Agreement on the Conservation of Albatrosses and Petrels

ACAP Advice on Improving Safety when Hauling Branch lines during Pelagic Longline Fishing Operations

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SUMMARY

The relative safety of weighted branch lines during flyback events in pelagic long line fishing requires thorough consideration. When the branch line is under tension when hauling catch, a flyback event may occur in two ways:

1. a 'bite off' event in which the branch line is bitten off, or
2. a 'tear out' event in which the catch is lost when the hook is torn out of the fish.

At that moment the tensioned branch line may flyback at speed and the crew on deck may be in danger of being hit by the weight, and, in the event of a tear out, the hook or the weight.

Flyback events are rarely reported. However, there have been a small number of reported cases where these events have caused injury and a few times death.

Weighted branch lines reduce the incidence of seabird bycatch. Decreasing the incidental catch of seabirds is important for the conservation of seabirds, especially threatened albatross and petrel species.

Branch line weighting potentially increases the hazard from flyback events.

To avoid or minimise the hazard of a flyback event, various technologies and techniques can be implemented as part of the fishing vessel's hazard management procedure. Branch lines with sliding weights will help to reduce the hazard posed by flyback events, compared with fixed weighted swivels. The crew may employ safety precautions that reduce the potential hazard from a flyback event, and which help to protect those involved in hauling of catch if a flyback event occurs.

A combination of new technologies and better techniques can address the hazard posed by flyback events to crew. These changes will enhance workplace safety when hauling catch during pelagic longline fishing operations.

1. INTRODUCTION

Pelagic longline fisheries occur throughout the world's oceans. Annual fishing effort by coastal states and distant water fishing nations likely exceeds a billion hooks each year (Anderson *et al.* 2011). Incidental mortalities of seabirds during pelagic longline fishing operations is a widely recognised conservation threat to seabirds (among other marine megafauna), particularly threatened albatrosses and petrels listed under Annex 1 of the *Agreement on the Conservation of Albatrosses and Petrels* (ACAP)[1] (Brothers 1991, Gales *et al.* 1998, Phillips et al. 2016). Global seabird bycatch in longline fisheries (pelagic longline and demersal longline) is estimated to be at least 160,000 (and potentially in excess of 360,000) seabirds every year (Anderson *et al.* 2011).

ACAP aims to achieve and maintain a favourable conservation status for albatrosses and petrels. To that end, the Agreement has developed advice and guidance to mitigate land-based and at-sea threats to albatrosses and petrels, including best practice advice for reducing the impact of pelagic longline fisheries on seabirds (ACAP 2017).

Branch line weighting is an effective strategy for reducing seabird bycatch. Three best practice measures are recommended by ACAP to be used simultaneously: branch line weighting, night setting and bird scaring lines (ACAP 2017). Branch line weighting is integral to the fishing gear and has the advantage of being more consistently implemented, hence facilitating compliance and port monitoring (ACAP 2017). Technology could be used for monitoring night setting compliance at a broad scale (Prince et al. 2019)

Branch line weighting increases the sink rate of a baited hook, reducing the time when the baited hook is within the diving range of seabirds (Barrington *et al.* 2016). Studies have demonstrated that branch line weighting, where there is a greater mass closer to the hooks, sink most rapidly and consistently (Barrington *et al.* 2016), significantly reducing seabird bycatch (Gianuca *et al.* 2013, Jiménez *et al.* 2019, Santos *et al.* 2019). ACAP recommends the use of either of three weighted branch line configurations (ACAP 2017):

1. 40 g or greater attached within 0.5 m of the hook, or
2. 60 g or greater attached within 1 m of the hook, or
3. 80 g or greater attached within 2 m of the hook.

In 2016 ACAP recognised hook-shielding devices as a best practice mitigation option, providing a stand-alone alternative to the measures described above (Sullivan *et al.* 2017, Baker *et al.* 2016, Barrington 2016). Hook-shielding devices encase the point and barb of baited hooks to prevent seabird attacks during line setting until a prescribed depth is reached (a minimum of 10 m), or until after a minimum period of immersion has occurred (a minimum of 10 min) that ensures that the baited hooks are released beyond the foraging depth of most seabirds (ACAP 2017). Presently, three hook-shielding devices have been assessed to meet ACAP's stipulated performance requirements, the 'Hookpod LED™' (68 g minimum weight), the Hookpod Mini (45 g minimum weight) and 'Smart Tuna Hook' (40 g minimum weight) (ACAP 2021).

[1] *Agreement on the Conservation of Albatrosses and Petrels*, amended by the Sixth Session of the Meeting of the Parties, Skukuza, South Africa, 7 - 11 May 2018.

Pelagic longline fishing vessels are a workplace. Crew face a range of workplace hazards during fishing operations. One of these hazards is a flyback event (Sullivan *et al.* 2012).

Flyback events arise when catch is being retrieved during hauling and the branch line is under tension. Flyback events may be hazardous in two ways:

1. **'bite off'** — a bite off event may occur when the hook is bitten off, often by a shark, which potentially sends the tensioned branch line recoiling back towards the vessel.
2. **'tear out'** — a tear out event may occur when the catch is lost off the hook, which potentially sends the tensioned branch line and hook recoiling back towards the vessel.

Flyback events can occur whether or not mitigation measures are in place to minimise seabird bycatch. Research has focussed on the hazard posed to crew during a flyback event either *in situ* or in circumstances that simulate a flyback event (see 3.2 below). Further research has considered both bite off and tear out events, and whether the flyback event is affected by factors including: (a) release of tension under water v the water surface, (b) where the hook is bitten off v where the hook is torn out of the fish, (c) fixed vs sliding weight branch line weighting, (d) branch line weighting configurations and (e) use of 'Hookpods' (see 3.2 below).

Although flyback events are rare and rarely reported, there have been reports in fisheries where weighted branch lines caused injuries and even death (McCormack and Papworth 2014, Rawlinson et al. 2018). The potential speed at which a flyback event occurs ordinarily means that the crew will not be able to take any evasive action. The potential consequences of a flyback event highlight the need to implement workplace hazard management procedures on fishing vessels undertaking pelagic longline fishing operations (Marine Safety Solutions 2008).

Understanding ways to avoid or mitigate flyback events helps crews to develop workplace hazard management procedures that improve crew safety when hauling during pelagic longline fishing operations. This in turn helps to respond to safety concerns within affected fisheries about using branch line weighting.

There is no substantive information available about the likelihood of a flyback event occurring in the pelagic longline fishery. There is limited information about the potential hazard posed by flyback events to crew. Such hazard from flyback events can be significantly reduced in some circumstances. If the tension on the branch line is released while the weight attached to the line is underwater, drag underwater quickly dissipates the energy released. As well, the amount of tension on the line when a bite off or tear out occurs may be insufficient for the branch line to recoil with sufficient energy to be hazardous. Recoiling branch lines and weights in flyback events may in these instances strike the vessel hull or fall short into the water depending on the amount of tension on the line and how submerged the weight is. In some pelagic longline fisheries a flyback event may occur when a hooked shark is alongside the vessel and the line is purposely cut to release it (Rollinson 2017).

Flyback events have the potential to cause injury to crew involved in hauling catch. Flyback events are likely under-reported, particularly those not resulting in injury to crew (Pierre *et al.* 2015, Rollinson 2017).

2. STUDIES

2.1 Preliminary survey

A survey study on the occurrence of flyback events considered pelagic longline fishing from six countries and over a 20 year period (McCormack and Papworth 2014). Over this period there were 12 reported injuries and three deaths linked to flyback events from weighted branch lines involving over a billion hooks hauled (McCormack and Papworth 2014, Anderson *et al.* 2011). The reported events noted that the crew member was struck in the head in a majority of instances, although the survey was limited by only considering reports about flyback events (McCormack and Papworth 2014). The survey did not provide information about the frequency or amount of flyback events that occurred, or where the hazard posed flyback event was not considered significant. These data are not routinely collected or reported during fishing operations. Following a death in a New Zealand pelagic longline fishery in 1996, New Zealand moved to no longer use weighted branch lines in its pelagic longline fisheries (Marine Safety Solutions 2008).

2.2. Research

2.2.1 Early Research

Early safety research sought to characterise the hazard posed by flyback events in pelagic longline fisheries. Consideration was given to whether early sliding weight designs were safer than fixed weights in flyback events (Marine Safety Solutions 2008). The research tested branch lines at varying levels of tension to determine the velocity of attached fixed weights and sliding weights and whether the weights would recoil with force. Sliding weights were found to have a significant reduction in velocity, compared to fixed weighted swivels, due to their ability to slide off the branch line when it recoiled, with the detached weight falling into the water in most cases (Marine Safety Solutions 2008). A later study found that the level of tension and the position of the weight on the branch line was a significant factor affecting whether the sliding weight would slide off the line in a flyback event. Branch lines under tension above 20 kg that had weights placed no more than 2 m from the hook were found to slide off the line. Weights placed at distances greater than 2 m from the hook were not as effective at sliding off the line, even under higher levels of tension on the line (Sullivan *et al.* 2012).

At-sea studies have been undertaken concerning flyback events. Bite off events were found to occur on a more frequent basis compared to tear out events due to catching sharks (Robertson *et al.* 2013, Rollinson 2017). Tear out events occurred due to the accidental loss of the catch, which in some cases was controlled by the crew member responsible for the hauling operation (Robertson *et al.* 2013). Another study found that in one bite off event, the shark bit off the line at the hook between the hook and the crimp, causing the line to recoil in a manner like a tear out event, i.e. the attached sliding weight was unable to slide off the branch line (Pierre *et al.* 2015).

Research found that placing a sliding weight on the branch line close to or at the hook was effective in having the sliding weight slide off in a bite off event (Robertson *et al.* 2013).

2.2.2 Recent Research

Research undertaken by McCormack and Rawlinson (2016) and Rawlinson *et al.* (2018), studied the relative safety of ACAP's recommended branch line weighting configurations

during these two types of flyback events. Only two of ACAP's three recommended branch line weighting configurations were tested (for 40 g and 60 g fixed and sliding weights), as 80 g sliding weights were not commercially available at the time of experimentation.

The research determined the velocity, kinetic energy and Blunt Trauma Criterion (BTC) scores for different fixed and sliding weight configurations in simulated bite off events. A baseline was determined where the BTC score indicated that serious injury would occur at least 50% of the time from a flyback event involving a fixed-weight branch line.

It is important to recognise that the findings consider flyback events where the branch line is under high tension (80 kg). The relative hazard posed to crew in pelagic longline fishing operations is likely to rarely reach that considered in the safety research.

Bite off events

Bite off events were the focus of research by McCormack and Rawlinson (2016). The research demonstrated the use of sliding weights with branch line configurations of 40 g or greater attached within 0.5 m of the hook, and 60 g or greater attached within 1 m of the hook significantly reduced the relative hazard of bite off events.

Tear out events

Tear out events were the focus of research by Rawlinson *et al* (2018). The research extended McCormack and Rawlinson (2016) bite off methodology to tear out events. Hookpods (50 g) were also tested to determine their effectiveness in shearing the hook off in a tear out event.

Sliding weights of 60 g positioned within 1 m of the hook slid off the branch line in a tear out event, as the collision energy arising from the recoiling hook was sufficient for the hook to be sheared off when it hit the sliding weight. This configuration (60 g within 1 m of the hook) significantly reduced the relative hazard in a tear out event.

Sliding weights of 40 g positioned at 0.5 metres closer to the hook were less effective in their ability to shear the hook off. Fixed weighted swivels were the greatest relative hazard in a flyback event.

The Hookpod was ineffective at shearing off the hook in a tear out (Rawlinson *et al.* 2018). The recoiling hook predominately shattered the Hookpod, reducing the relative hazard although results varied. Detached pieces of the Hookpod where the fragments recoiled back with the branch line may also represent a hazard (Rawlinson *et al.* 2018).

This recent research supports a balance is needed between the mass of the sliding weight and its position from the hook. Establishing a hazard management procedure to improve safety when hauling branch lines during pelagic longline fishing operations (see 5 below) is particularly important where fixed weight branch line configurations are employed.

2.2.3 Potential hazard during flyback events

Previous research focused on velocity and the conditions of severe flyback events. McCormack (2015) conducted research that characterised the hazard posed by flyback events to crew. The research determined the velocity of the recoiling weights attached to the branch line and then calculated the kinetic energy involved during a flyback event. The kinetic energy varied significantly depending upon where the weight was positioned on the branch line and whether the weight was submerged or out of the water when the flyback occurred. If the weight

was submerged the kinetic energy quickly dissipated. The weight recoiled with the greatest kinetic energy when it was at or above the surface of the water, free from any drag from the water (McCormack 2015).

McCormack (2015) also considered approaches to determine the potential significance of the hazard posed by a flyback event by adopting the (BTC) as a measure of relative safety. This criterion takes into account the velocity, mass, size and kinetic energy of the weight (Sturdivan *et al.* 2004, Frank *et al.* 2011). It applies these measurements to determine the effect of the weight at the point of impact on the person struck, i.e. the significance of the hazard. By applying the BTC, McCormack (2015) reported that a smaller weight resulted in a lower BTC score, however the effect of weight size was negligible if the flyback event occurred at a high velocity.

This research supports establishing a hazard management procedure to improve safety when hauling branch lines during pelagic longline fishing operations (see section 5 below).

3. IDENTIFYING THE HAZARD

In any industrial setting there are workplace hazards. There is a range of workplace hazards on fishing vessels. Flyback events are a potential hazard that may occur when hauling catch during pelagic longline fishing operations.

The hazard posed by a flyback event has certain characteristics.

A flyback event hazard only arises when the branch line is under tension when hauling catch. The potential hazard increases as the tension on the line increases, by the actions of the crew placing the line under tension by hauling the catch, and/or by the actions of the hooked fish by swimming against the direction at which the line is being hauled. Although the crew can manage the former situation, vigilance is required to manage tension on the branch line in the latter situation.

A flyback event arises when the tension on the branch line is released when hauling catch. This may occur: (1) by a bite off or (2) a tear out event. (see 2 above). Under certain circumstances, a bite off may occur between the hook and the crimp that attaches the hook to the branch line. In these circumstances, the hazard posed by a recoiling branch line is potentially closer to that arising in a tear out event, e.g. if the crimp prevents a sliding weight from sliding off the branch line.

A flyback is only hazardous in instances where the tension that is released is sufficient for the branch line to recoil directly towards areas where crew are working. The potential hazard posed by the recoiling line is dissipated if the bite off or tear out occurs while the weight on the branch line is submerged under water—as the drag imposed on the weight by the water rapidly dissipates the energy released. The potential hazard is increased if the weight on the branch line is at or above the waterline.

Flyback events may occur at high velocities. In these instances, there will not be enough time for the crew involved in the hauling operation to take action to avoid being hit by any recoiling projectile.

The hazard posed by a flyback event potentially affects the crew on deck and specially members involved in hauling catch either at the open door or behind the adjacent bulwark.

The crew may potentially be struck by the recoiling line, the weight on the line, the hook, and fragments, e.g. from a recoiling Hookpod. The potential hazard to crew is reduced when personal protective equipment, particularly hard hats and face shields are worn. The potential hazard to crew is significantly reduced if the line is hauled at an angle, not directly in front of for instance an open fish landing door.

Fixed weights are potentially hazardous in both bite off and tear out events, where the weight remains attached to the recoiling branch line in a flyback event. Sliding lead weights have the ability to slide off the line in a flyback event. This may significantly reduce the hazard in a bite off event or tear out event, depending on the branch line weighting configuration.

4. ADDRESSING THE HAZARD

4.1 Hazard management procedure

The hazard posed by a flyback event may be addressed by implementing an appropriate workplace hazard management procedure. The hazard management procedure should focus on the potential for flyback events to occur when crew are hauling catch during pelagic longline fishing operations. The procedure should outline the technologies and techniques for avoiding or minimising the hazard posed by a flyback event to crew. Technologies and techniques for avoiding or minimising a flyback event should be used in combination.

4.2 Core procedures

Where possible, tension on the branch line should be kept to a minimum when hauling catch. Boat speed, line hauling speed, branch line spacing and branch line length are all critical aspects contributing to pressure on crew and exposure to this hazard. Letting the fish run will help to minimise tension on the branch line.

Personal protective equipment should be used by crew involved in the hauling of catch. Wearing this safety equipment will help to reduce the potential hazard from a flyback event. Core protective equipment includes hard hats and helmets that help protect the head, as well as shields and visors that help protect the face. Additional protective equipment should also be considered to protect the upper chest.

Angled hauling methods help to remove the crew involved in hauling catch from the direct path of a recoiling branch line. Poles or loops can be welded onto the vessel’s bulwark that allow for hauling to proceed away from the open door and the direct path of a flyback event. The bulwark provides additional protection to crew when angled hauling methods are employed.

4.3 Fixed weights

Branch line weighting configurations with fixed weights are considered a greater relative hazard in the event of a flyback as the weight is attached to the branch line when it recoils. The hazard to crew is similar in both bite off and tear out flyback events.

4.4 Sliding weights

Sliding weights can have safety benefit over fixed weights. If a sliding weight is used according to ACAP’s best practice advice for branch line weighting the relative hazard of a bite off event may be reduced. For bite off events the use of sliding weights with branch line configurations

of 40 g or greater attached within 0.5 m of the hook, and 60 g or greater attached within 1 m of the hook performed best in reducing the relative hazard (McCormack and Rawlinson 2016).

If a sliding weight is used according to ACAP's best practice advice for branch line weighting the relative hazard of a tear out event may be significantly reduced. For tear out events the use of sliding weights with a branch line weighting configuration of 60 g or greater within 1 m of the hook reduced the relative hazard (Rawlinson *et al.* 2018). Research has found that sliding weights of 40 g or greater attached within 0.5 metres of the hook were less effective than the previous configuration (Rawlinson *et al.* 2018).

Sliding weights need to be adjusted to the line and checked regularly to stay in place during normal fishing operations and should be free enough to slide when tension is rapidly released in the event of a tear out or bite off event.

4.5 Hook-shielding devices

Research demonstrates that for bite off events the Hookpod has similar characteristics of a sliding weight 40 g or greater attached within 0.5 m of the hook. The Hookpod will likely slide off the branch line in a flyback event, reducing the relative hazard (Rawlinson *et al.* 2018). Research has found that for tear out events a Hookpod attached at any distance from the hook was less effective (Rawlinson *et al.* 2018). The Hookpod was also found to break into fragments during the tear out event and the relative hazard was greater (Rawlinson *et al.* 2018).

The 'Smart Tuna Hook' was not the subject of research into flyback events. This hook-shielding device is distinct, in that when setting occurs the shield detaches from the hook 10 min after immersion in seawater (Baker *et al.* 2016, ACAP 2017). This means that the branch line is unweighted when it is hauled, and as such during a bite off event a Smart Tuna Hook would not recoil as the branch line lacks any weight. In tear out events the relative hazard from the recoiling hook is greater.

5. CONCLUSIONS

5.1 General conclusions

Branch line weighting is an important best practice technique for reducing seabird bycatch in pelagic longline fisheries. ACAP best practices recommend weighting configurations that help to minimise seabird bycatch, particularly bycatch of threatened albatross and petrel species. Hook-shielding devices also contribute to reducing seabird bycatch.

Pelagic longline fishing is an industrial activity with consequent workplace hazards to crew involved in hauling catch. Flyback events are a workplace hazard that arises when crew are hauling catch on branch lines in circumstances where the line is under tension and that tension is released in a bite off or tear out event. Completely eliminating the hazard from flyback events may be infeasible. Research has characterised the hazards to crew from flyback events when hauling catch. Hazard management procedures are essential to crew safety during pelagic longline fishing operations. Research has identified ways to help reduce the relative hazard from flyback events.

For fixed weights, the weight, size and position on the line of the branch line weighting configuration are contributing factors affecting the potential hazard posed by a flyback event.

Smaller sized weights resulted in a marginally decreased relative hazard; however, the difference in weight is negligible when a flyback event occurs at a high velocity. The highest relative hazard concerning a flyback event occurred when the weight was at or above the water line. The energy arising from a flyback event was quickly dissipated if the weight was submerged when the tension on the line was released, due to the drag imposed by the water.

During a flyback event in a bite off, sliding weights of 40 g or greater attached within 0.5 m of the hook, and 60 g or greater attached within 1 m of the hook significantly reduced the relative hazard. Sliding weights were found to have a mean slippage of 3 m when the branch line is at a higher level of tension. This highlights that a branch line weighting configuration where a sliding weight is placed close to the hook will help to reduce the hazard from a flyback event.

Tear out events are a greater relative hazard. This is because the hook potentially recoils with the weight on the branch line. In flyback events when a tear out occurs, sliding weights of 60 g or greater attached within 1 m of the hook significantly reduced the relative hazard. Lighter sliding weights of 40 g or greater attached within 0.5 metres of the hook and the Hookpod (50 g) were less effective, and the Hookpod was also found to break into fragments during the tear out event.

5.2. Future Studies

The relative safety of the ACAP's recommended branch line weighting configuration of 80 g or greater attached within 2 m of the hook should be assessed, if an 80 g sliding weight becomes commercially available. Research on no stretch branch lines should be considered to ascertain whether the branch line recoils in a bite off or tear out event. Underwater setting devices should be considered, provided there is a means of verifying compliance. These technologies may reduce or eliminate the need for branch line weighting, as setting occurs by stealth at a depth beyond the depth ordinarily reached by diving seabirds (Robertson *et al.* 2015, Robertson *et al.* 2018).

6. REFERENCES

ACAP, 2021. *Review and Best Practice Advice for reducing the impact of pelagic longline fisheries on seabirds.* Agreement on the Conservation of Albatrosses and Petrels. Revised at the Twelfth Meeting of the Advisory Committee, Virtual meeting, 31 August – 2 September 2021. Available from https://acap.aq/en/bycatch-mitigation/mitigation-advice

Anderson, O., Small, C., Croxall, J., Dunn, E., Sullivan, B., Yates, O., and Black, A., 2011. Global seabird bycatch in longline fisheries. *Endangered Species Research* **14**: 91-106

Baker, G.B., Candy, S.G., and Rollinson, D., 2016. Efficacy of the 'Smart Tuna Hook' in reducing bycatch of seabirds in the South African Pelagic Longline Fishery. Agreement on the Conservation of Albatrosses and Petrels, Seventh Meeting of the Seabird Bycatch Working Group, La Serena, Chile, 24 May 2016, SBWG7 Inf 07

Barrington, J.H.S., 2016. 'Hook Pod' as best practice seabird bycatch mitigation in pelagic longline fisheries. Agreement on the Conservation of Albatrosses and Petrels Seventh Meeting of the Seabird Bycatch Working Group, La Serena, Chile, 24 May 2016, SBWG7 Doc 10

Barrington, J.H.S., Robertson, G., and Candy, S.G., 2016. Categorising branchline weighting for pelagic longline fishing according to sink rates. Agreement on the Conservation of Albatrosses and Petrels, Seventh Meeting of the Seabird Bycatch Working Group, La Serena, Chile, 24 May 2016, SBWG7 Doc 07

Brothers, N., 1991. Albatross mortality and associated bait loss in the Japanese longline fishery in the Southern Ocean. *Biological Conservation* **55**: 255268

Frank, M., Bockholdt, B., Peters, D., Lange, J., Grossjohann, R., Ekkernkamp, A., and Hinz, P., 2011. Blunt criterion trauma model for head and chest injury risk assessment of cal. 380 R and cal. 22 long black cartridge actuated gundog retrieval devices. *Forensic Science International* **208**: 37-41

Gales, R., Brothers, N., Reid, T., Seabird mortality in the Japanese tuna longline fishery around Australia, 19881995. *Biological Conservation* **86**: 37-56

Gianuca, D., Peppes, F.V., César, J.H, Sant'Ana, R., and Neves, T., 2013. Do leaded swivels close to hooks affect the catch rate of target species in pelagic longline? A preliminary study of southern Brazilian fleet. Agreement on the Conservation of Albatrosses and Petrels, Fifth Meeting of the Seabird Bycatch Working Group, La Rochelle, France, 13 May 2013 SBWG5 Doc 33

Jiménez, S., Domingo, A., Forselledo, R., Sullivan, B.J., Yates, O., 2019. Mitigating bycatch of threatened seabirds: the effectiveness of branch line weighting in pelagic longline fisheries. *Animal Conservation* **22**: 376–385

Marine Safety Solutions, 2008. *Safe Lead impact study: Impact comparisons between SLL snoods fitted with Safe Leads, weighted swivels and no line weighting.* Marine Safe Solutions, Port Nelson, New Zealand, 24p.

McCormack, E., 2015. The relative safety of pelagic longline weighting configurations during a fly-back event. (Dissertation submitted in part completion of BAppS (Hons) Institute of Marine and Antarctic Studies, University of Tasmania) 94p.

McCormack, E., and Papworth, W., 2014. Review of evidence of injuries sustained by fishers in the course of using weighted lines in pelagic longline fisheries. Sixth Meeting of the Seabird Bycatch Working Group, Punta del Este, Uruguay, 10-12 September 2014 SBWG6 Doc 15

McCormack, E., and Rawlinson, N., 2016. The relative safety of the agreement on the Conservation of Albatrosses and Petrels (ACAP) recommended minimum specifications for the weighting of branchlines during simulated fly-backs. Agreement on the Conservation of Albatrosses and Petrels, Seventh Meeting of the Seabird Bycatch Working Group, La Serena, Chile, 24 May 2016 SBWG7 Doc 08

Phillips, RA, R. Gales, GB Baker, MC Double, M Favero, F Quintana, M Tasker, H Weimerskirch, M Uhart & A Wolfaardt. 2016. The conservation status and priorities for albatrosses and large petrels. *Biological Conservation* **201**: 169–183.

Pierre, J.P., Goad, D.W., and Abraham, E.R., 2015. *Novel approaches to line weighting in New Zealand's inshore surface-longline fishery*. Final report prepared for the Department of Conservation: Conservation Services Programme project MIT2012-04, Dragonfly Data Science, Wellington, New Zealand 41p.

Prince S, T Hochberg, N Miller, D Kroodsma, C Small, P Augustyn, 2019. A new method using AIS data to obtain independent compliance data to determine night setting use at sea. Agreement on the Conservation of Albatrosses and Petrels, Ninth Meeting of the Seabird Bycatch Working Group, Florianópolis, Brazil, 6 - 8 May 2019, SBWG9 Doc 18.

Rawlinson N., Haddy, J., Williams, M., Milne, D., Ngwenya, E., and Filleul, M., 2018. The relative safety of weighted branchlines during simulated fly-backs (cut-offs and tear-outs), Final Report. AMC Search, Launceston, Tasmania 50p.

Robertson, G., Ashworth, P., Ashworth, P., Carlyle, I., Jiménez, S., Forselledo, R., Domingo, A., Candy, S.G., 2018. Setting baited hooks by stealth (underwater) can prevent the incidental mortality of albatrosses and petrels in pelagic longline fisheries. *Biological Conservation* **225**:134–143

Robertson, G., Ashworth, P., Carlyle, I., and Candy, S.G., 2015. The development and operational testing of an underwater bait system to prevent the mortality of albatrosses and petrels in pelagic longline fisheries. *Open Journal of Marine Science* **5**: 112

Robertson, G., Candy, S., and Hall, S., 2013. New branchline weighting regimes to reduce the risk of seabird mortality in pelagic longline fisheries without affecting fish catch. *Aquatic Conservation: Marine and Freshwater Ecosystems* **23**: 885–900

Rollinson, P.R., 2017 Understanding and mitigating seabird bycatch in the South African pelagic longline fishery. (Dissertation submitted in part completion of PHD, University of Cape Town, South Africa), 169p.

Santos, R.C., Silva-Costa, A., SantAna, R., Gianuca, D., Yates, O., Marques, C. and Neves, T., 2019. Improved line weighting reduces seabird bycatch without affecting fish catch in the Brazilian pelagic longline fishery. Aquatic Conservation: Marine and Freshwater Ecosystems **29**: 442-449

Sturdivan, L.M., David, BS. MS., Viano C., Champion H.R., 2004. Analysis of injury criteria to assess chest and abdominal injury risks in blunt and ballistic Impacts. *The Journal of Trauma Injury, Infection and Critical Care* **56**: 3: 651–663

Sullivan B.J., Kibel P., Robertson G., Kibel B., Goren M., Candy S., and Wienecke B. 2012. Safe Leads for safe heads: safer line weights for pelagic longline fisheries. *Fisheries Research* **134136**: 125132

Sullivan, B.J., Kibel, B., Kibel, P., Yates, O., Potts, J.M., Ingham, B., Domingo, A., Gianuca, D., Jiménez, S., Lebepe B., Maree B.A., Neves T., Peppes F., Rasehlomi., Silva-Costa A., and Wanless R.M., 2017. At-sea trialling of the Hookpod: a 'one-stop' mitigation solution for seabird bycatch in pelagic longline fisheries. *Animal Conservation* **21**: 159167