Conservation Services Programme Project MIT2014-02:

Improving tori line performance in small-vessel longline fisheries

Milestone 2: Progress report

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Contents

Introduction

The objective of project MIT2014-02, funded through DOC's Conservation Services Programme, is to develop improved tori lines which are specifically optimised for safe and effective use on small longline vessels. The project focuses on bottom longline vessels in the first instance, and surface longline vessels subsequently. The first milestone of the project required the completion of an information review (including seeking the inputs of international experts) and the identification of preferred vessels for testing tori line designs. This progress report documents the second milestone, that is, the outcomes and recommendations of a workshop held to formulate the project team's approach to at-sea testing of tori line designs and construction materials.

Progress update

Workshop:

A workshop was held in Wellington on May 4. Initially, participants were to include Johanna Pierre, Dave Goad, John Cleal, Richard Wells, Greg Summerton and Larry Johnson. However, on the day, Greg and Larry were unable to attend due to airport fog and an altered vessel schedule, respectively. Therefore, their input was sought subsequent to the workshop, on a one-on-one basis.

The objectives of the workshop were to:

- identify potential issues relating to the use of tori lines on smaller longline vessels, in terms of tori line performance, barriers to implementation, and safety
- pull together ideas on effective construction and design for small-vessel tori lines that are considered likely to address these issues, and,
- identify next steps, including the outline of an at-sea programme, to develop an effective tori line design for smaller-vessel bottom longline fisheries.

The workshop group concluded that the most challenging element of tori line design, and also the most critical to ensuring tori line efficacy, was the attachment of the tori line to the vessel. The attachment determines the height from which the tori line is deployed. It also affects the practicality of the tori line from an operational perspective (i.e., the ease with which the tori line is deployed and retrieved) and its safety. Therefore, if a structurally robust and operationally practical attachment method cannot be achieved, tori lines are unlikely to be used. Further, if the attachment does not elevate the tori line sufficiently, the efficacy of the tori line will be compromised.

With the attachment of the tori line recognised as being central to good design and efficacy, the group focused their discussions on approaches to testing tori line designs intended for four defined groups of vessels. These groups were defined based on the type and extent of metal structures close to vessel sterns that would be appropriate for tori line attachment and deployment. These vessel types were identified (with examples) in the progress report for Milestone 1, and are briefly described again here:

- Very small vessels (i.e., around 8 m or less in length) with a wheelhouse but no other significant superstructure: These vessels will be the most challenging in terms of tori line development, given their low height above water and minimal options for tori line attachment. This group comprises an estimated number of five vessels.
- Vessels around 9 – 12 m in length with some metalwork above the deck: This category comprises the majority of small bottom longline vessels. The shelter deck may have a hard (fibreglass or metal) or soft (canvas) roof. The structural supports for the shelter deck provide opportunities for robust tori line attachment, e.g., through bolting davits from which tori lines are deployed onto metal struts. This group comprises an estimated 30 vessels.
- Vessels around 12 – 15 m in length that were formerly trawlers but have been converted for longlining: These vessels are the most straightforward to deploy tori lines from. This is because they have some residual gantry metalwork in place, which is robust and can be used to elevate and support tori lines. An estimated 6 vessels are in this group.
- Vessels that are 15 – 20 m in length and fish using both the bottom and surface longline methods: These vessels have metalwork around the stern that can be used to attach and elevate tori lines. The deck layout at the stern may differ significantly between vessels, but all offer a number of potential options for tori line attachment. This groups comprises an estimated number of 6 vessels.

In addition, a fifth vessel type was identified following the workshop. This comprises the few vessels that use the bottom longline and surface longline method and have no deck structure aft (in common with the first vessel group) but are larger in size (like the fourth vessel group). These vessels will be considered alongside the first group, given the similar constraints on tori line attachment.

The workshop group identified the first, second, and fourth categories of vessels as higher priority than the third category. This was because attachment approaches used for the third category of vessels can easily be transferred from the other vessel groups. The overall priority identified was the second category of vessels, as this includes the most vessels that also collectively deploy the most bottom longline fishing effort.

Tori line designs:

Ultimately, the project team's goal is to develop and test a suite of tori line design options that will deliver a known level of performance (in terms of aerial extent, efficacy in tracking the longline and protecting the hooks, and safety). For example, for the final tori line design emerging from the project, describing performance in terms such as the following is the goal: "an attachment height of X with Y construction design and materials delivers an aerial extent of Z under setting speed A. But, under setting speed Q the aerial extent changes to R". Developing tori lines that work at a range of setting speeds, irrespective of the target fish species, is appropriate. This is because of the variation in setting speeds documented for particular target species. Further, because gear on all smaller bottom longline vessels is set from the stern, there are no target-specific considerations with respect to tori line placement. That is, as long as tori lines are deployed clear of the immediate stern area, they will be out of the way of crew activities during setting operations.

The seabird assemblage that the tori line is intended to deter may also be an important design consideration. Observations at sea that diving birds (e.g., flesh-footed shearwaters and black petrels) are effectively distracted/deterred by splashing can be incorporated into designs, for example, by attaching components that will generate splash to the in-water or drag section of the tori line. In contrast, splashing seems less important for distracting/deterring albatrosses. However, attaching splash-generating material to tori lines may increase tangling risk (and so is therefore unlikely to be a preferred option for surface longline fisheries, given the shallower depths, longer snoods, numerous surface floats and beacons, and slower sink rates characteristic of that gear type at setting).

After extensive discussion, the workshop team agreed on the following approach to tori line development.

Setting speeds:

- Develop tori lines that perform effectively at setting speeds of 2 knots, 4 knots, 6 knots, and 8 knots. Bottom longline vessels are captured in the 2 – 6 knot range, and surface longliners in the 6 – 8 knot range. Both bottom and surface longline vessels could be setting at around 6 knots.

Attachments:

- Try attachments that would provide for tori line heights at the stern to be 5 m, 7 m and 9 m above the sea surface.
- Develop a bolt-on attachment approach that looks something like a fishing rod holder. Additional support for a tori pole may be provided by a fabricated tube in which the pole sits.
- If budget allows, try a version that folds out (i.e., a metal boom that deploys the tori pole out at an angle from the vessel, rather than straight up, with support struts to lock the arms in place while the tori line is deployed).

Deployment poles:

- Initially, having just one pole will be investigated. However, where this is proven feasible, deploying a second pole on the other side of the vessel is desirable. This means that one tori line can be deployed from either side of the vessel (depending on wind conditions), or two tori lines can be deployed simultaneously. These approaches will provide for better coverage of the mainline by tori lines, and the mechanism for attachment of the second pole should be straightforward having resolved the attachment of the first pole. Where two tori lines are used, some tweaking of the tori lines relative to each other may be required (e.g., length and drag) to reduce the risk of the two lines tangling.

Storage:

- Investigating reels for storage was the workshop group's preferred option. Reels may be custom-made or purchased off the shelf. Further investigation will occur as the testing plan is developed.

Two model tori line set-ups:

- The workshop team considered that taking two broad approaches to tori line development would be appropriate in the first instance.
    - The first test approach has a target aerial extent (75 m) and involves experimentally determining the drag needed to deliver this at different deployment heights. A series of plastic kitchen funnels will be explored in the first instance to provide drag. These have the added feature of creating water disturbance (thought to deter/distract diving seabirds – see above). The number and dimensions of funnels can easily be adjusted (e.g., for use on vessels with different setting speeds). In addition, they are cheap and readily available. Further, creating drag using funnels should mean that the tori line is not difficult to retrieve (e.g., by a single crew member) as the drag is effectively spread across a number of points rather than just one (compared to if a single float was used). Funnels have been used previously in this way, but the outcome of deployments has not been documented in detail. Tangling is a particular risk that would need to be considered here. If funnels do not provide sufficient drag, other terminal objects (e.g., a road cone or float, as below) may be required.
    - The second approach is to try drag objects known to be in use, and ascertain the aerial extent these deliver when other elements (e.g., setting speed, attachment height) are varied. Options initially selected by the workshop group are a road cone, a surface longline float, and a trawl float with rope/net around it. (Further work on developing the testing plan will identify the dimensions of these objects to be tested). The road cone will be tested with and without an internal float, and with and without a piece of ply on its base (i.e. covering the hole underneath the cone, holding the float inside, and with a central bolt in place to reduce flexing). A funnel-like object (e.g., the top part of a plastic pop bottle) will be attached over the pointed end of the cone to reduce the risk of gear hook-ups. (This approach has been observed on a bottom longline vessel at sea).
- The same "middle sections" (i.e., the backbone materials and streamers) of the tori line would be tested for both approaches. Testing may demonstrate that specific alterations are required.

Middle sections:

- Three candidate materials were considered worth further investigation as tori line backbones. These were multi-braid non-rotating rope that floats (e.g., waterski rope or albacore braid), autoline backbone, and monofilament. For multi-braid and autoline backbones, the aerial section would probably benefit from being thinner (lighter) than the drag section. Possible diameters are 3-4 mm for the aerial section and 8-10 mm for the drag section. The diameters of monofilament that would be tested initially are 3 – 5 mm.
- The workshop group preferred not to include swivels in the design and the use of non-rotating rope should mitigate the need for them. Swivels add extra complexity to the line. They also add weight and provide opportunities for tangling and hook-ups.
- Single-stranded streamers were identified as preferred by the workshop group for smaller-vessel tori lines as these are lighter than double streamers. Double streamers provide back-up in case

of breakage (i.e., if one strand of the streamer breaks, the other is still there). However, single streamers placed more frequently provide similar protection whilst distributing the weight of the streamers more evenly along the tori line backbone.

- To reduce weight on the tori line backbone, a hybrid streamer line design was preferred by the group, i.e., alternate long and shorter streamers. Long streamers would reach the sea surface and comprise Kraton® (or potentially Kraton® noodles cut in half along the streamer length, if needed to reduce weight). Shorter streamers would comprise "Irri-tape"[1], the holographic tape used as a bird deterrent in vineyards and agricultural applications. The thin version of this tape is not strong enough to be durable at sea. However, thicker tapes are available and these would be the focus of trials in the first instance.
- The workshop group discussed having long streamers 3-5 metres apart along the tori line. Short streamers would then go in between. Streamers would stop at the end of the aerial section of the tori line (i.e., would not be on the drag section in the water).

Weak links:

- Two weak links will be incorporated into tori line designs tested. One of these will be close to the tip of the deployment pole (and before any lazy line used to control the tori line). The second will be immediately forward of the drag section of the tori line.
- The workshop group identified several options for weak links. The key characteristic is that the weak link snaps at a known breaking strain, and that this is less than the longline backbone's breaking strain. Potential sources for materials of known and tested breaking strains include wire and rope manufacturers (e.g., Donaghys, Bridon Cookes). These options will be explored as part of developing the detailed testing plan for Milestone 3 of the project.

Next steps

The team identified land-based and at-sea components of a testing programme to progress towards this goal. Next, the testing plan will be finalised, and the logistics of testing (location, safety, etc.) will be resolved. The testing plan will be documented in the report prepared for Milestone 3 of this project.

At sea, extensive testing of tori line components and performance can take place on a single vessel (e.g., by varying setting speeds, pole heights, etc.). This test vessel will be identified as the at-sea plan is developed.

Subsequently, the tori line designs refined on that vessel can be deployed on a broader range of vessels amongst the vessel groups identified, for further testing and evaluation. In terms of specific vessels to involve in the final testing phase, several candidates have been identified. These include vessels with skippers who have made contact with Dave to request advice on tori line design and setup.

[1] http://www.bird-x.com/irri-tape-products-52.php?page_id=61

Other notes

- Kraton®, used for streamer lines in longline and trawl fisheries can tangle around birds in the water. Therefore, keeping streamers out of the water is important. Kraton® is otherwise a very good material for tori line streamers – it is bright-coloured, UV-protected, and comes in a variety of diameters (and so can be used as part of tori lines with different drag characteristics). Larger diameters can also be cut in half to make lighter streamers. As it is a tube, Kraton® can also be used to cover tori line backbones to increase their visibility.
- On smaller bottom longline vessels in particular, some skippers are deploying polystyrene "cotton-reel" floats (without streamers) with the goal of protecting their hooks from seabirds. In concept these provide a streamerless tori line. The floats create splash on the water. They are sometimes serially deployed – i.e., clipped onto the longline backbone on setting (and then another is deployed for its tori line-like function, and subsequently clipped onto the backbone, and so on). On some vessels with full tori lines, the cotton-reel floats are sometimes deployed with the goal of protecting the longline closest to the vessel stern and before the tori line streamers start.
- One skipper of a small vessel tows a series of "splashboards" (a bit like mini finless surfboards) astern during setting to create disturbance on the water surface. He considers that this deters birds from diving on his gear. The boards are attached following a 3-mm diameter length of monofilament line. The diameter of this mono means that windage is very low.
- If tori lines are deployed on lateral booms, these must be able to fold up to ensure vessels can pull up alongside the wharf.
- Ensuring the tori line tracks the longline effectively can be difficult. Bridle systems help with this, by making it easier to move the tori line after it is deployed. A rudder-type system is also being tested by Dave. The concept is that being able to change rudder angle depending on the day's weather conditions helps control the position of the tori line. Remote control options are being explored. A manual version would also be possible to make, where the rudder could be locked into one of a number of pre-set positions before tori line deployment.
- The Rotorua-based Kilwell fishing rod manufacturers may be a possible cost-effective supplier of tori line poles. Their supply of seconds (at very reasonable prices, given the construction materials) seems especially promising.
- On the FV Odyssey (fishing ling), a pole-mount is used to attach the tori line. The pole is mounted on the deck (which is 3 m above the sea surface). Another support for the pole is attached to the roof. The tori line has a weak link incorporated in it. The tori line is 40-50 ftm long overall. From the stern, there is 20 - 30 ftm of bare tori line backbone until the first streamers. The tori line backbone is 400 lb monofilament. It has a swivel clip on a small float (drag object) and 2 to 3 other swivels along the backbone. Streamers (white packaging tape) are attached 2-3 fathoms apart. A blue float is used as the terminal object. A lazy line is used to help control the tori line. The tori line is stored on a hose reel.
- Note that for surface longlines, monofilament may be the best method to create drag given the increased risk of the gear tangling with the tori line.
- Storage of tori lines on reels and coiled in barrels or bins has been observed.