Agreement on the Conservation of Albatrosses and Petrels

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Mitigation of seabird bycatch in Chilean trawl fisheries - FACT SHEET

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SUMMARY

In fishing operations by trawl vessels, regardless of the type of target fishery, there is always the possibility of collision and/or entanglement of seabirds with the cables that emerge from the vessels. These cables are employed during fishing operations, such as the warp wires and others intended for specific and complementary tasks, such as the netsonde cable, also known as the third wire. Regarding the third cable, it has been recognized as the main source of seabird's mortality due to collisions or entanglements, mainly because this cable is submerged in the water three times farther from the stern of the vessels compared to the warp wires and because its diameter is three times thinner than the warp wires' diameter.

The different cables used in trawl fisheries have specific construction characteristics related to their functions. For example, the tow cables, also known as warp wires, are made of steel of twisted construction in various arrangements such as Seale, Warrington-Seale, etc., which result in different openings of the wires during the fishing maneuver because of string tension and distensions, according to the best performance for the different target species and the size of the vessels. In the same way, the third cable also suffers string tension and distension deformations due to the change in tension, mainly in the final stage of the net retrieving. The string tension and distensions of the third wire are of high risk for seabirds perched in the water near it, being able to trap specimens firmly to finally drown them in the water.

Both the warp wires and the third wire have different angles of entry into the water surface during fishing operations. The warp wires extend from the towing sheaves on the rear bow of larger boats and their angle is smaller compared to the third cable which comes out from a higher part of the boat on the side of the bow, so in in practical terms, this last cable dives much further back (+/- 20 meters) than the warp wires.

Regarding the interactions of seabirds with trawlers, three types of risks were identified: a) due to collision during flight, b) due to whipping and c) due to entrapment at different stages of the fishing maneuvers.

The purpose of this document is to add a new information sheet dedicated especially to collisions of seabirds with auxiliary support cables in trawl fisheries such as the netsonde cable or third wire.

This document developed simple titles in colloquial language on the most relevant aspects of this matter and was prepared based on the documents presented in the ACAP Forum mainly in the ACAP SUMMARY ADVICE FOR REDUCING IMPACT OF PELAGIC AND DEMERSAL TRAWL GEAR ON SEABIRDS (La Serena , Chile, 9 – 13 May 2016) along with other available sources, as well as specialized scientific documents and advice from senior professionals, NGOs, and the crews of the Chilean trawl fishing industry. Comments, recommendations and suggestions for improvements from the Bycatch Working Group are welcome.

FACT SHEET

Practical information on mitigation measures for seabird bycatch in Chilean trawl fisheries

Trawl fisheries and collisions of seabirds with net-sonde cables or other fishing support cables

<u>What are cable collisions?</u>

In trawling operations, regardless of the type of fishery, there is always the possibility of seabirds colliding with the cables running from the vessels which are associated with the fishing operation, such as trawl cables (setting cables) and others used for specific and complementary tasks such as the net-sonde cable, also known as the third-wire cable.

Each of these cables has specific characteristics relating to its construction depending on the task performed; for example, trawl cables are made of a twisted steel construction in various arrangements such as Seale, Warrington-Seale, etc., and these also have different wire openings which take place during the fishing manoeuvre due to the effect of strand tensions and stresses, according to the best performance for the different target species and vessel size.

Similarly, the third-wire cable (net-sonde cable), may be a twisted external construction involving steel strands that also tend to open up due to changes in strand tension and stress, particularly at the final net hauling stage. There are also net-sonde cables that are not twisted, where the support can be cross-braided and have an outer sheath, usually made of polyurethane.

On the other hand, each of the cables mentioned above (setting or net-sonde) has different angles of exposure to the water during the fishing operation. The angle of the setting cables extending from the trawl snatch blocks at the rear bow of the vessel is greater than the angle corresponding to the net-sonde cable. This means that in practice, the former go into the water at a far greater distance from the stern (+/- 20 metres) than the net-sonde cables.

What causes seabirds to collide with the net-sonde cables?

Since the net-sonde cable emerges from a higher point on the vessel and is also quite small in diameter (usually 11 mm (7/16") in diameter), it enters the water approximately three times further aft of the vessel compared to the distance covered by setting cables by the time they enter the water. In addition, the thinner net-sonde cable (which is 1/3 the diameter of the cove cable) makes it difficult for birds to distinguish and avoid it, a situation that becomes more critical during fishing manoeuvres in low light and bad weather.

On the other hand, processing plants on factory trawlers are constantly dumping fish waste and offal in the sea, which not only attracts seabirds but fosters extreme competition between different species foraging for food. This situation is exacerbated at two points during the fishing operation, to wit, at the beginning of net setting and at the end of net hauling, increasing the risks of catch, entanglement and mortality.

Types of interaction

In general, there are three types of collisions or interactions between seabirds and the net-sonde cable or third-wire cable: a) direct collisions with the wire during flight, b) when the wire whips across the bodies of the birds floating on the sea surface during net setting or hauling, and c) when their feathers become entangled in the wire strands opening and closing during the tensions and stresses of the net-sonde cable when the net is set or hauled.

Mitigation measures

Apart from specific actions that can be taken to protect seabirds from possible interactions with cables emerging from vessels, one critical element is the management of fish waste and discards during fishing, as this contributes to attracting seabirds and exacerbates their behaviour. Therefore, to reduce the attraction of birds, it would be helpful to avoid dumping fish waste or discards from the on-board processing plant into the sea at the start of net setting and during hauling.

Regarding trawl or setting cables, these usually stay above the water and enter the sea at a set angle that is hard to change, given the relationship required between different variables such as: weight of the doors, the resistive forces of the doors and the net, the net mouth opening, trawling speed, the seabed and other factors. To mitigate interactions with these cables, Tori lines have been successfully used. In practice, this is a main line with secondary lines hanging down to the sea surface, connecting loosely over the setting cable, while the vessel side is anchored higher than the trawl cable snatch blocks (2-3 metres).

For the third-wire or net-sonde cable, the Tori line does not effectively deter over its whole length above the water as this cable is higher up than the setting or trawl cables, and is thus more exposed. In addition, the third-wire cable is lighter, positioned in the centre of the net float headline. Also, as it is at a much lesser angle compared to the setting lines, it enters the water much further from the stern, meaning that it is unprotected by the bird-scaring lines for part of its length.

Options for improvement in this regard could include deploying an additional bird-scaring line, or raising the existing ones to cover a distance of at least 10 metres behind the third-wire cable's entry into the sea, or reducing the third-wire cable's entry angle so that ideally, it enters the sea before the bird-scaring line's weighted buoy.

The first option (an additional bird-scaring line) is not feasible, mainly due to the area where vessels operate in Chile, making this alternative dangerous and impractical for deck crew work. On the other hand, the option of reducing the angle of the third-wire cable's entry into the sea means using a snatch block to secure the third-wire cable and pull it down closer to the sea surface.

To solve the problem of the third-wire cable being so exposed above water, discussions have been held with trawler operating companies. The objective is to find the most practical way to reduce the cable's exposure while interfering as little as possible with net setting and hauling operations. Therefore, the company EMDEPES S. A. and one of its vessels, with the support of its Petty Officer and deck crew, have been working on this idea. After repeated tests, they came up with an approach called the "Culun" system, that meets the requirements of the mitigation measure. They determined that the weight necessary to sink the third-wire cable near the trawl cables is nearly 90 kg (pieces of chain links) placed in a bag. This "device" has been shown to substantially minimise bird deaths during the fishing process due to a significant reduction in the aerial exposure of the third-wire cable. (Figures 1 and 2).

<u>Best practice recommendations</u>

- Eliminate the third-wire cable.
- Alternative use of wireless net-sonde or setting cables with a data core able to fulfil the role of the net-sonde.
- Avoid the third-wire cable “whipping” against the water surface during net hauling to avoid striking or trapping the birds.
- Use of a net-sonde cable with a polyurethane sheath so that birds are not exposed to entrapment or entanglement in the wires as is the case with conventional cables.
- Avoid dumping fish waste and discards from the processing plant into the sea during the fishing operation, mainly during net setting and hauling.
- Use of floating blocks and weights to change the angle of entry into the sea of the net-sonde cable and reduce its aerial exposure. This option is especially relevant for large fishing vessels, where using a snatch block could be dangerous for the crew and might damage the cable.

<u>Potential problems and solutions</u>

- Commercially available wireless net-sondes do not produce images of the same quality as the analogue systems currently in use. Lower quality may mean this system is rejected by fishing captains.
- There is a likelihood of entanglement problems or difficulties in implementing the "Culun" system during fishing operations in bad weather.
- The cost of installing net-sonde cables with polyurethane sheaths is considerably higher than for conventional cables.
- If the net-sonde cable continues to whip, especially when raising the net, an additional solution needs to be found.

Acknowledgements

The authors are grateful for the significant contributions and effort made by Héctor Torruela and EMDEPES; Jorge Stillman and José Oyarzo from Chile's National Fisheries and Aquaculture Service as regards the implementation of the onboard cameras and electronic logs, as well as Carolina Irrarazábal from the Instituto de Fomento Pesquero (IFOP) for graphic design. Her contribution as a context for the preparation of this document is also gratefully acknowledged.

Special thanks are due to Petty Officer Mr. José Culun Vivar for his time and dedication to finding a solution.

REFERENCES: (pending the next version)

FIGURES SUPPORTING THE TEXT

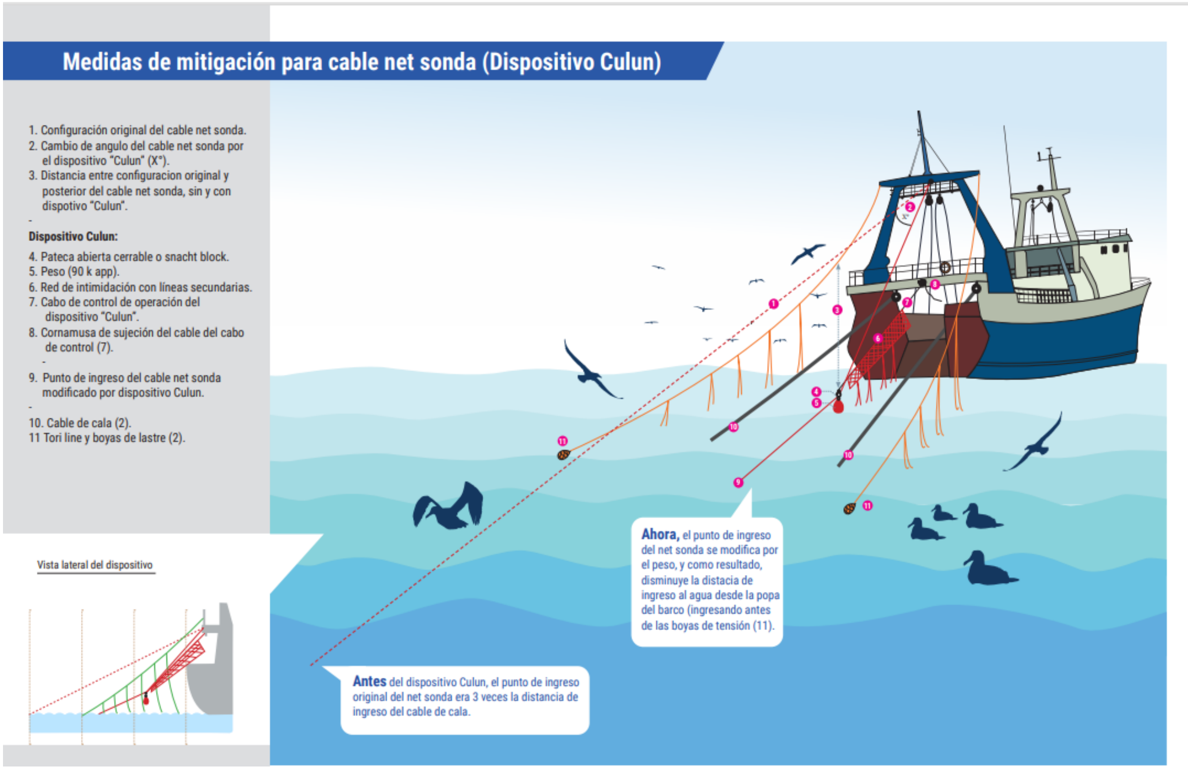


Figure 1. Deployment of the "Culun" system with a floating block and weights as a replacement for the snatch block.

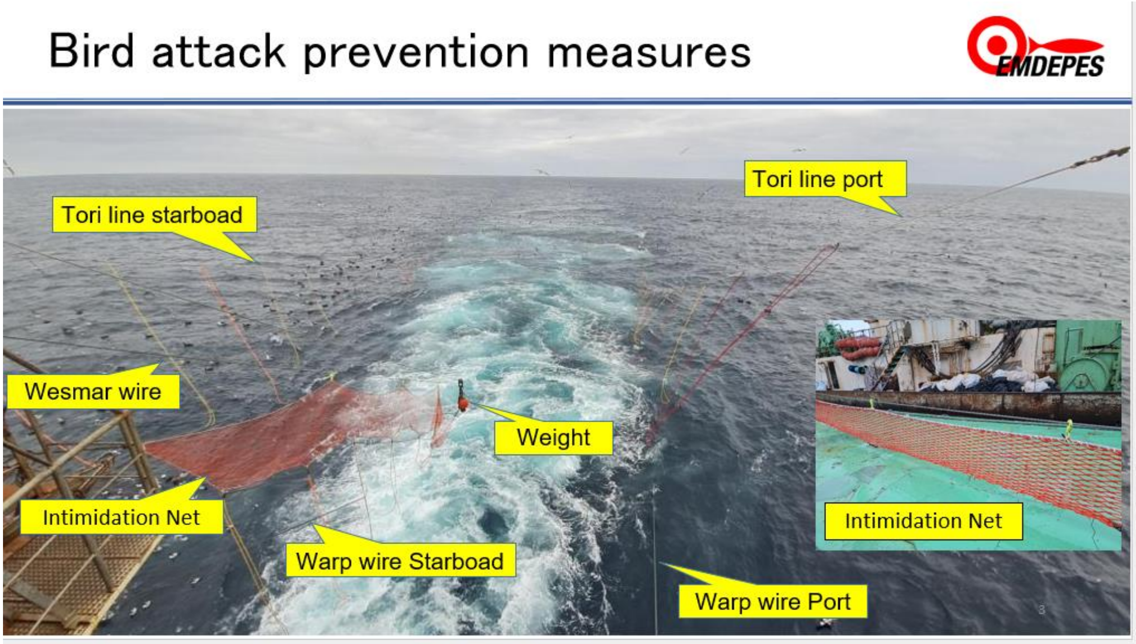


Figure 2. Deployment of the "Culun" system with a floating block and weights as a replacement for the snatch block. Use of snatch block and suspended weight to change the angle of the third-wire cable, proposed by EMDEPES Chile. Layout and details of construction and layout of Tori lines in trawl fisheries in Chile. Taken from EMDEPES Chile.

The intimidation net or curtain is a complementary measure which adds visibility to the net-sonde cable sector.

<u>Different working angles and heights of the setting and third-wire cables.</u>

Рис. 1. Внешний вид крупнотоннажного траулера типа БМРТ и расположение кабеля прибора контроля трала – сетного зонда (1), правого ваера (2) и левого ваера (3) на стадии траления

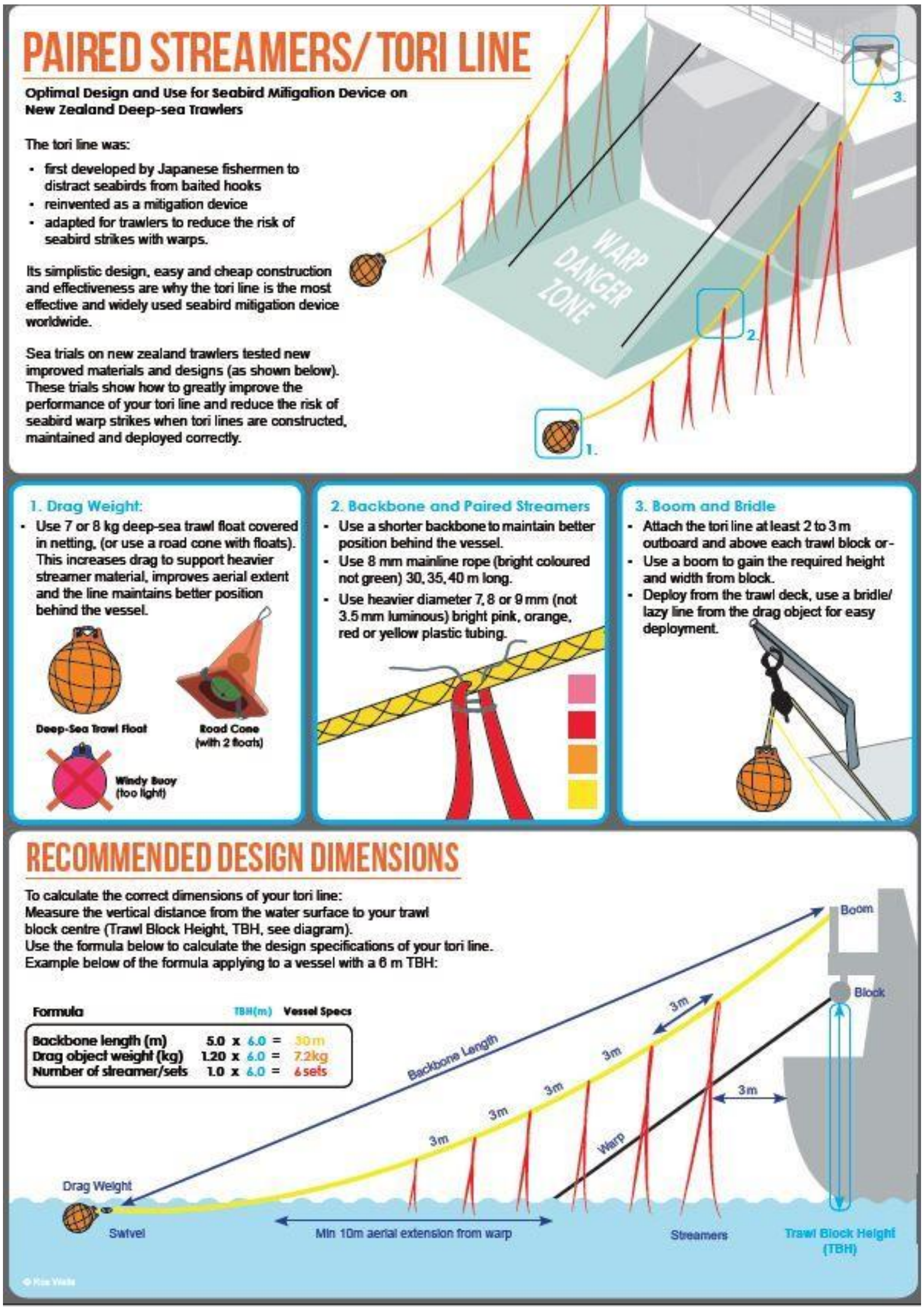
Figura 1. La aparición de un arrastrero de gran tonelaje del tipo BMRT y la ubicación del cable de tercer hilo del sonar de red (1), urdim (2) y urdimbre izquierda (3) en la etapa de arrastre

Examples of whipping and entanglement with the third-wire cable

Рис. 3. Контакты морских птиц с кабелем сетного зонда: a — налёт стаи тонкоклювых буревестников в зону погружения кабеля в воду: b — зацеп тёмноспинного альбатроса крылом

Fig. 3. Contacts of seabirds with net sonar third wire cable: a — the flight of a short-tailed shearwater flock into the area of cable immersion in water; b — the hook of a Laysan albatross by wing

Credits Seabirds interacting with fishing gear in the pollock and squid trawl fisheries in the northwest Bering Sea during the ice-free period. Yuri B. Artukhinb 2022. Kamchatka branch of the Pacific Geographic Institute («KB□PGI FEB RAS»), 19a, pr. Rybakov, Petropavlovsk-Kamchatsky, 683024, Russia E-mail: artukhin61@mail.ru


PAIRED STREAMERS/TORI LINE
Optimal Design and Use for Seabird Mitigation Device on New Zealand Deep-sea Trawlers
The tori line was:
• first developed by Japanese fishermen to distract seabirds from baited hooks
• reinvented as a mitigation device
• adapted for trawlers to reduce the risk of seabird strikes with warps.
Its simplistic design, easy and cheap construction and effectiveness are why the tori line is the most effective and widely used seabird mitigation device worldwide.
Sea trials on new zealand trawlers tested new improved materials and designs (as shown below). These trials show how to greatly improve the performance of your tori line and reduce the risk of seabird warp strikes when tori lines are constructed, maintained and deployed correctly.
WARP DANGER ZONE
1.
2.
3.
1. Drag Weight:
• Use 7 or 8 kg deep-sea trawl float covered in netting, (or use a road cone with floats). This increases drag to support heavier streamer material, improves aerial extent and the line maintains better position behind the vessel.
Deep-Sea Trawl Float
Road Cone (with 2 floats)
Windy Buoy (too light)
2. Backbone and Paired Streamers
• Use a shorter backbone to maintain better position behind the vessel.
• Use 8 mm mainline rope (bright coloured not green) 30, 35, 40 m long.
• Use heavier diameter 7, 8 or 9 mm (not 3.5 mm luminous) bright pink, orange, red or yellow plastic tubing.
3. Boom and Bridle
• Attach the tori line at least 2 to 3 m outboard and above each trawl block or -
• Use a boom to gain the required height and width from block.
• Deploy from the trawl deck, use a bridle/ lazy line from the drag object for easy deployment.
RECOMMENDED DESIGN DIMENSIONS
To calculate the correct dimensions of your tori line:
Measure the vertical distance from the water surface to your trawl block centre (Trawl Block Height, TBH, see diagram).
Use the formula below to calculate the design specifications of your tori line.
Example below of the formula applying to a vessel with a 6 m TBH:
Formula TBH(m) Vessel Specs
Backbone length (m) 5.0 x 6.0 = 30m
Drag object weight (kg) 1.20 x 6.0 = 7.2kg
Number of streamer/sets 1.0 x 6.0 = 6 sets
Boom
Block
Backbone Length
3m
3m
3m
3m
3m
3m
Warp
Drag Weight
Swivel
Min 10m aerial extension from warp
Streamers
Trawl Block Height (TBH)

HOJA INFORMATIVA

Información práctica sobre medidas de mitigación para la captura incidental de aves marinas en pesquerías de arrastre de Chile

Pesquerías de arrastre y colisiones de aves marinas con los cables de net sonda u otros cables de apoyo a la pesca

¿Qué son las colisiones con los cables?

En las operaciones de pesca con arrastre, independiente del tipo de pesquería, siempre existe la posibilidad de colisión de las aves marinas, con los cables que emergen desde las embarcaciones los que se asocian con la faena de pesca, como son los cables de arrastre (cables de cala) y otros destinados a tareas específicas y complementarias como el cable del netsonda, también conocido como tercer cable.

Cada uno de estos cables tiene características de construcción específicas dependiendo de la tarea que desempeñan, por ejemplo, los cables de arrastre son de acero de construcción torcida en variadas disposiciones como Seale, Warrington-Seale, etc., los que además tienen distintas aperturas de los alambres (wire) durante la maniobra de pesca por efecto de las tensiones y distensiones de las cuerdas de acuerdo con el mejor desempeño para las distintas especies objetivo y tamaño de las naves.

De manera similar, el tercer cable (cable de netsonda), puede ser de construcción externa torcida con componentes de acero que también sufren de aperturas debido al cambio de tensiones y distensiones de las cuerdas, particularmente en la etapa final del virado de la red. También existen cables de netsonda que no son torcidos, y el soporte puede ser trenzado cruzado, con una protección externa, usualmente en poliuretano.

Por otra parte, cada uno de los cables anteriores (de cala o de net sonda) presentan distintos ángulos de exposición de entrada al agua durante la faena de pesca, siendo mayor el ángulo de los cables de cala que se extienden desde las pastecas de arrastre en el arco posterior de las embarcaciones y menor el ángulo correspondiente al cable de netsonda, el cual sale de una parte más alta (en comparación al cable de cala), desde un costado del arco, lo que significa que en la práctica este último cable se sumerge mucho más lejos de la popa (+/- 20 metros) que los cables de cala.

¿Qué causa la colisión de las aves marinas con los cables de net sonda?

Dado que el cable del netsonda emerge desde un punto más alto en el buque y que además tiene un diámetro bastante reducido (usualmente 11 mm (7/16") de diámetro), implica que ingresa al agua aproximadamente 3 veces más lejos de la popa de la embarcación en comparación con la distancia que lo hacen los cables de cala. Adicionalmente, al ser más fino el cable de net sonda (1/3 del diámetro del cable de cala) a las aves les es difícil distinguirlos y evitarlos, lo que se hace más crítico durante maniobras de pesca con poca luz y mal tiempo.

Por otro lado, las plantas de procesamiento en buques fábricas de arrastre arrojan constantemente desperdicios y restos de pescado, lo que resulta en atracción y genera eventos de alta competencia por alimentación entre diferentes especies de aves marinas. Esto se ve aumentado durante dos momentos de la operación de pesca, al inicio del calado de la red y al final del virado de ésta, aumentando los riesgos de captura, enredos y mortalidad.

Tipos de interacción

En general se observan tres tipos de colisiones o interacciones de las aves marinas con el cable de net sonda o tercer cable: **a**) colisiones directas con el cable durante el vuelo, **b)** azotes del cable sobre partes del cuerpo de las aves reposadas sobre el mar en momentos de acomodo del izado o calado de la red, y **c)** enredo por atrapamiento de las plumas en los alambres (wire) que se abren y cierran durante las tensiones y distensiones del cable de net sonda en momentos de calado y virado de la red.

Medidas de mitigación

Independiente de las acciones específicas relativas a proteger a las aves marinas de posibles interacciones con los cables que emergen de las embarcaciones, un elemento trascendental es el manejo de los descartes y desechos durante la pesca, ya que aumentan la atracción y exacerban el comportamiento de las aves. En este sentido sería de utilidad para reducir la atracción de aves, que durante el inicio del calado y durante el virado de la red, no se botaran al mar desperdicios o descartes provenientes de la planta de proceso a bordo.

En relación con los cables de arrastre o cala, en general mantienen una exposición aérea y un ángulo de entrada al mar difícil de modificar, dado la relación que debe existir entre diferentes variables tales como; peso de los portalones, fuerzas resistivas de éstos y la red, abertura de la boca, velocidad de arrastre, fondo marino y otros. Para mitigar las interacciones con estos cables se ha usado con éxito los “Tori lines”, o Líneas Espanta Pájaros (LEP), que en la práctica es una línea principal con líneas secundarias colgantes hasta la superficie del mar, que se conecta libremente por sobre al cable de cala, mientras la parte del buque se afianza a mayor altura que las patecas de los cables de arrastre (2-3 metros).

Respecto del tercer cable, o cable del netsonda, las Tori line” no cumplen con el objetivo de disuasión en la totalidad de su extensión aérea, dado que este cable emerge más arriba que los cables de cala o arrastre, quedando expuesto. Además, el tercer cable es más liviano y se dispone en el centro de la relinga de flotadores de la red, por lo que, al tener un menor ángulo en comparación con los cables de cala, se hunde mucho más distante de la popa de la embarcación, quedando desprotegido de las líneas espantapájaros en parte de su extensión.

Opciones de mejora en este sentido podrían incluir el despliegue de una LEP adicional o elevar las existentes hasta cubrir por lo menos 10 metros detrás del ingreso del tercer cable al mar o bajar el ángulo de entrada al mar del tercer cable para que éste ingrese al mar idealmente antes de la posición de la boya de lastre de la LEP.

La primera opción (LEP adicional) no es viable, principalmente por la zona de operación de las embarcaciones en Chile, que hace peligrosa y poco práctica esta alternativa para el trabajo de los tripulantes de cubierta. Por otra parte, la opción de bajar el ángulo de entrada del tercer cable al mar requiere usar una pateca abierta cerrable o “snacht block” que pueda ser desplazada sobre el tercer cable, con una fuerza hacia abajo que lo acerque a la superficie del mar.

A modo de buscar una implementación y solución consensuada al problema de la exposición aérea del tercer cable, se ha conversado con las empresas que operan naves con arrastre, para que exploren la manera más práctica reducir la exposición aérea de este cable de una forma que permita interferir lo menos posible la maniobra de calado y virado. En este sentido la empresa EMDEPES S.A y una de sus embarcaciones, contando con el apoyo de su contramaestre y tripulación de cubierta, han trabajado esta idea, y después de repetidas pruebas, han diseñado un sistema (**sistema “Culun**”) que cumple con los requerimientos de la medida de mitigación, determinando que el peso necesario para su hundimiento cerca de los cables de arrastre, se acerca a los 90 kg seco (trozos de eslabones de cadena) colocado en una bolsa, “dispositivo” que ha demostrado minimizar sustantivamente la muerte de aves durante el proceso de captura debido a una significativa reducción de la exposición aérea del tercer cable (**Figura 1** y **2**)

Recomendaciones para las mejores prácticas

- Eliminar el tercer cable.
- Uso alternativo de net sonda inalámbrico o uso de cables de cala con alma de conducción de datos que cumplan el rol del net sonda.
- Evitar los “azotes” del tercer cable contra la superficie del agua durante el virado para evitar los goles a las aves y su atrapamiento.
- Uso de cable de net sonda con protección de poliuretano con el objetivo de no exponer las aves al apretamiento o enredo en los alambres como ocurre en los cables convencionales.
- Evitar los descartes y desechos de la fábrica durante la faena de pesca, principalmente durante el calado y virado.
- Uso de patecas y pesos flotantes para cambiar el ángulo de ingreso del cable del net sonda al mar reduciendo su exposición aérea. Esta opción es relevante en grandes embarcaciones de pesca donde el uso de una pateca fija puede ser peligrosa para la tripulación y además puede poner en riesgo la integridad del cable.

Potenciales problemas y soluciones

- Que el uso de net sonda inalámbricos disponibles en el mercado no alcancen la calidad de imagen de los sistemas analógicos actualmente en uso. Si la calidad es menor puede resultar en un rechazo por parte de los capitanes de pesca.
- Problemas de enredo o dificultades de implementación del sistema “Culun” durante faenas de pesca con mal tiempo.
- Que el costo de los cables de net sonda con cubiertas de poliuretano sean significativamente superiores a los cables convencionales.
- De persistir los azotes del cable de net sonda, en especial al momento del izado de la red es necesario la búsqueda de una medida complementaria.

Agradecimientos

Los autores agradecen el gran aporte y trabajo de Héctor Torruela y de la Empresa EMDEPES; Jorge Stillman y José Oyarzo del Servicio Nacional de Pesca y Acuicultura de Chile en la implementación de los Dispositivos de Registro de Imágenes DRI y Sistemas de Cuaderno Electrónico SIBE y de Carolina Irrarazábal de IFOP por el Diseño gráfico. También se agradece su contribución como contexto para la preparación de este documento.

De manera especial agradecer la atención e involucramiento en la búsqueda de una solución al contramaestre Sr Josè Culun Vivar

RERERENCIAS (Pendientes para la próxima versión)

FIGURAS DE APOYO AL TEXTO

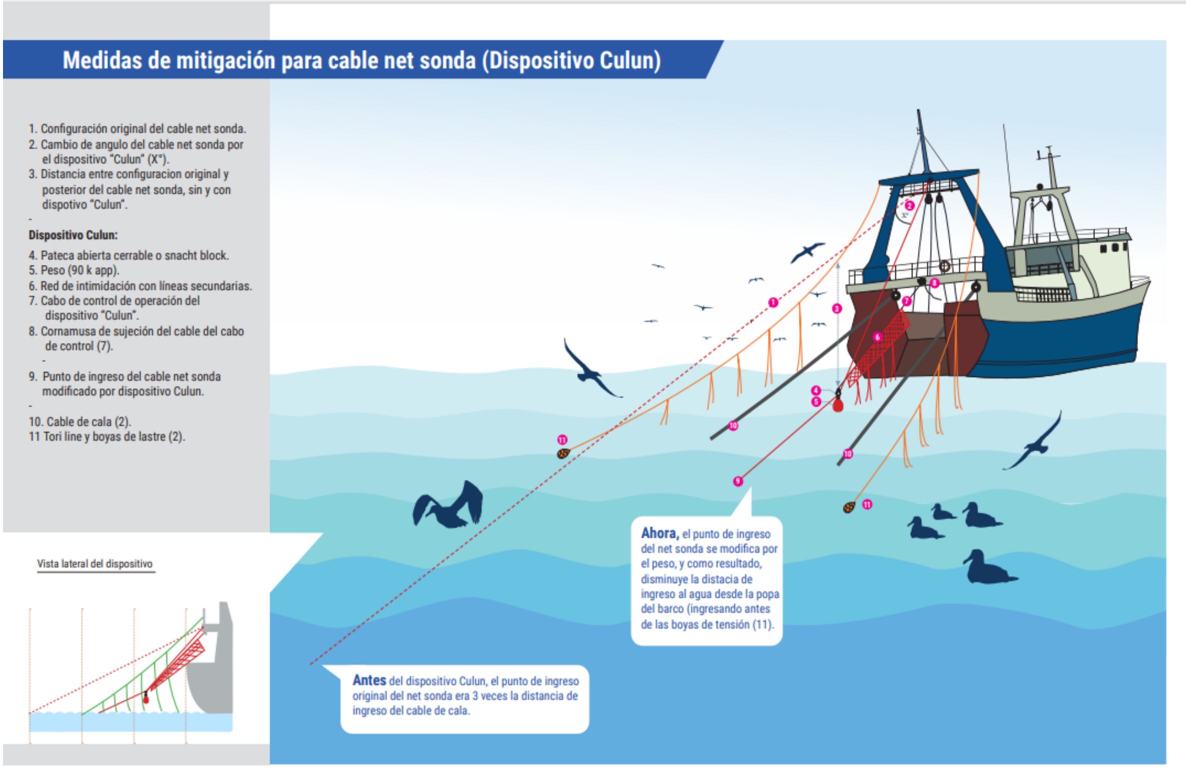
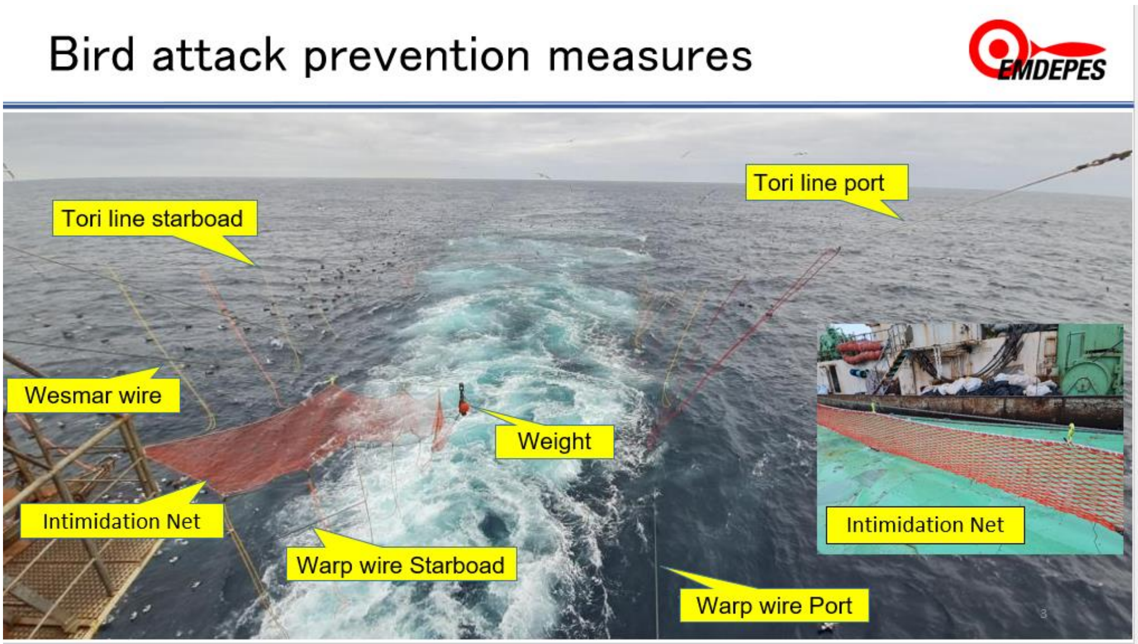


Figura 1. Despliegue de sistema “Culun” con pateca y pesos flotantes en reemplazo de pateca fija.

Figura 2. Despliegue de sistema “Culun” con pateca y pesos flotantes en reemplazo de pateca fija. Uso de pateca y peso suspendido para cambio de ángulo del tercer cable, propuesta de Empresa EMDEPES Chile**.** Disposición y detalles de construcción y disposición de las Tori Line en Pesquerías de Arrastre en Chile. Tomado de EMDEPES Chile.



La red de intimidación o cortina es una medida complementaria para agregar visibilidad al sector del cable de net sonda

Diferentes ángulos de trabajo y alturas de los cables de cala y tercer cable.

Рис. 1. Внешний вид крупнотоннажного траулера типа БМРТ и расположение кабеля прибора контроля трала – сетного зонда (1), правого ваера (2) и левого ваера (3) на стадии траления

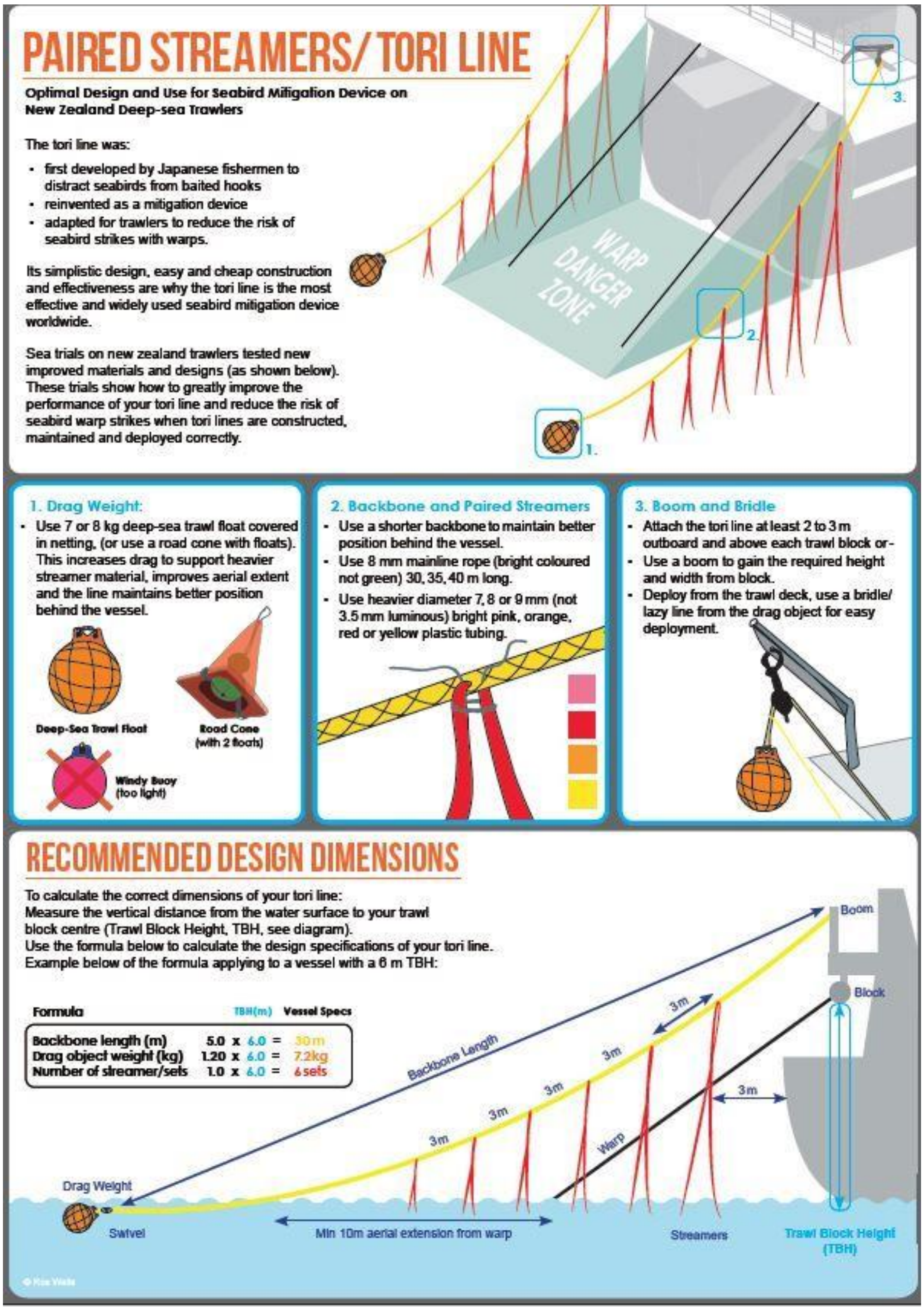
Figura 1. La aparición de un arrastrero de gran tonelaje del tipo BMRT y la ubicación del cable de tercer hilo del sonar de red (1), urdim (2) y urdimbre izquierda (3) en la etapa de arrastre

Ejemplos de azotes y enredos con el tercer cable

Рис. 3. Контакты морских птиц с кабелем сетного зонда: a – налёт стаи тонкоклювых буревестников в зону погружения кабеля в воду: b – зацеп тёмноспинного альбатроса крылом

Fig. 3. Contacts of seabirds with net sonar third wire cable: a – the flight of a short-tailed shearwater flock into the area of cable immersion in water; b – the hook of a Laysan albatross by wing

Créditos Interacciones de las aves marinas con los artes de pesca en las pesquerías de abadejo y calamar con redes de arrastre en la parte noroeste del mar de Bering durante el período libre de hielo. YuriB.Artukhinb 2022. Sucursal de Kamchatka del Instituto Geográfico Pacifc («KB□PGI FEB RAS»), 19a, pr. Rybakov, Petropavlovsk- Kamchatsky, 683024, Rusia Correo electrónico: artukhin61@mail.ru


PAIRED STREAMERS/TORI LINE
Optimal Design and Use for Seabird Mitigation Device on New Zealand Deep-sea Trawlers
The tori line was:
• first developed by Japanese fishermen to distract seabirds from baited hooks
• reinvented as a mitigation device
• adapted for trawlers to reduce the risk of seabird strikes with warps.
Its simplistic design, easy and cheap construction and effectiveness are why the tori line is the most effective and widely used seabird mitigation device worldwide.
Sea trials on new zealand trawlers tested new improved materials and designs (as shown below). These trials show how to greatly improve the performance of your tori line and reduce the risk of seabird warp strikes when tori lines are constructed, maintained and deployed correctly.
WARP DANGER ZONE
1.
2.
3.
1. Drag Weight:
• Use 7 or 8 kg deep-sea trawl float covered in netting, (or use a road cone with floats). This increases drag to support heavier streamer material, improves aerial extent and the line maintains better position behind the vessel.
Deep-Sea Trawl Float
Road Cone (with 2 floats)
Windy Buoy (too light)
2. Backbone and Paired Streamers
• Use a shorter backbone to maintain better position behind the vessel.
• Use 8 mm mainline rope (bright coloured not green) 30, 35, 40 m long.
• Use heavier diameter 7, 8 or 9 mm (not 3.5 mm luminous) bright pink, orange, red or yellow plastic tubing.
3. Boom and Bridle
• Attach the tori line at least 2 to 3 m outboard and above each trawl block or-
• Use a boom to gain the required height and width from block.
• Deploy from the trawl deck, use a bridle/ lazy line from the drag object for easy deployment.
RECOMMENDED DESIGN DIMENSIONS
To calculate the correct dimensions of your tori line:
Measure the vertical distance from the water surface to your trawl block centre (Trawl Block Height, TBH, see diagram).
Use the formula below to calculate the design specifications of your tori line.
Example below of the formula applying to a vessel with a 6 m TBH:
Formula TBH(m) Vessel Specs
Backbone length (m) 5.0 x 6.0 = 30m
Drag object weight (kg) 1.20 x 6.0 = 7.2kg
Number of streamer/sets 1.0 x 6.0 = 6 sets
Boom
Block
Backbone Length
3m
3m
3m
3m
3m
3m
Warp
Drag Weight
Swivel
Min 10m aerial extension from warp
Streamers
Trawl Block Height (TBH)