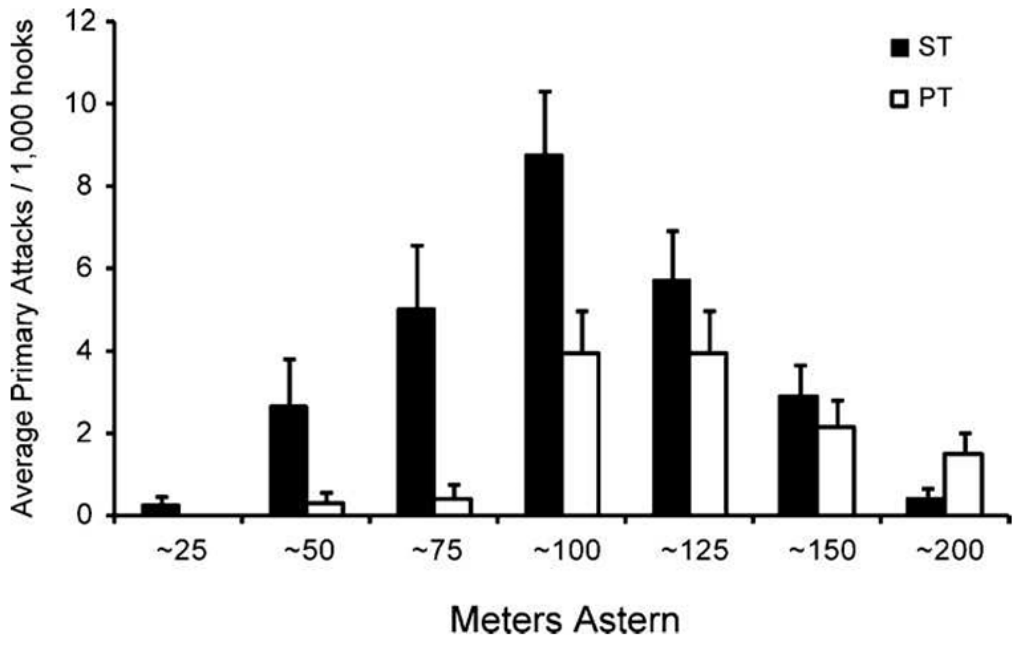
Pierre 2023

BPUE (usually /1000 hooks) with tori line	BPUE (usually /1000 hooks) without tori line	Change (%)	Location	Source
0.47	0.74	-36	Australia	Brothers 1991
0.47	2.23	-79	Hawai'i (swordfish)	McNamara 1999
0.8	10.7	-93	Hawai'i (tuna)	McNamara 1999
0.10	0.64	-84	South Africa	Peterson et al. 2008
0.31	0.85	-64	Brazil	Mancini et al. 2009
0.11	0.33	-67	South Africa	Rollinson et al. 2017
0.13	0.85	-85	Southwest Atlantic	Domingo et al. 2017
2.35	5.49	-57	Uruguay	Jimenez et al. 2019
-	-	-51	New Zealand	Meyer & MacKenzie 2022
0.022	0.304	-93	Hawai'i	Gilman et al. 2022

Evidence from around the world overwhelming illustrates the efficacy of tori lines in reducing seabird bycatch (On average, 70% in the WCPO)

Tori (bird scaring) lines





Sato et al. 2013

Pairing tori lines further improves bycatch reduction efficacy (-52% attack rates in the Western North Pacific)

Tori (bird scaring) lines

Practical considerations:

- Tori lines must have the right specifications to be effective
- Tori lines must be monitored and maintained to be effective
- To achieve sufficient aerial extent, deployment structures may be required, particularly on small vessels
- Weak links can enable rapid releases (e.g., Gilman et al. 2021)
- Secondary lines can enable tori line retrieval
- Deployment reels can facilitate efficacy

Pierre 2023

Tori (bird scaring) line specifications in the Southern Hemisphere (South of 25° S)

Specifications	CMM 2018-03 requirements		ACAP Best Practice	
Vessel size	**≥35 m**	**<35 m**	**≥35 m**	**<35 m**
# tori lines	1-2	1-2	1-2	1-2
Long streamers	• Colourful • Intervals <5 m • Swivels • reach sea surface in calm conditions	Optional: • Colourful • Intervals <5 m for first 75 m • Swivels optional • Reach sea surface in calm conditions (but first 15 m may be modified	• Colourful • Intervals <5 m • Swivels • reach sea surface in calm conditions	Optional: • Colourful • Intervals <5 m for first 75 m • Swivels optional • Reach sea surface in calm conditions (but first 15 m may be modified
Short streamers	• Colourful • >1 m length • <1 m intervals	• Colourful • >1 m length • <1 m intervals	• Colourful • >1 m length • <1 m intervals	• Colourful • >1 m length • <1 m intervals
Aerial extent	≥100 m	≥75 m	≥100 m	≥75 m
Tori line length	>200 m	Sufficient to maintain aerial extent	>200 m	Sufficient to maintain aerial extent
Deployment height	>7 m	>6 m	>8 m	>6 m
Deployment location	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line

Tori (bird scaring) line specifications in the Northern Hemisphere (North of 23° N)

Specifications	CMM 2018-03 requirements		ACAP Best Practice	
Vessel size	**≥24 m**	**<24 m**	**≥35 m**	**<35 m**
# tori lines	0-2	0-2	0-2	0-2
Long streamers	Optional: • Intervals <5 m • Swivels optional • As close to water as possible	Optional: • Intervals <5 m • Swivels optional • As close to water as possible	Required: • Colourful • Intervals <5 m • Swivels required • Reach sea surface in calm conditions	Optional: • Colourful • Intervals <5 m • Swivels optional • Reach sea surface in calm conditions
Short streamers	• >0.3 m length • <1 m intervals	Optional: • >0.3 m length • <1 m intervals	• Colourful • >1 m length • <1 m intervals	Required: • Colourful • >1 m length • <1 m intervals
Aerial extent	Over sinking hooks	Over sinking hooks	≥100 m	≥75 m
Tori line length	≥100 m	NA	≥200 m	Sufficient to maintain aerial extent
Deployment height	≥5 m from where line enters water	≥5 m from where line enters water	>8 m	>6 m
Deployment location	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line	If using 1: windward of sinking baits, if using 2: at opposite sides of deployment line

Tori line specifications for small vessels in the Northern Hemisphere

CMM 2018-03 requires that the specifications of tori lines for vessels <24 m in the Northern Hemisphere are reviewed based on scientific data.

Northern Hemisphere tori line specifications for small vessels deviate from best practice as follows:

- Aerial extent is not specified
- Streamers are optional
- Streamer design is optional

Tori line specifications for small vessels in the Northern Hemisphere

A range of studies have evaluated the tori line specifications from small vessels in the NH and their efficacy (e.g., Katsumata et al. 2015, Ochi 2022, Ochi 2023), as following:

- Overall, result suggest that streamer-less tori lines are as effective as small streamer tori lines

Ochi 2022

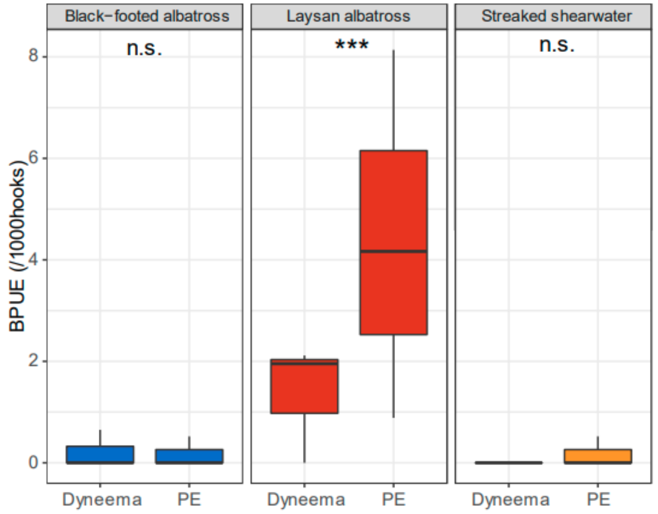
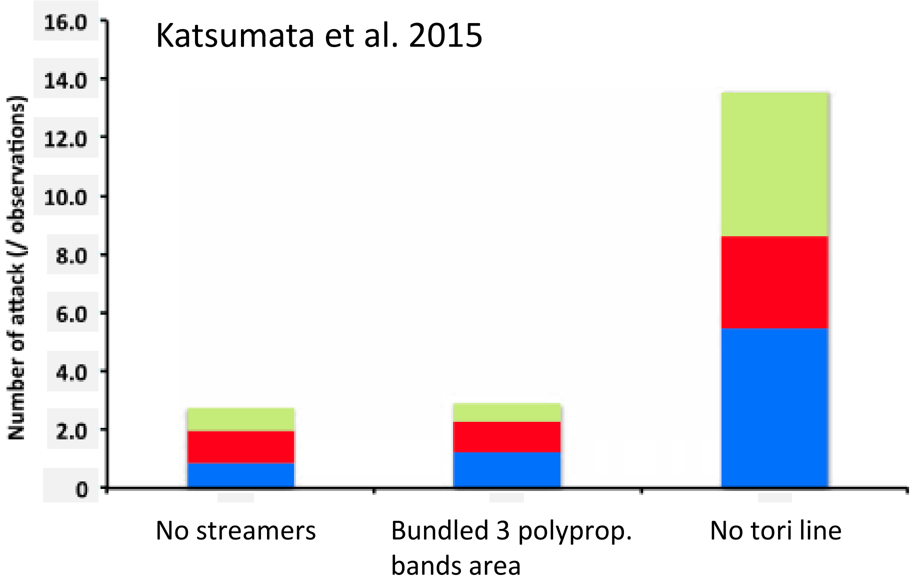
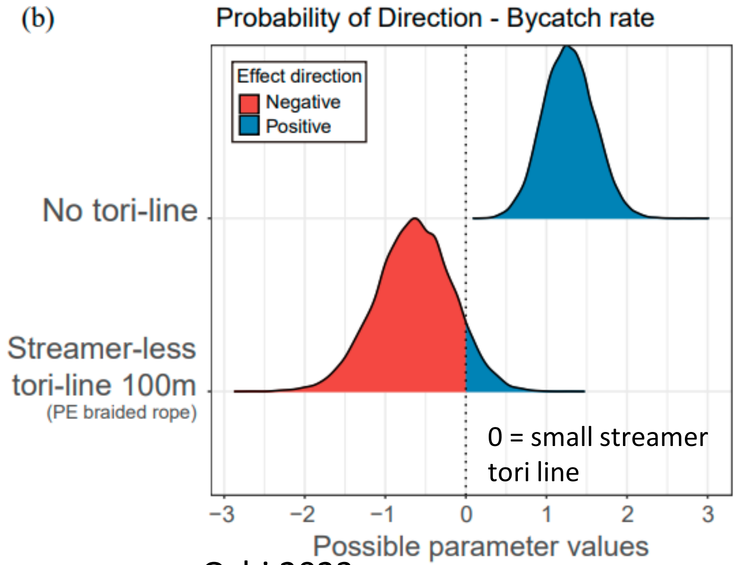


Figure 5 Bycatch rate (BPUE) for each tori-line recorded in the bycatch mitigation effectiveness experiment. Asterisks indicate for significant testing in BPUE between tori-lines using the generalized linear model, and *** denotes p < 0.001.





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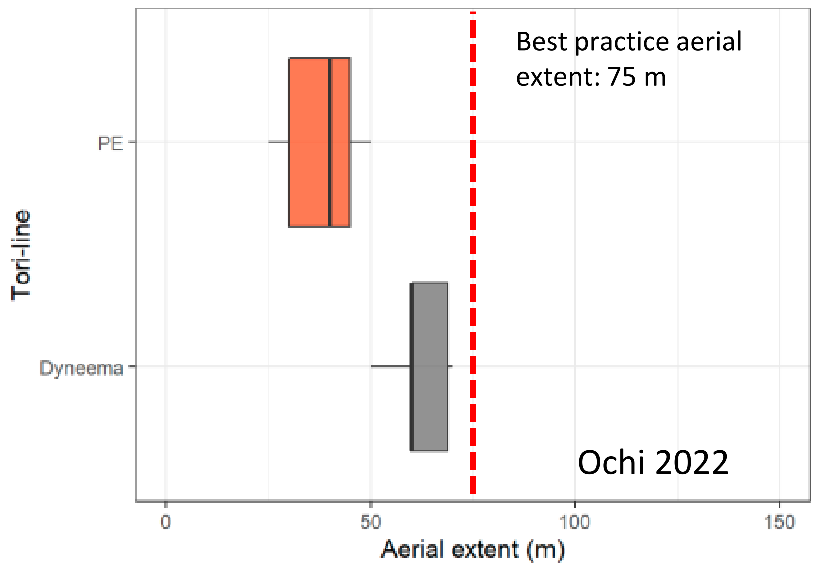
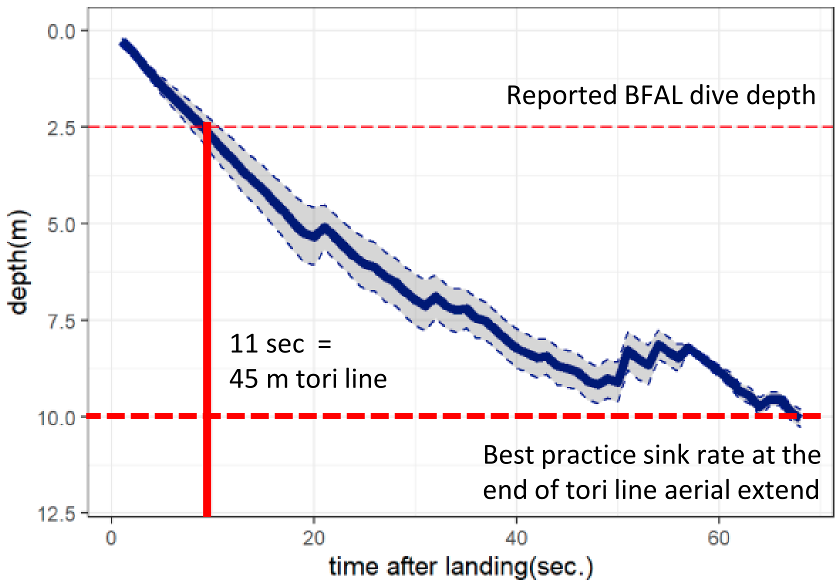
- Overall, result suggest that streamer-less tori lines are as effective as small streamer tori lines
- However, experiments were confounded by varying (and suboptimal) aerial extents, even when considering sink rates and BFAL dive depths

Light streamer tori line aerial extent	Streamer-less tori line aerial extent
37 m	40 m

Ochi 2023

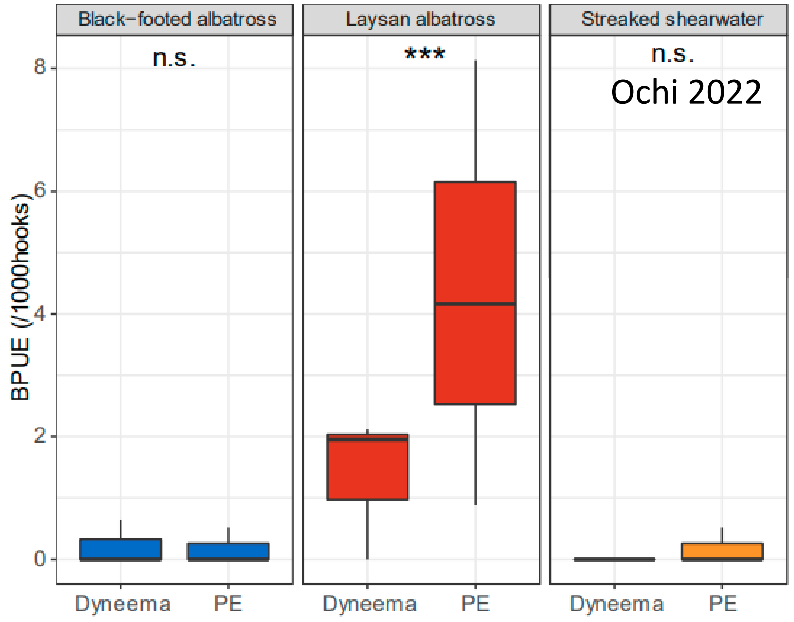




Tori line specifications for small vessels in the Northern Hemisphere

A range of studies have evaluated the tori line specifications from small vessels in the NH and their efficacy (e.g., Katsumata et al. 2015, Ochi 2022, Ochi 2023), as following:

- Overall, result suggest that streamer-less tori lines are as effective as small streamer tori lines
- However, experiments were confounded by varying (and suboptimal) aerial extents, even when considering sink rates and BFAL dive depths
- BPUE under all tori line treatments in experiments were still high



Design	BPUE	Aerial extent	Source
Streamer-less	**0.29**	**40 m**	Katsuma et al. 2015, Ochi 2023
3 polyprop bands	0.43	37 m	Katsuma et al. 2015, Ochi 2023
None	1.34	NA	Katsuma et al. 2015, Ochi 2023
Streamer-less	**~2**	**61 m**	Ochi 2022
PE	~4	38 m	Ochi 2022

Tori line specifications for small vessels in the Northern Hemisphere

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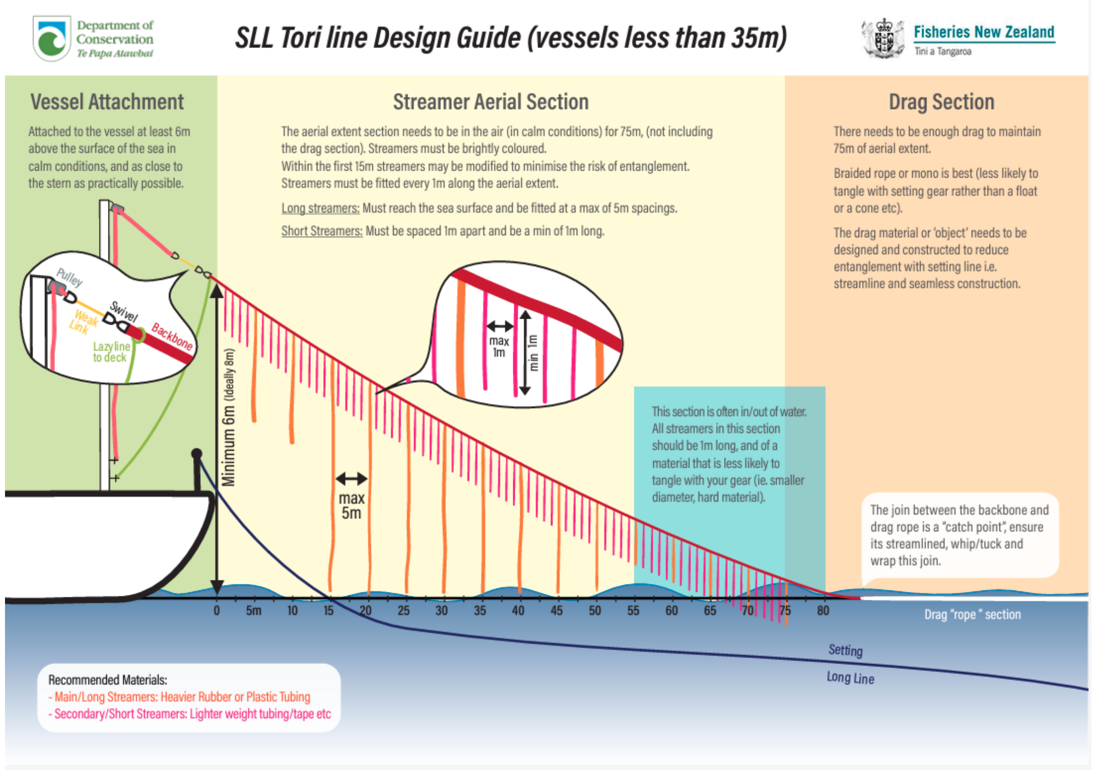
- Overall, result suggest that streamer-less tori lines are as effective as small streamer tori lines
- However, experiments were confounded by varying (and suboptimal) aerial extents even when considering sink rates and BFAL dive depths
- BPUE under all tori line treatments in experiments were still high
- **Consequently, there appears little compelling evidence to consider streamer-less tori lines, or small-streamer tori lines with suboptimal aerial extent, an effective mitigation method**

Tori line specifications for small vessels in the Northern Hemisphere

While there appears little evidence to consider streamer-less tori lines an effective mitigation method, their aerial extent is better than conventional small-streamer tori lines.

Gaining adequate aerial extent in small vessels can be challenging.

However, it has been proven that equipping small streamer tori lines with adequate (≥75 m) aerial extent on small (12-25 m) vessels in NZ is feasible and practicable (Goad & Debski 2017).

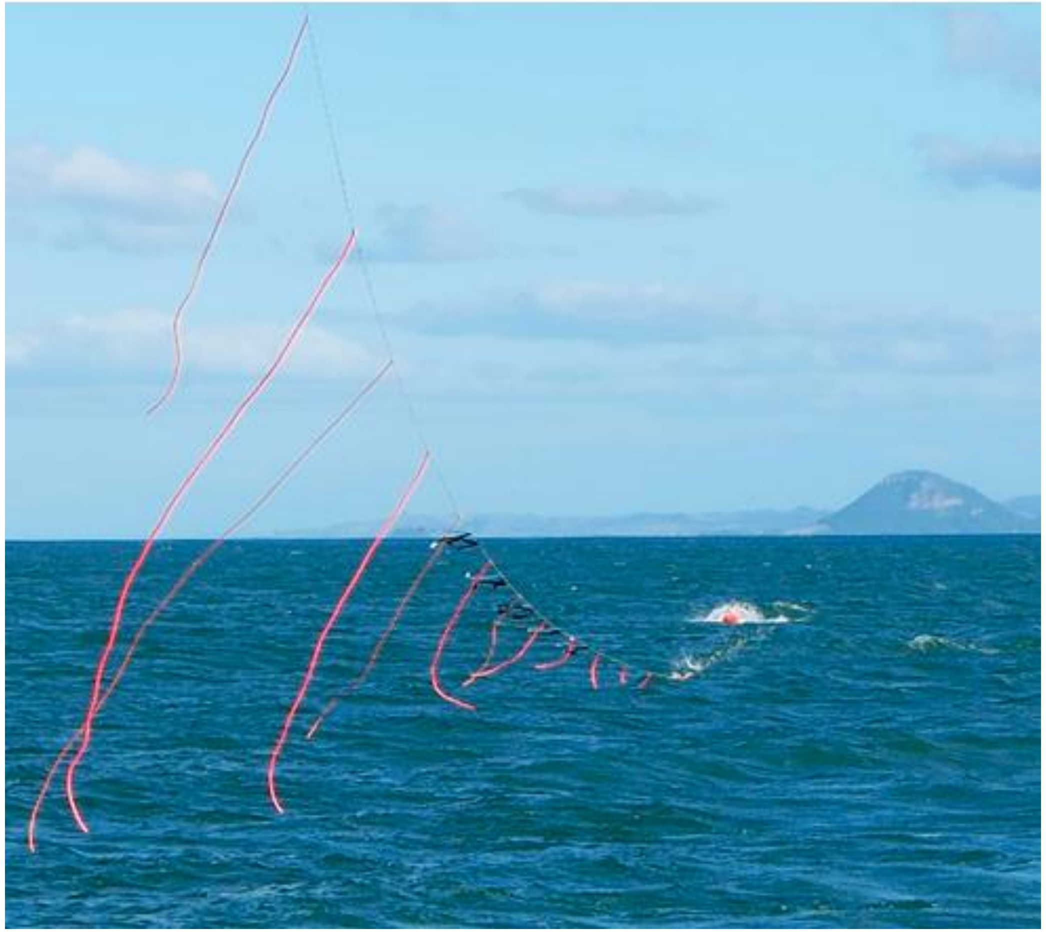


Tori line specifications

Not all CMM2018-03 specifications are considered best practice.

Consequently:

- Is there any scientific evidence to suggest that the tori line specifications between the two hemispheres should be different?
- Is there any scientific evidence to suggest that streamer-less tori lines are as effective as tori lines with streamers, when accounting for aerial extent?
- Is there any scientific evidence to suggest that the aerial extent of tori lines should be different between the two hemispheres?



References

- ACAP. Updated ACAP advice on reducing the bycatch of albatrosses and petrels in WCPFC fisheries. WCPFC-SC19-EB-IP-21.
- Brothers 1991. Approaches to reducing albatross mortality and associated bait loss in the Japanese long-line fishery. Biological Conservation 55: 255-268.
- Domingo et al. 2017. Effectiveness of tori line use to reduce seabird bycatch in pelagic longline fishing. PLoS ONE: 12: e0184465.
- Gillman et al. 2021. Practicality and efficacy of tori lines to mitigate albatross interactions in the Hawaii deep-set longline fishery. Western Pacific Regional Fisheries Management Council. Honolulu.
- Gilman et al. 2023. Could tori lines replace blue-dyed bait to reduce seabird bycatch risk in the Hawaii deep-set longline fishery? WCPFC-SC18-EB-IP-15.
- Goad & Debski. 2017. Tori line designs and specifications for small pelagic longline vessels. WCPFC-SC13-EB-WP-08.
- Jimenez et al. 2019. Mitigating bycatch of threatened seabirds: the effectiveness of branch line weighting in pelagic longline fisheries: Animal Conservation 22: 376-385.
- Katsumata et al. 2015. At-sea experiment to develop the mitigation measures of seabirds for small longline vessels in the western North Pacific. WCPFC-SC11-EB-WP-10.
- Mancini et al. 2009. The effect of light tori line on seabird bycatch and fish catch rates in the pelagic longline fishery off southern Brazil. Collective volume of Scientific Papers at ICCAT 64: 2499-2507.
- McNamara et al. 1999. Hawaii longline seabird mortality mitigation project. Western Pacific Regional Fisheries Management Council, Honolulu.
- Melvin et al. 2014. Best practice seabird bycatch mitigation for pelagic longline fisheries targeting tuna and related species. Fisheries Research 149: 5-18.
- Meyer & MacKenzie 2022. Factors affecting protected species captures in domestic surface longline fisheries. Fisheries New Zealand, Wellington.
- Ochi. 2022. Consideration for tori-line and tori-pole design suitable for small-scale tuna longline vessels in the North Pacific based on experimental results. WCPFC-SC18-EB-WP-04.
- Ochi. 2023. Supplemental information for WCPFC-SC18-EB-WP-04: statistical comparison of bycatch mitigation performance with and without streamers in tori-lines for small LL vessels. WCPFC-SC19-EB-IP-10.
- Peterson et al. 2008. Understanding and mitigating vulnerable bycatch in southern African trawl and longline fisheries. WWF South Africa Report Series.
- Rollinson et al. 2016. A review of seabird bycatch mitigation measures, including experimental work, within South Africa's tuna longline fishery. IOTC-2016-SC19-13-REV-1.
- Sato et al. 2013. Comparison of effectiveness of paired and single tori lines for preventing bait attacks by seabirds and their bycatch in pelagic longline fisheries. Fisheries Research 140: 14-19.
- WCPFC. Conservation and management measure to mitigate the impact of fishing for highly migratory fish stocks on seabirds. CMM 2018-03.