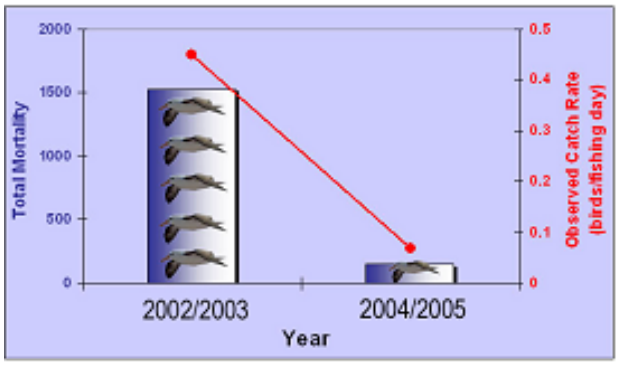
# Review of tori lines in the Falkland Islands Trawl Fleet 2006

Tori lines have been mandatory on all finfish trawlers since July 2004, and were introduced in July 2006 in the Loligo fishery. During 2004/05 Falklands Conservation found a 90% reduction in trawler related seabird mortalities[1] with the adoption of tori lines in the finfish fleet. Although seabird mortality has been substantially reduced since this introduction, in some circumstances issues of safety and reduced performance in rough sea conditions have been identified. During May 2006 trials were conducted by FC to test tori line performance with environmental conditions using the standard FIFD buoys and modified road cones.





Modified road cone

## Tori line Development - Road Cone Trials

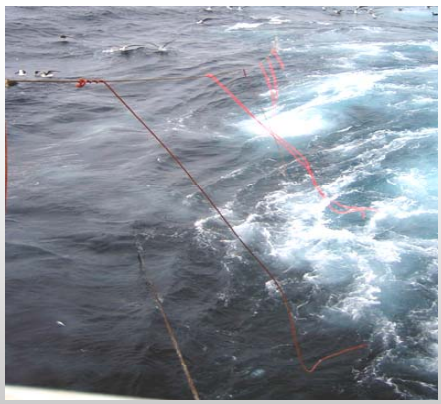
24 trials using modified road cones (left) and 20 trials using current FIFD buoys were conducted over one month on a finfish trawler in 2006 in sea conditions ≤ F9. Results indicated that cones on average performed better than the buoys in calm and moderate sea conditions. The road cones created a higher tension on the lines and a higher percentage of streamers aloft of the surface.

Wind direction and wind strength as a combined index had the highest influence on tori line deflection (blown of course by winds/swells). For example, strong crosswinds had a higher effect than strong into/astern winds. No data was available for cone performance in extreme conditions, however in rough seas the cones bounced or skipped unpredictably causing the line to randomly jerk and performance deteriorated. The random jumping effect of cones may be beneficial in lessening bird habituation but also may increase entanglements with the warp cables.

For almost one third of observations (both cones and buoys), one or both of the tori lines crossed the warp cables. In these instances the warp – sea interface was not protected by the bird streamers, and when both tori lines were deflected over both warps a 15 fold increase of seabird contacts on the warps were recorded, compared to when no tori lines crossed the warps.

For eighty five percent of observations the warp cable deviation was greater than zero, (i.e. the cables were not being towed directly straight behind the vessel). As tori lines and warp cables deviate independently to each other it is highly probable that tori lines will be deflected across the cables in certain conditions. Solving this problem entails designing the tori lines to act dependently to the warps i.e. attaching them to the warps. This then raises issues with splices, safety and practicality issues, and leads to the warp scarer designs. (see below)

Improved line tension created by cones and its "bouncing" nature in swells.



Warp towing at a gradient and tori line blown over in opposing direction

## Seabird and tori line entanglements

Birds foraging in proximity to the tori lines were more vulnerable to entanglements if line tension was not keeping a high proportion of the line and streamers aloft from the surface. When cones were trialled they created better line tension and streamers were less likely to lie on the surface. Seabird mortality attributed to tori lines is a rare event[2] and in reality the negligible number of mortalities caused by bird scaring devices is an acceptable trade-off compared to the benefits of overall mortality reductions by mitigation devices

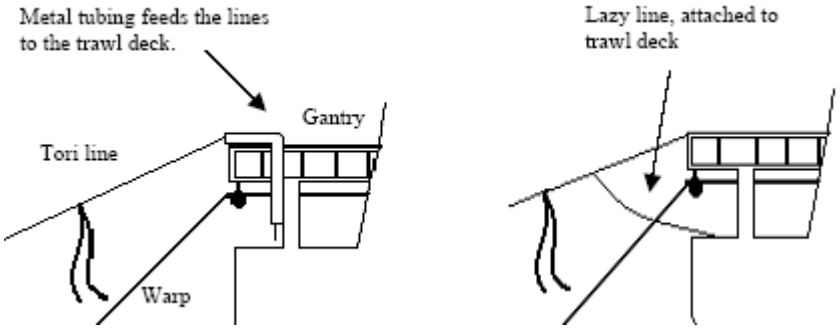
## Pre tori lines contact rates

Typically tori lines are deployed after the net has been shot and the ground gear hits the bottom, this leaves a period (10-15mins) when the warps are unprotected and the factory is often discarding. During 2004/05 FC trips found 64% of observed seabird mortalities where killed during this period and recorded a pre-tori line total contact of 27.1 seabirds/hr, compared to post tori line of 1.6 seabirds/hr [3] and in 2006 a total contact rate of 17.3 seabirds/hr during pre –tori line deployment. Pre-tori line period has been highlighted as the most vulnerable period for seabird warp strikes and mortalities; this could be resolved by delaying factory discarding (a matter of only 15 minutes) until the tori lines have been deployed.

## Practicality and Safety

Although the performance of tori lines is paramount in adverse conditions, the aspect of crew safety and practicality of application is also vital. As environmental conditions worsen the safety aspect of deploying and retrieving tori lines heightens.

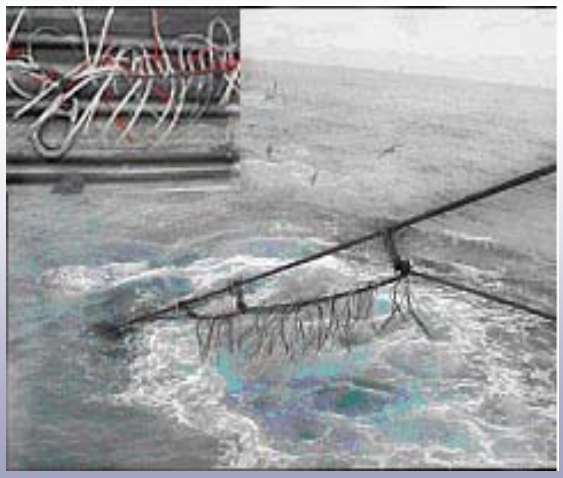
Presence at the stern of the vessel is required to deploy / retrieve lines prior and post shooting. Safety concerns should be addressed accordingly with the vessels own safety policies, such as safety harnesses in extreme conditions. A number of trawlers operating in the Falklands have designed simple solutions were by retrieval and deployment is carried out from the stern trawl deck, therefore eliminating un-necessary risks associated with climbing the gantry in adverse conditions (see diagram below).



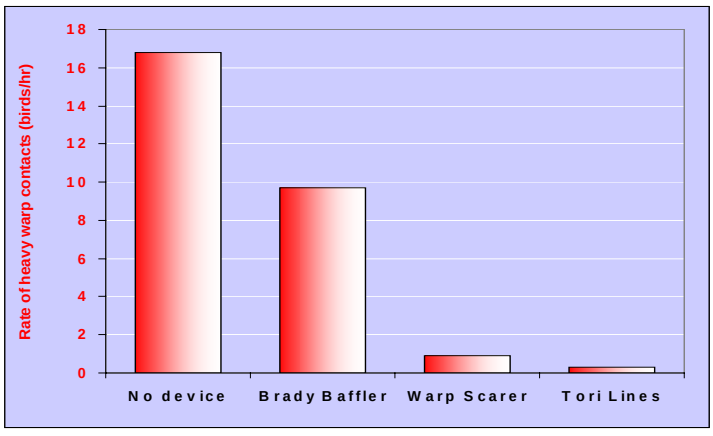

Examples of Modifications to retrieve / deploy tori lines eliminating access to gantry

### The Carey device (CAREFREE'S CUNNING CONTRAPTION)

The Carey device, designed by Chris Carey a skipper in New Zealand, is a modified warp-scaring device. Ropes that have stiff streamers and bristles are attached by clips to the warps cables. Currently results in NZ southern squid fishery indicate they are less effective than tori lines[5].
The design still has a number of concerns that need to be addressed, and the device does not always protect the warp-sea interface where the birds are at most risk of being dragged under by the warps.



## Comparison with other mitigation devices used in trawl fisheries.




The concept of warp scaring devices essentially eliminates problems associated with crosswinds, and potentially gives improved protection, as the device cannot behave independently from the warps. Trials of a warp scaring device in the Falklands in 2002 concluded that although it significantly reduced contact rates, practicality and safety issues raised concerns, and problems arose from repeated damage to the device[4]. Warp scarers used in the New Zealand southern

squid fishery (Carey device and modifications of this design) have been trialled and shown to be not as effective as a seabird deterrent compared to tori lines[5].

Brady Bafflers, a series of protruding steel arms at the stern with deterrents create a visual curtain to deter seabirds. Although trialled in the Falklands[4] results indicated they were not effective compared to other mitigation devices. In other global fisheries Brady Bafflers are inconclusive with mixed reports ranging from relative success to poor effectiveness and practical problems in adverse conditions.

Tori lines are used successfully in a large number of global trawl and long-line fisheries. In the Falkland fisheries this device has been shown through trials to be the most effective and cost efficient solution in reducing seabird mortalities[4].

## Conclusions and Recommendations

- Individual vessels should respond to concerns of crew safety, for example use of safety harnesses in adverse conditions and use of lazy lines to retrieve tori lines eliminating unnecessary access to the gantry.
- The first two streamers placed at 5m and 10m cause most warp entanglements. These are also the most crucial positions in deterring birds from the warp-sea interface and should not be altered or interfered with.
- Use of a heavier grade brightly coloured (preferable U.V coated) plastic tubing may be feasible for the first two streamers (5m and 10m). However use of this material should be limited to the first two streamers as the extra weight to the tori line effects line tension, resulting in higher percentages of the line and streamers sitting on the surface.
- Seabird entanglements with tori lines increase when line tension is not sufficient and higher portions of the lines and streamers lie on the surface.
- In some situations use of buoys without netting may create extra drag, and be beneficial in cases where there is insufficient line tension. This should be tested at each vessel's discretion.
- It has been identified that pre-tori line deployment whilst the factory is discarding is the most vulnerable period for seabird warp strikes and mortalities. Either the vessel should be deploying tori lines immediately after the trawl doors enter the water, or delaying factory discarding until the tori lines have been deployed.
- Modified road cones showed an improved performance in calm to moderate conditions, however in rough conditions the cones were still prone to deflecting across warps, and the jumping nature in heavy swells may also increase warp entanglements.
- Currently tori lines are designed to be retrieved by one person, however this can sometimes result in poor line tension from insufficient drag, therefore reducing overall performance. Manual retrieval does not need to be a limiting factor, in some global fisheries winches are used to retrieve bird scarring lines that are designed to create more drag.

**References:**
1.2.3. Reid, T., and Edwards, E. (2005) Consequences of the introduction of tori lines in relation to seabird mortality in Falkland Islands trawl fishery, 2004/2005. Falkland Conservation.
4. Sullivan, B.J., Brickle, P. Reid, T.A, Bone, D.G, Middleton, D.A.J. (2006) Mitigation of seabird mortality on factory trawlers: trials of three devices to reduce warp cable strike. *Polar Biology*
5. Middleton, D. and Abraham, E. (2006) The efficacy of warp strike mitigation devices: Trials in the 2006 squid fishery – The New Zealand seafood industry Council Ltd.

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