WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Options for a Regulatory Amendment:
Modification of Seabird Interaction Mitigation Measures
in the Hawaii Deep-set Longline Fishery

187th Council Meeting
September 21-23, 2021
Web Conference

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1 INTRODUCTION

Seabird interactions in the Hawaii longline fishery, composed mostly of black-footed albatross (BFAL) and Laysan albatross (LAAL), have been monitored through the NMFS Pacific Islands Regional Office Observer Program since 1994. Starting in 2001, implementation of seabird mitigation measures including night-setting, blue-dyed bait, and weighted branchlines resulted in reductions in interactions by 70-90% (Van Fossen 2007; Gilman et al. 2008). LAAL and BFAL interactions in the Hawaii deep-set longline (DSLL) fishery have gradually risen in subsequent years with significant increases since 2015 for BFAL.

The increase in albatross interactions in the DSLL fishery appear to be driven by a combination of factors including oceanographic changes (Gilman et al 2016). In 2017, the Western Pacific Regional Fishery Management Council (Council) held a workshop exploring the causes of higher BFAL interactions observed in the Hawaii longline fishery in 2015-2016. Potential drivers identified included positive Pacific Decadal Oscillation, strong westerly winds, and cooler sea surface temperatures, which may increase the overlap of DSLL effort and BFAL foraging grounds (Wren et al. 2019).

In 2018, the Council held a second workshop to review seabird mitigation requirements and the best scientific information available for the Hawaii longline fishery. The workshop resulted in the identification of priority mitigation measures suitable for the Hawaii longline fishery,

potential changes to seabird measures, and research needs to inform future changes to seabird measures (Gilman and Ishizaki 2018). Specifically, workshop participants identified blue-dyed bait as a candidate for removal from the existing suite of seabird mitigation measures because of concerns with efficacy and practicality, and identified deterrents such as tori lines (also called streamers) to be a high priority for further research and development due to its potential to provide an effective alternative to blue-dyed bait. Participants discussed that the requirement for using blue-dyed bait was intended to be used for squid bait but currently only fish are used for bait[1] in both Hawaii longline fisheries, and that blue-dyed fish bait may also be less effective at mitigating seabird catch risk than blue-dyed squid bait. Industry members who participated in the workshop indicated that blue-dyed bait is not favored by fishermen as the dye is messy and thawing of bait reduces retention on hooks. Additionally, recent analysis of observer data indicate that side-setting is more effective than blue-dyed bait in the DSLL fishery (Gilman et al. 2016).

Tori lines were previously tested in the Hawaii longline fishery in the late 1990s, which showed that the deterrents were effective in reducing seabird contact rates with bait and gear (McNamara et al. 1999, Boggs 2001). However, these early studies also identified issues with practicality and crew safety resulting from tori line entanglement with gear. The Council considered inclusion of tori lines in the seabird mitigation measures in 1999 and again in 2004, but to date tori lines have not been included as an option for the Hawaii longline fishery.[2]

Following the 2018 workshop, the Council at its 174th Meeting in October 2018 recommended 1) enhancing outreach and training efforts to ensure proper application of existing seabird mitigation measure requirements; 2) NMFS provide support for research and development for alternative measures with potential to replace blue-dyed bait, with high priority placed on identifying suitable designs for tori lines; and 3) encourage submission of Experimental Fishing Permit (EFP) applications for testing alternative measures without the use of blue-dyed bait to allow comparison of measure effectiveness with and without blue-dyed bait. The Council additionally directed staff to prepare a discussion paper for the March 2019 Council Meeting to evaluate the effect of potential removal of blue-dyed bait without additional replacement measures on seabird interaction rates.

The Council at its 176th Meeting in March 2019 reviewed the discussion paper and determined that removal of blue-dyed bait without replacement measures would likely increase seabird interactions. The Council additionally endorsed strategies for identifying alternative mitigation measures and improving seabird measure effectiveness for the Hawaii longline fishery, including addressing captain effects through strategic outreach, identifying tori line designs suitable for the

[1] SSLL vessels are required to use mackerel-type fish bait and DSLL vessels use fish bait by preference. Squid bait is also more expensive than fish bait.

[2] The Council initially recommended including towed deterrents such as tori lines and towed buoys as part of its original seabird mitigation action in 1999 in which vessels would have been required to use two out of six mitigation measures. However, tori lines were not part of the seabird mitigation measures implemented in 2001 because the measure was not included in the Terms and Conditions in the 2000 Biological Opinion developed by USFWS. The Council again recommended requiring the use of tori lines as part of stern-setting measures when it developed the side-setting option in 2004, but later modified its recommendation in 2005 to remove tori lines from the proposed modifications in part due to the limited number of studies to inform construction and operating performance standards of using tori line systems in the Hawaii longline fishery.

Hawaii fishery, encouraging trials for making minor modifications to existing required measures, and progressing international bycatch assessments for North Pacific albatross species. To further address the priority for identifying suitable tori line designs, the Council directed staff to work with industry, NMFS, Pelagic Plan Team and other expertise as appropriate to identify draft minimum standards for tori lines, taking into consideration existing standards established for other fisheries, designs currently used voluntarily by Hawaii longline vessel operators, and diversity of vessel size and configuration in the Hawaii longline fishery.

In 2019-2020, a joint Cooperative Research Project by the Council, Hawaii Longline Association (HLA), NMFS Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO) was implemented to conduct 1) demonstration and trial of tori lines in the Hawaii longline fishery to inform minimum standards specific to this fishery, 2) field trials of tori lines to collect data on operational practicality and effectiveness in using tori lines under commercial fishing operations in the DSLL fishery. The results from the study indicate that tori lines are effective in reducing albatross contacts and attempts on baited hooks when used in conjunction with existing seabird bycatch mitigation measures in the DSLL. Specifically, the results indicate that albatross attempts are about 2 times less likey, and contacts about 3 times less likely when tori lines are used (Gilman et al. 2021a, 2021b).

The Council at its 183rd Meeting in September 2020 recommended additional at-sea trials for winter 2020/spring 2021 to test tori line efficacy in the DSLL without the use of blue-dyed bait when fishing north of 23°N under an EFP to inform development of options for revising mitigation measures. The Council concurrently recommended development of an options paper to consider inclusion of tori lines in the seabird mitigation measures, including an option to allow the use of tori lines without blue-dyed bait.

The Council at its 184th Meeting in December 2020 reviewed the options paper, and directed staff to form an Action Team, initiate development of a regulatory amendment to evaluate options for allowing the use of tori lines in lieu of blue-dyed bait and removing the strategic offal discharge requirement in the DSLL fishery, and schedule further action when the results of EFP study are available. The Council also directed staff to work with the Action Team to develop draft regulatory specifications for tori lines in the DSLL for Council review. The Council at the 186th Meeting in June 2021 reviewed the draft regulatory specifications and concurred with the approach of focusing the regulatory requirements on tori line length, attachment point height, and streamer design, and having additional design and safety recommendations as non-regulatory guidelines. The Council directed staff to refine the draft specifications and non-regulatory design guidance for inclusion in the Council action to revise seabird mitigation measures at a future meeting.

The Hawaii Longline Association (HLA) applied for an EFP to test tori lines in lieu of blue-dyed bait, and NMFS issued the approved EFP on January 27, 2021 (86 FR 8341; February 5, 2021). Field trials for the EFP study were conducted from February to June 2021. The results of the study will be presented at the 187th Council meeting. The results showed that albatross attempts are 1.5 times less likely, contacts are 4 times less likely, and captures 14 times less likely on tori line sets compared to blue-dyed bait sets (Chaloupka et al. in prep.).

2 PURPOSE OF THE OPTIONS PAPER

This paper evaluates options for a regulatory amendment to allow the use of tori lines in lieu of blue-dyed bait and removing the strategic offal discharge requirement in the DSLL fishery. The purpose of the action is to modify the seabird mitigation measures for the DSLL fishery to reflect the results of the recent cooperative research and the best available scientific information, and to improve the overall operational practicality and mitigation efficacy of the required measures.

The options have been refined from those presented to the Council at the 184th Meeting in December 2020, based on the results of the recent EFP study. The Council at the 187th Meeting in September 2021 will consider initial action on the regulatory amendment, and may provide further direction to prepare the regulatory amendment for final action at the December 2021 Meeting or another future meeting. The options considered in this document are as follows:

1) Status Quo/No Action – Continue managing the Hawaii deep-set longline fishery under existing seabird interaction mitigation measures
2) Allow use of tori lines in the Hawaii deep-set longline fishery as a third option
3) Replace blue-dyed bait with tori line in the required measures for the Hawaii deep-set longline fishery
4) Modify strategic offal discard requirement in the Hawaii deep-set longline fishery

The options paper presented in December 2020 included additional options to consider the applicability of the action to the Hawaii shallow-set longline (SSLL) sector, conversion of requirements to mirror RFMO measures, and addressing cross-taxa impacts associated with weighted branch lines. These options are no longer considered in this paper for the following reasons:

- *Applicability of the action to the SSLL sector*: The Council at the 184th Meeting directed staff to work with the Action Team and industry representatives to further develop options for the shallow-set longline fishery for Council consideration at the March 2021 meeting. The options paper presented at the 185th Meeting in March included considerations for removing blue-dyed bait and strategic offal from the shallow-set seabird mitigation measures, allow flexibility in setting time by requiring additional mitigation measures, and exploring a broader set of potential modifications. Based on input from the advisory bodies and industry representatives, the Council recommended prioritizing additional research and development of appropriate measures for the shallow-set fishery, with high priority placed on identifying combination of mitigation measures that maintain effectiveness of seabird deterrence during dusk compared to the existing night-setting suite of measures, to provide operational flexibility in starting the setting operations before sunset. Management action on the SSLL fishery will be considered separately from this action at a later time.
- *Conversion of requirements to mirror international measures*: The menu approach implemented under the conservation measures for Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) provides more flexibility for vessel operators to select mitigation methods that work best for their fishery. However, this approach may also allow vessel operators to use combination of methods that may not be as effective as others. For example, under the WCPFC measures, a Hawaii DSLL vessel could either side-set with a bird curtain and

weighted branch lines, or use weighted branch lines and deep-setting line shooter, and be both compliant. However, since all Hawaii DSLL vessels use a line shooter for the gear to reach depths needed to target bigeye tuna, the addition of side-setting is likely to be more effective than only using weighted branch lines. Therefore, applying the WCPFC and IATTC menu approach may reduce the fleet-wide effectiveness of seabird mitigation measures in the Hawaii longline fishery. Alternatively, considering a limited set of menu options that eliminates the less effective measures results in a list of options similar to what is otherwise presented in this paper, with the exception of measures that are considered not practical for the DSLL (e.g., night setting) or have not been tested in the fishery (e.g., hook pods).

- *Addressing cross-taxa impacts associated with weighted branch lines*: The intent of this option was to consider the impacts that the weighted branch line requirement may have on sharks and other protected species, as DSLL has adapted to use wire leaders to reduce the risk of gear flyback. HLA has since announced the voluntary conversion of wire leaders to monofilament nylon or similar materials, and the Council took final action to prohibit wire leaders in the DSLL fishery. Therefore, this option is no longer a priority at this time.

3 BACKGROUND INFORMATION

3.1 Seabird Mitigation Measures in the Hawaii Longline Fishery

Current gear-based seabird mitigation measures required in the Hawaii DSLL and SSLL fisheries are summarized in Table 1. This set of seabird measures were implemented in 2006, which amended earlier requirements implemented in 2001 for DSLL and in 2004 for SSLL. These measures apply to DSLL vessels when fishing north of 23°N, and SSLL vessels wherever they fish.

For both components of the longline fishery, vessels have the option to side-set or stern set, with each option having additional required measures. For both DSLL and SSLL fisheries, if vessels choose to side-set, they are also required to use weighted branch lines (i.e., attach weights equal to or greater than 45 grams to branch lines within one meter of each hook). DSLL vessels that stern set are required to use blue-dyed thawed bait, weighted branch lines, line shooter, and strategic offal discards. SSLL vessels that choose to stern set are required to night set, use blue-dyed thawed bait, and use strategic offal discards. In 2019, 25 out of the 140 (82.1%) observed DSLL vessels chose the blue-dyed thawed bait measure over side-setting, and 100% of SSLL vessels used blue-dyed thawed bait (NMFS 2021).

In addition to the gear-based measures, the Hawaii longline fishery is required to handle live seabirds in a manner that maximizes the chances of long-term survival after release and to annually attend a protected species workshop conducted by NMFS.

Table 1. Summary of current seabird mitigation measures required in the Hawaii DSLL and SSLL fisheries (50 CFR 665.815).

DSLL	
When side-setting north of 23°N, also use:	**When stern-setting north of 23°N, use:**
Bird curtain >45g weight within 1m of hook	Blue-dyed bait (thawed) >45g weight within 1m of hooks Line shooter Strategic offal discards (when seabirds present)
SSLL	
When side-setting, also use:	**When stern-setting, use:**
Bird curtain >45g weight within 1m of hook	Blue-dyed bait (thawed) Strategic offal discards (when seabirds present) Night set

3.2 Timeline of Seabird Mitigation Measure Implementation

The Council began addressing seabird interactions in the Hawaii longline fishery in the mid-1990s, with a series of workshops conducted in conjunction with the US Fish and Wildlife Service (USFWS) to inform fishermen of seabird interaction issues and provide information on mitigation measures. The Council and NMFS in 1998-1999 conducted at-sea trials of various mitigation measures, including blue-dyed bait, thawed bait, towed deterrents, night setting, weighted branch lines, and offal discharge (McNamara et al. 1999; Boggs 2001).

The Council took action in October 1999 recommending that Hawaii longline vessel operators when fishing north of 25°N employ two or more of the following seabird deterrent techniques: 1) blue-dyed bait; 2) strategic offal discards; 3) towed deterrents (e.g., tori lines or towed buoy); 4) line-setting machine with weighted branch lines; 5) weighted branch lines; and 6) night setting. The Council's recommendation was intended to allow fishermen to select a combination of methods to use and find the most effective combination so that seabird measures may be amended based on their operational experience and data. At the time, blue-dyed bait had been primarily tested on squid bait used in the SSLL fishery, and minimal testing had been done on fish bait used in the DSLL fishery.

After NMFS published a proposed rule in July 2000 based on the October 1999 Council recommendation, USFWS issued a Biological Opinion (BiOp) in November 2000 analyzing the impacts of the Hawaii longline fishery on ESA-listed short-tailed albatrosses (STAL). The BiOp concluded that the fishery was not likely to jeopardize the STAL, but estimated that the fishery would take 15 STALs during a 7-year period (for the purpose of the BiOp, USFWS defined "take" to include injury, mortalities, and any STAL striking at baited hooks or gear). Based on this assessment the 2000 BiOp included Reasonable and Prudent Measures (RPMs) and Terms and Conditions that required 1) all Hawaii longline vessels to use thawed blue-dyed bait and strategic offal discards when operating north of 23°N; and 2) DSLL vessels to additionally use line-setting machine with weighted branch lines when operating north of 23°N. The Terms and Conditions of the 2000 BiOp was implemented in June 2001 through an Emergency Interim Rule, and later through a Framework Amendment to the Pelagic Fishery Management Plan (FMP) in June 2002. A Regulatory Amendment to the Pelagic FMP implemented in April 2004

additionally required that SSLL vessels use night-setting (no earlier than one hour after local sunset and no later than local sunrise) when fishing north of 23°N.

The USFWS issued a revised BiOp in November 2002 in response to the court-ordered SSLL fishery closure in 2001 that modified the federal action subject to ESA Section 7 consultation. In reinitiating the consultation, NMFS included as part of the proposed action an experiment to test the efficacy of blue-dyed fish bait. The revised BiOp recognized the limited data available on the effectiveness of blue-dye on fish bait, and required interim and final reports of the experiments to be submitted to USFWS.

Following a series of cooperative research trials that tested blue-dyed fish bait along with side-setting and underwater setting chutes, the Council took initial action in June 2004 for a regulatory amendment to the seabird measure. In October 2004, the Council took final action to recommend the addition of side-setting as an alternative seabird mitigation measure to blue-dyed bait, the addition of tori lines to the existing blue-dyed bait measure, and modification of the SSLL seabird requirements to apply wherever they fish. The Council additionally indicated in its action that it would use the period of the regulatory process to collect supplementary data on bird behavior and coordinate with the USFWS to remove the requirement for blue dyed thawed bait and offal discards, if appropriate. A letter from the US Department of Interior (DOI) to NMFS dated October 15, 2004, received after the Council Meeting, stated that blue-dyed thawed bait and strategic offal discards should be retained as mitigation measures. DOI agreed that there is limited data on effectiveness of blue-dyed fish bait and acknowledged that trials in New Zealand show that mackerel-type bait hold dye less well than squid. However, DOI argued that blue-dyed thawed bait should be retained in the mitigation measures unless replaced by a demonstrably more effective deterrent, given that thawed bait has some deterrent effect due to its faster sink rate compared to frozen bait and that the blue dye has unclear but “perhaps neutral or positive deterrent effect”. The letter further suggested that strategic offal discards should be used only when seabirds were present. DOI also recommended that tori lines not be included as an optional seabird deterrent unless they are used in addition to more effective deterrents, as results of Hawaii-based studies using tori lines indicated tori lines were not as effective as other deterrent measures.

Following the publication of the proposed rule, the Council in November 2005 modified its recommendation to remove tori lines from the regulatory amendment. The decision was due to information that seabird interactions had already been reduced significantly, construction and operating performance standards of using tori line systems in the Hawaii longline fishery had not been thoroughly studied, and tori lines were originally included in the recommendations as an incentive to convert to side-setting whereas as of 2005, 40 vessels had converted to side setting with more on the way given NMFS financial assistance. The regulatory amendment adding the side-setting option and modifying SSLL requirements to apply wherever they fish was implemented in January 2006.

3.3 Seabird Interactions Trends

Seabird interactions in the Hawaii longline fishery have been monitored through the Pacific Islands Regional Observer Program since 1994. The observer coverage rate was initially low at around 5% from 1994 to 1999. The bigeye tuna-targeting DSLL fishery has been consistently

monitored at a minimum of 20% coverage since 2001, and the swordfish-targeting SSLL fishery has been monitored at 100% coverage since 2004.

Most seabird interactions in the Hawaii longline fishery are with BFAL and LAAL. Between 1994 and 1999, fleet-wide BFAL interactions were estimated to range from 1,134 to 1,830 annually, and LAAL interactions were estimated to range from 844 to 2,067 annually (McCracken 2000). Implementation of seabird mitigation measures in 2001 resulted in reductions in interactions by 70-90% (Van Fossen 2007; Gilman et al. 2008).

In the decade since the successful implementation of seabird mitigation measures, the DSLL fishery has seen a gradual increasing trend in LAAL and BFAL interactions (Gilman et al. 2016), with higher rates of BFAL interactions seen since 2015 (WPRFMC 2021**;** Figure 1). In contrast, LAAL interactions have remained relatively stable in recent years. A similar, but less pronounced pattern has been observed in the SSLL fishery. To date, STAL interactions have not been observed in the DSLL and SSLL fisheries. In both fisheries, interactions are highest in the first and second quarters of the calendar year (January-June) due to fishing effort overlapping with the BFAL and LAAL foraging distribution during breeding season in the northwestern Hawaiian Islands. Albatross interactions in the SSLL fishery have a single peak in March and April, while those in the DSLL fishery have two peaks, in February and May. Most interactions on DSLL vessels occur during the set, while majority of interactions occur during the haul on SSLL vessels.

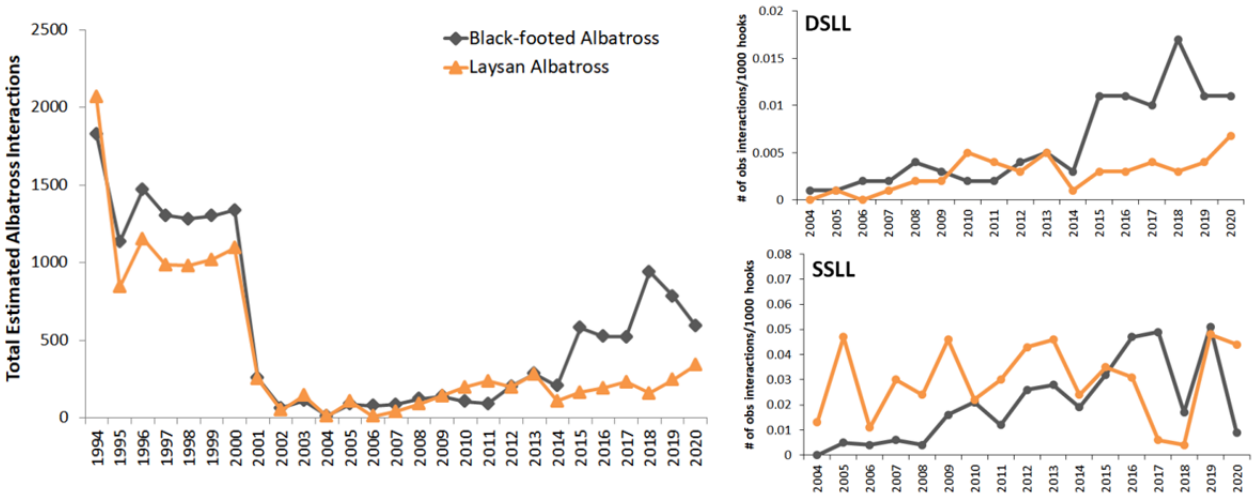

Figure 1. BFAL and LAAL interactions in the Hawaii longline fishery. Left panel shows total estimated BFAL and LAAL interactions in the DSLL and SSLL fishery combined, 1994-2020. Right panels show BFAL and LAAL interaction rates in the DSLL (top) and SSLL (bottom) fisheries. SSLL data for 2006 and 2018-2019 are primarily first quarter data due to fishery closures related to sea turtle interactions. Source: WPRFMC 2021.

The gradual increase of albatross interactions over time and recent elevated levels of interactions in the DSLL appear to be driven by a combination of factors. An analysis conducted by Gilman and colleagues (2016) using data from October 2004 to May 2014, indicated that albatross interaction rates significantly increased during years of higher annual mean multivariate El Niño

index (MEI), suggesting that oceanographic changes may have contributed to the increasing trend in albatross catch rates. This analysis also showed a significant increasing trend in the number of albatrosses observed around fishing vessels, which may have contributed to the increasing catch rates. Council's 2017 Workshop further examined the potential environmental factors affecting higher BFAL interactions observed in the Hawaii longline fishery in 2015-2016. Analysis conducted for the 2017 Workshop suggested that while fleet dynamics (month, latitude and longitude of fishing) explained much of the variation over the years, positive Pacific Decadal Oscillation (PDO), strong westerly winds, and cooler sea surface temperatures explained the increase in BFAL sightings in recent years (Wren and Polovina 2018; Wren et al. 2019). Stronger westerly winds may drive productive surface waters to the south, increasing the overlap of DSLL fishing effort and BFAL foraging grounds, and more birds may also transit through the fishing grounds when westerly winds move south during positive PDO years.

Additionally, analysis prepared for the Council's 2018 Workshop suggested that a unique captain effect (i.e., probability of albatross interactions differed by individual vessel operators) may also be contributing to the higher interactions in recent years (Fitchett and Ishizaki 2018). Mean annual captain effects (calculated as odds ratios) increased significantly from 2010 to 2012 and again from 2016 to 2018, commensurate with the recent increase in seabird interactions. Increased albatross attraction to vessels through albatross learning behavior over time was speculated as a factor contributing to larger abundance around vessels in the 2017 Workshop discussions, although data are lacking to test this hypothesis.

BFAL population modeling updated for the 2017 Workshop indicated that the increased interactions in 2015-2016 in the Hawaii longline fishery, if it is temporary or stabilized at the higher level, is likely to have an imperceptible difference on the population growth (Bakker and Finkelstein 2017). If the elevated interaction rates are applied consistently throughout North Pacific fisheries (U.S. and international fleets) with BFAL bycatch, the population is projected to decline. However, data on BFAL interactions in non-U.S. fisheries are limited, and the total BFAL interactions in the North Pacific are unknown.

3.4 Summary of the Tori Line Cooperative Research Project

In 2019, a joint Cooperative Research Project by the Council, HLA, PIFSC, and PIRO was initiated to conduct 1) demonstration and trial of tori lines in the Hawaii longline fishery to inform minimum standards specific to this fishery, 2) field trials of tori lines to collect data on operational practicality and effectiveness in using tori lines under commercial fishing operations.

The project was divided into two phases. Phase 1 goals were to identify potential tori line designs based on industry input, expert advice, existing international standards and guidelines for tori lines, land trials, and sea trials. Five different tori line prototype designs were tested during at-sea demonstrations with the goal of determining operational practicality and design preferences based on interviews with vessel operators.

The final design selected for field trials under commercial fishing operations was a short streamer design with a 50 meter aerial extent using a light material (dyneema) backbone and 55 meter drag section (Figure 2, Figure 3). The short streamer design was most favored by captain

and crew due to their ease of deployment and retrieval, and having sufficient amount of streamers to deter seabirds from sinking baited hooks. The 50 meter aerial extent provides sufficient distance to cover the area with sinking baited hooks in the DSLL (approximately 40 m from vessel stern[3]), and allowed the design to meet existing tori line specifications for the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC). During Phase 2 field trials, data on seabird strike attempts and contacts were collected throughout each setting operation using stern video cameras connected to the vessel's Electronic Monitoring (EM) system to evaluate the tori line's effectiveness.

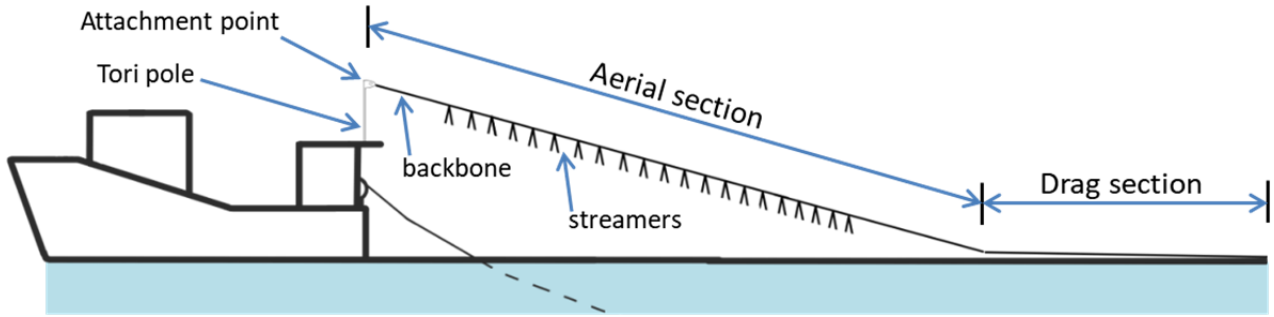

Figure 2. Components of a tori line.

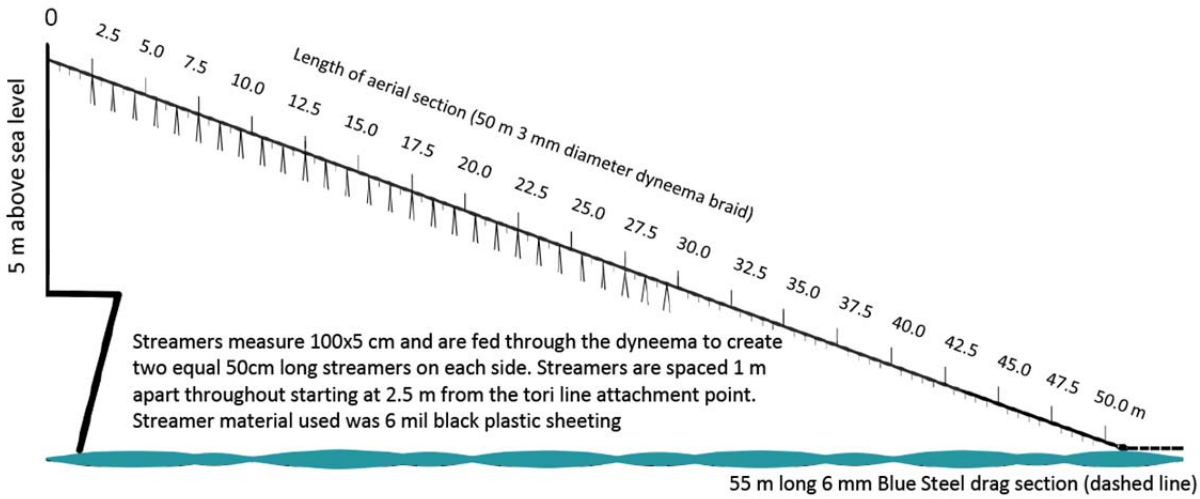

Figure 3. Schematic diagram showing the tori line design developed in the 2019-2020 cooperative research project (source: Gilman et al. 2021a).

The results from the field trials concluded that tori lines are effective in reducing albatross attempts and contacts on baited hooks. Specifically, the results indicate that albatrosses attempts are about 2 times less likely, and contacts about 3 times less likely when tori lines are used (Gilman et al. 2021a, 2021b). However, this initial study did not provide an evaluation of the tori

[3] BFAL and LAAL, the primary species that have incidental interactions with the Hawaii longline fishery are not diving birds, thus the project team determined that aerial extent to cover the area with sinking baited hooks would be sufficient to prevent primary attacks on baited hooks from these species. Secondary attacks by deeper diving seabirds that bring bait to the surface and making them available to other seabirds are not common in the Hawaii longline fishery.

line effectiveness if used in lieu of blue-dyed bait. Additionally, the results showed that seabird attempts and contacts were more likely to occur when offal discharge was used during the set, although results were inconclusive due to the lack of standardized procedure for strategic offal discharge during the field trials and the potential that crew utilized strategic offal discharge when attempts and contacts were actively observed (*see* Section 3.5 for additional discussion on offal discharge).

The Council at its 183rd Meeting recommended additional at-sea trials for winter 2020/spring 2021 to test tori line efficacy without the use of blue-dyed bait when fishing north of 23°N under an EFP to inform development of options for revising mitigation measures. The Hawaii Longline Association (HLA) applied for an EFP to test tori lines without the use of blue-dyed bait or strategic offal discharge (discharging bait and fish offal when seabirds are present), both of which are normally required while deploying DSLL gear north of 23°N. NMFS issued the approved EFP on January 27, 2021 (86 FR 8341; February 5, 2021).

Field trials for the 2021 EFP study were conducted from February to June 2021. The trials involved three DSLL vessels, 7 total trips, and 87 sets. The vessels alternated sets between two treatments: 1) blue-dyed bait used in conjunction with branch line weights; and 2) tori line used in conjunction with untreated bait and branch line weights. On all sets, crew were instructed not to discharge offal or spent bait during setting operations. Data on seabird strike attempts and contacts were collected throughout each setting operation using stern video cameras connected to the vessel's EM system. The results show that albatross attempts are 1.5 times less likely, contacts are 4 times less likely, and captures 14 times less likely on tori line sets compared to blue-dyed bait sets (Chaloupka et al. in prep.).

The DSLL tori line studies conducted in 2019-2021 provide robust scientific evidence that tori lines are significantly more effective in mitigating seabird interactions in the DSLL than the existing blue-dyed bait measure.

3.5 Additional Background and Available Scientific Information on Blue-dyed Bait and Strategic Offal Discards

Blue-dyed Bait

Hawaii DSLL vessel owners and operators, when stern-setting, are required to use completely thawed bait that has been dyed blue to an intensity level specified by a color quality control card issued by NMFS. The owners and operators are also required to maintain a minimum of two cans (each sold as 0.45 kg or 1 lb size) containing blue dye on board the vessel.

Dyed bait in pelagic longline fisheries were experimented in East Coast fisheries as early as the mid-1970s to increase catch rates of target species. Fishermen found that a variety of different colored squid baits were effective in targeting swordfish, but found that blue-dyed bait reduced bait losses to seabirds (McNamara et al. 1999). It was not known whether the blue dye creates a camouflage effect against the ocean and the seabirds do not see dyed bait well, or if seabirds do not consider blue-dyed bait as food.

Blue-dyed bait was first tested in the Hawaii longline fishery in the late 1990s. McNamara and colleagues (1999) tested blue-dyed bait, tori lines, towed buoy system, and offal management on both SSLL and DSLL trips, with night setting additionally evaluated for SSLL. Each of the mitigation measures were tested individually, and data on all mitigation measures except for night setting were collected during daylight hours. Of the five trips observed for the study, one trip targeted tuna using DSLL gear and fish bait, and four trips targeted swordfish using SSLL gear and squid bait. Results from the SSLL trips indicated that blue-dyed squid bait was the most effective measure among the mitigation strategies tested, reducing seabird gear contacts by 77% and capture rates by 95%. Experimental treatments on the DSLL trip had a small sample size in the study, with only two sets testing blue-dyed fish bait, during which there were no gear contact with seabirds on hooks with blue-dyed fish bait, whereas 10.7 attempts to pick up baited hooks per seabird per 1,000 hooks were observed on control hooks. In this study, seabirds that were actively pursuing natural-colored baits were observed to ignore dyed baits that were within view and range, and their foraging behavior toward dyed baits was greatly reduced during setting and hauling operations. Based on the results of the study, the authors recommended different combination of mitigation measures to be considered for DSLL and SSLL vessels due to operational and gear characteristics unique to each component, and only recommended blue-dyed bait for SSLL using squid for bait.

A second experiment testing blue-dyed squid bait, tori lines and weighted branch lines was conducted in 1999 on a research vessel using SSLL gear (Boggs 2001). This study found that blue-dyed squid bait reduced the number of albatross contacts with baits by approximately 90% compared to the control treatment. These two studies (McNamara et al. 1999; Boggs 2001) provided the basis for the Council's 1999 recommendation that would have required that vessels in the Hawaii longline fishery use two out of six mitigation measures including blue-dyed bait, as well as the RPM and associated Terms and Conditions in USFWS' 2000 BiOp that first required blue-dyed bait to be used in both SSLL and DSLL fisheries.

Following implementation of the seabird measures, Gilman and colleagues (2007) tested the effectiveness of blue-dyed bait along with underwater setting chutes and side-setting on both DSLL and SLL gear. The study found that blue-dyed bait had higher seabird catch rates than side-setting on both DSLL and SSLL sets, and found that blue-dyed bait was impractical due to the amount of time required to dye the bait and the need to fully thaw the bait, which increases bait loss from hooks.

Studies of blue-dyed bait effectiveness on seabird interaction rates outside of Hawaii have had mixed results. An experiment testing blue-dyed squid and fish bait effectiveness on wedge-tailed shearwaters showed that dyed fish bait had higher bird strike rates compared to dyed squid bait, and that habituation to dyed fish bait was observed with bird strike rates increasing from 48% to 90% over the trial period (26 longline sets) (Cocking et al. 2008). In contrast, a trial of blue-dyed squid and fish baits on Japanese longline research vessels targeting Southern Ocean bluefin tuna showed that blue-dyed fish bait was effective in reducing albatross interactions at levels similar to blue-dyed squid bait, although blue-dyed bait also reduced target catch in this study (Ochi et al. 2011). Ochi and colleagues (2011) speculated that the blue-dyed fish bait effectiveness may vary by seabird species, as their study focused on interaction rates with albatrosses and petrels rather than shearwaters.

In addition to the study by Cocking and colleagues (2008) that suggested shearwater habituation to blue-dyed fish bait, a study conducted in New Zealand also suggests that seabirds are able to detect blue-dyed bait but may not pursue them due to preference for non-dyed bait over dyed bait (Lydon and Starr 2005). In the New Zealand study where albatrosses, petrels and shearwaters were observed, seabird behavior appeared to change when blue-dyed bait was deployed after non-dyed control bait. Whereas seabirds actively pursued and fought over non-dyed bait, seabird behavior in six of the seven observed sets during the trial changed to making only brief landings on the surface and fewer seabirds present. However, in the final set during the trial, seabirds actively attacked the blue-dyed bait, even though setting conditions (e.g., time of day, water color, cloud cover) remained similar to the first six sets and thus contrast between dyed bait and the water would have been similar. Blue-dyed bait remained visible to the human eye in various sea conditions, thus Lydon and Starr (2005) concluded that seabirds preferred controlled bait over blue-dyed when given a choice, and that the lack of interest was not likely due to detection failure. Behavior observed in the New Zealand study is supported by available information on avian eyesight and color vision, which indicate that avian eyes are more morphologically complex than for mammals.

Early studies primarily testing blue-dyed squid bait in the Hawaii longline fishery showed that albatrosses showed little interest in dyed bait compared to non-dyed bait. It is unknown whether albatross behavior toward blue-dyed fish bait in the Hawaii fishery has changed over time.

Strategic Offal Discards

Hawaii DSLL vessels, when stern-setting, are required to discharge fish, fish parts, or spent bait while setting or hauling, on the opposite side of the vessel from where the longline gear is being set or hauled, when seabirds are present. Vessels are also required to retain sufficient quantities of offal and spent bait between setting operations, and cut swordfish heads in half for the purpose of strategic offal discharge. The regulations do not specify the amount or frequency of offal discharge, thus a small amount of offal or bait discarded during setting or hauling would meet the requirement. Additionally, as described in McNamara et al. (1999), effective use of strategic offal discard would require a dedicated crew to observe seabirds and discharge offal accordingly. This measure therefore creates compliance and enforcement challenges, and it is likely that the strategic offal discard is not being utilized in a manner that is effective.

The use of strategic discards in the Hawaii fishery was a practice that started with SSLL vessels by using halved swordfish heads to attract seabirds away from fishing gear and bait. The large swordfish heads provide a large floating attractant that stayed afloat until seabirds were well astern of the vessel and less likely to resume pursuit of the baited hooks. The measure also requires vessels to retain offal and spent bait during hauling operations so that discharge material is available during setting operations, which create practicality and safety issues for crew. A controlled experiment conducted in the Hawaii longline fishery found that strategic offal discharge during setting operations was effective in reducing seabird attempts and contacts (tested on swordfish-targeting vessels only), whereas retention of offal during hauling operations resulted in higher seabird attempts and contacts than if offal was discarded (McNamara et al. 1999).

Discharging offal from processed catch, spent bait and dead discards away from setting and hauling operations may draw scavenging seabirds' attention away from where baited hooks are available and reduce seabird catch rates during that fishing operation, as demonstrated in some studies in pelagic and demersal longline fisheries (Cherel et al., 1996; McNamara et al., 1999). However, this might be a short-term effect. Based on research conducted in trawl fisheries, increased time between offal discharge events and retention of offal reduces the number of seabirds attending vessels (Abraham et al., 2009; Pierre et al., 2010, 2012). The lower the seabird density attending vessels, the lower the seabird catch risk (Gilman et al., 2005; Abraham et al., 2009). Retention might also reduce competitive seabird scavenging behavior and foraging intensity, reducing capture risk (Delord et al., 2005; Gilman et al., 2016).

Hawaii longline fishery may be unique in requiring 'strategic' offal discharge during setting or hauling as the only option for managing offal discharge. The seabird measures of the two Pacific Ocean tuna RFMOs define 'management of offal discharge' as either (a) not discharging offal during setting or hauling, or (b) discharging offal only from the opposite side of the vessel from where setting or hauling is occurring (IATTC, 2012; WCPFC, 2018) and we are not aware of domestic fisheries management systems that implement option b other than in the Hawaii longline fisheries. The Agreement on the Conservation of Albatrosses and Petrels (ACAP) discourages discharge during line setting, and recommends retention or strategic discharge during hauling (from opposite side of the vessel from where hauling operation is taking place) (ACAP, 2019). The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) (2018) prohibits offal and discard discharging during setting in longline fisheries, consistent with the ACAP recommendations.

3.6 Seabird Mitigation Measures under the Regional Fishery Management Organizations

The Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) have adopted measures to mitigate seabird bycatch in longline fisheries. Both commissions have adopted a "menu approach" whereby vessels may choose measures from two columns, and in the North Pacific, both commissions require measures to be applied north of 23°N.

WCPFC's Conservation and Management Measure (CMM) 2018-03 have separate requirements by the overall length of vessels. Vessels equal to or greater than 24 meters are required to use at least two mitigation methods from Table 2, with at least one from column A, and vessels that are less than 24 m in length are required to use at least one mitigation method from column A in Table 2. IATTC's Resolution C-11-02 applies to longline vessels greater than 20 m in overall length. The resolution requires longline vessels to use at least two mitigation methods listed in Table 3, with at least one coming from column A, but not using the same measure from Column A and Column B.

Table 2. Seabird Mitigation Measure Table in WCPFC CMM 2018-03.

Column A	Column B
Side setting with a bird curtain and weighted branch lines[1]	Tori line[2]
Night setting	Blue-dyed bait
Tori line	Deep setting line shooter
Weighted branch lines	Management of offal discharge
Hook-shielding devices[3]	

[1] If using side setting with a bird curtain and weighted branch lines from Column A, this will be counted as two mitigation measures
[2] If a tori line is selected from both Column A and Column B, this equates to simultaneously using two (i.e. paired) tori lines.
[3] Hook-shielding devices can be used as a stand-alone measure.

Table 3. Seabird Mitigation Measure Table in IATTC Resolution C-11-02.

Column A	Column B
Side-setting with bird curtains and weighted branch lines[1]	Tori line[2]
Night setting with minimum deck lighting	Weighted branch lines
Tori line	Blue-dyed bait
Weighted branch lines	Deep-setting line shooter
	Underwater setting chute
	Management of offal discharge

[1] This measure can only be applied in the area north of 23° N until research establishes the utility of this measure in waters south of 30° S. If using side setting with a bird curtain and weighted branch lines from Column A, this will be counted as two mitigation measures.
[2] If a tori line is selected from both Column A and Column B, this equates to simultaneously using two (i.e. paired) tori lines.

4 OPTIONS

This section describes the range of options for Council consideration at its 187th Meeting for a regulatory amendment to allow the use of tori lines in lieu of blue-dyed bait and removing the strategic offal discharge requirement in the DSLL fishery.

Changes to seabird mitigation measures in the SSLL fishery are not considered at this time, based on the Council's recommendation at the 185th Meeting to prioritize additional research and development of appropriate measures for the shallow-set fishery, with high priority placed on identifying combination of mitigation measures that maintain effectiveness of seabird deterrence during dusk compared to the existing night-setting suite of measures, to provide operational flexibility in starting the setting operations before sunset. For other options eliminated based on earlier Council discussion, see Section 2.

4.1 Option 1: Status Quo/No Action – Continue managing the Hawaii deep-set longline fishery under existing seabird interaction mitigation measures

Under the No Action option, the Council would not recommend changes to management measures intended to mitigate seabird interactions in the DSLL fishery. All existing measures to mitigate interactions with seabirds, including blue-dyed bait and strategic offal discards would be maintained.

Expected Fishery Outcomes

Under Option 1, DSLL fishery participants would continue to be managed under the existing seabird mitigation measures under the Pelagic FEP, and would be required to use blue-dyed bait and strategic offal discards when stern-setting north of 23°N. The blue-dyed bait measure is known to be less effective than the alternative side-setting measure (Gilman et al. 2016), whereas most DSLL currently use blue-dyed bait instead of side-setting (82.1% of observed DSLL vessels in 2019; NMFS 2021). Additionally, offal discharge may be contributing to long-term increase in albatross interactions in the DSLL fishery by attracting more birds attending the vessels. Therefore under Option 1, BFAL and LAAL albatross interactions would be expected to remain at the higher levels observed since 2015 if no changes are made to improve the effectiveness of the required mitigation measures.

If vessel operators in the DSLL fishery prefer to use tori lines as a seabird mitigation measure, they would need to use it in addition to the existing suite of required measures. While some vessels may voluntarily add another mitigation measure, tori line is not likely to be widely adopted in the fleet without additional incentives. Additionally, voluntary adoption of tori lines by DSLL vessels would lack the implementation of minimum standards, and effectiveness of tori lines would likely vary significantly between vessels.

Table 4. Comparison of pros and cons of option 1.

Pros	Cons
• Fishermen are familiar with the existing suite of measures	• DSLL fishery participants would continue to be required to use blue-dyed bait when stern-setting north of 23°N for DSLL vessels • Albatross interactions would be expected to remain at elevated levels observed since 2015 • Tori lines would need to be used in conjunction with all existing required measures, including blue-dyed bait, if fishermen wish to voluntarily use tori lines • Wide adoption of tori line among the fleet not likely without additional incentives • Lack of tori line minimum standards would result in varying level of effectiveness

4.2 Option 2: Allow use of tori lines in the Hawaii deep-set longline fishery as a third option

Under Option 2, the Council would create a third suite of seabird mitigation measures in addition to the existing side-setting and blue-dyed bait suite of measures for the DSLL fishery. Under the new third suite, vessels may replace the use of blue-dyed bait with tori lines, but would otherwise be required to follow the same set of requirements as the existing blue-dyed bait suite of measures (i.e., weighted branch lines, line shooter, and strategic offal discards when seabirds are present). The Council may separately consider modification of the strategic offal discard requirement under Option 4. No other changes would be made to the existing side-setting or blue-dyed bait suite of measures.

As part of Option 2, the Council would specify minimum specifications for tori lines. The Council at the 186th Meeting in June 2021 reviewed the draft regulatory specifications and concurred with the approach of focusing the regulatory requirements on tori line length, attachment point height, and streamer design, and having additional design and safety recommendations as non-regulatory guidelines. The draft specifications as presented at the June 2021 meeting are included in Appendix A. The Council will review the final draft specifications at the time of final action.

Table 5. DSLL seabird mitigation measures under option 2.

When side-setting north of 23°N, also use:	When stern-setting north of 23°N, use:	
Bird curtain >45g weight within 1m of hook	Blue-dyed bait (thawed) >45g weight within 1m of hooks Line shooter Strategic offal discards (when seabirds present)*	**Tori line** >45g weight within 1m of hooks Line shooter Strategic offal discards (when seabirds present)*

* The Council may consider modifications to the strategic offal discards requirement under Option 4.

Expected Fishery Outcomes

Under Option 2, some, but an unknown proportion of stern-setting DSLL vessels are expected to switch to the new tori line suite of measures. This option 2 would provide flexibility for vessels interested in trying out tori lines to switch from blue-dyed bait to tori lines, while allowing other vessels to continue using blue-dyed bait. While many DSLL fishery participants have expressed interest in using tori lines in lieu of blue-dyed bait, citing the operational burdens of using blue dye (Ayers and Leong 2020), some participants are expected to continue using the measure due to its familiarity and perceived uncertainty associated with a new measure.

The degree to which this option would reduce albatross interactions is dependent on the proportion of vessels that convert from blue-dyed bait to tori lines. Most vessels that side-set are expected to continue using that measure, because those captains are likely to be using that method by preference and consider it to be practical and safe for their fishing operation and vessel configuration (Gilman and Ishizaki 2018). For those vessels that choose tori lines over

blue-dyed bait, albatross interactions are expected to be significantly reduced. Specifically, the 2021 study showed that albatross contact with bait when tori line is used was 4 times less likely than when blue-dyed bait is used, and captures may be reduced as much as 14 times (Chaloupka et al. in prep.).

This option would also allow collection of operational data to further evaluate efficacy of the existing side-setting and blue-dyed bait measures against the tori line measure, if some vessels continue to use blue-dyed bait.

Table 6. Comparison of pros and cons of option 2.

Pros	Cons
• Provides fishery participants with flexibility for trying out tori lines in place of blue-dyed bait • Allow collection of operational data to evaluate efficacy of side-setting, blue-dyed bait, and tori line measures • Provides fishery participants with the option to use tori lines without blue-dyed bait • Albatross interactions expected to be reduced for those vessels that convert to tori lines	• Some vessels likely to continue using blue-dyed bait, which is likely to be less effective than tori lines

4.3 Option 3: Replace blue-dyed bait with tori line in the required measures for the Hawaii deep-set longline fishery

Under Option 3, the Council would replace blue-dyed bait with tori lines in the existing suite of blue-dyed bait measure for the DSLL fishery, and thus vessels would be required to choose between the side-setting and tori line suite of options when seabird measures are applicable. Under the tori line suite, vessels would also be required to use weighted branchlines, line shooter, and strategic offal discards when seabirds are present. The Council may separately consider modification of the strategic offal discard requirement under Option 4. No changes would be made to the existing side-setting measure.

As part of Option 3, the Council would specify minimum specifications for tori lines. The Council at the 186th Meeting in June 2021 reviewed the draft regulatory specifications and concurred with the approach of focusing the regulatory requirements on tori line length, attachment point height, and streamer design, and having additional design and safety recommendations as non-regulatory guidelines. The draft specifications as presented at the June 2021 meeting are included in Appendix A. The Council will review specifications again at the time of final action.

Table 7. DSLL seabird mitigation measures under option 3.

When side-setting north of 23°N, also use:	When stern-setting north of 23°N, use:
Bird curtain >45g weight within 1m of hook	**Tori line** >45g weight within 1m of hooks Line shooter Strategic offal discards (when seabirds present)*

* The Council may consider modifications to the strategic offal discards requirement under Option 4.

Expected Fishery Outcomes

Under Option 3, vessels that currently use blue-dyed bait would be required to switch to tori lines or to side-setting. This option is expected to have a greater effect in reducing seabird interactions in the fleet compared to Option 2, as the less effective blue-dyed bait would be removed from the required suite of measures. Albatross interactions are expected to be significantly reduced on vessels that convert to tori lines from blue-dyed bait. Specifically, the 2021 study showed that albatross contact with bait when tori line is used was 4 times less likely than when blue-dyed bait is used, and captures may be reduced as much as 14 times (Chaloupka et al. in prep.).

Table 8. Comparison of pros and cons of option 3.

Pros	Cons
• Allows fishery participants to use tori lines without blue-dyed bait • Blue-dyed bait would be replaced with a more effective mitigation measure • Albatross interactions expected to be reduced for stern-setting vessels	• Does not provide opportunity to collect operational data to evaluate effectiveness of blue-dyed bait against tori lines under broader commercial application • Does not provide flexibility for vessels that prefer to use blue-dyed bait over tori lines

4.4 Option 4: Modify strategic offal discard requirement in the Hawaii deep-set longline fishery

Under Option 4, the Council would modify the strategic offal discard requirement in conjunction with including tori lines as part of the seabird mitigation measures under Options 2–3. The Council may consider the following modifications in the Hawaii DSLL fishery:

a) ***Remove the requirement for strategic offal discards:*** This modification would remove the regulatory requirement for strategic offal discards, and would not specify when and how offal should be discarded during setting or hauling operations. Fishermen would have the option to utilize strategic offal discard as a voluntary measure in addition to the required measure.

b) ***Prohibit offal discard during setting and daytime hours, and allow offal discard only at night and from the opposite side of the vessel from where the gear is being hauled***: This

modification would prohibit offal discard during daylight hours when seabirds are most actively foraging, and specify that offal should be discarded strategically during the night-time hauling operations.

Expected Fishery Outcomes

As described in Section 3.5, available information suggest that the strategic offal discard requirement (i.e., discharging fish, fish parts, or spent bait while setting or hauling, on the opposite side of the vessel from where the longline gear is being set or hauled, when seabirds are present) may distract seabirds from the baited hooks in the short-term, but may increase interactions in the long-term due to increase in seabirds attending to the vessel over time.

Hawaii DSLL vessels that stern-set are required to use strategic offal discard as part of the mitigation measures when seabirds are present. The regulations do not specify the amount or frequency of offal discharge, thus a small amount of offal or bait discarded during setting or hauling would meet the requirement. Additionally, as described in McNamara et al. (1999), effective use of strategic offal discard would require a dedicated crew to observe seabirds and discharge offal accordingly, and it is likely that this measure is not being utilized in a manner that is effective. Compliance monitoring for strategic offal discard relies on observer reports, which has created significant administrative burden for the Pacific Islands Regional Observer Program in reviewing observer data on the measure and reporting it to NOAA Office of Law Enforcement.

The Hawaii DSLL fishery conducts setting operations during daylight hours, and hauling operations during nighttime hours. Hauling operations are typically completed before sunrise, although infrequently some fish processing may be continuing around sunrise. Offal and spent bait are generated throughout the hauling operation as the gear is retrieved and retained catch are gilled and gutted prior to being packed in ice in the fish hold. Most seabird interactions in the DSLL fishery occur during the daytime setting operations.

The extent to which the strategic offal discard requirement aids or detracts from other existing Hawaii DSLL seabird mitigation measures have not been quantified. The results of the 2019-2020 Cooperative Research Project showed that seabird attempts and contacts were more likely to occur when offal discharge was used during the set; however, the results were inconclusive due the strategic offal discharge procedure not being standardized during the field trials and the potential that crew utilized strategic offal discharge when attacks and contacts were actively observed. The results from the 2021 EFP study, which instructed crew not to discard any offal during the setting operations, showed that tori lines significantly reduced interactions compared to blue-dyed bait. These results suggest that strategic offal discards is not necessary to reduce interactions with seabirds.

The outcomes would be different depending on the modification that the Council selects:

a) ***Remove the requirement for strategic offal discards***

In the absence of a strategic offal discard requirement, offal and spent bait would likely be discarded as they are generated during the hauling operation, and little to no discards would occur during the setting operation. The removal of this regulatory requirement is not likely to have a significant short-term effect on seabird interaction rates in the Hawaii DSLL fishery, because this existing strategic offal discard measure is not likely being implemented in an effective manner under the status quo. Where offal discard is occurring during the setting operation, available information suggest that this practice is likely to attract more seabirds around the fishing vessel, and thus the absence of offal discard during setting operation may reduce seabird attraction to vessels.

This modification would remove the burden for fishermen to retain offal from the hauling operation to discard during setting when seabirds are present, as well as the data collection and administrative burden by the Pacific Islands Regional Observer Program in reviewing the offal discard data and reporting it to NOAA Office of Law Enforcement.

The DSLL fishery would remain in compliance with WCPFC and IATTC seabird conservation measures even without the strategic offal discard requirement, because at least two other primary mitigation measures (i.e., side-setting and weighted branch lines; blue-dyed bait and weighted branch lines; or tori lines and weighted branch lines) would continue to be required under Options 2 or 3.

b) ***Prohibit offal discard during setting and daytime hours, and allow offal discard only at night and from the opposite side of the vessel from where the gear is being hauled:***

This modification would require offal discard to occur in a manner similar to what DSLL fishermen would do in the absence of a strategic offal discard requirement. Under this modification, fishermen would not be allowed to use strategic offal discard as an optional measure during setting operations. If some offal and spent bait are generated during the hauling operation after sunrise, fishermen would be required to retain them until the next hauling operation, unless additional exemptions are considered for daytime discards when seabirds are not present. The offal discard practice under this option would likely be similar to option A above, because instances of fishermen using strategic offal discard as a voluntary measure during setting operations and instances of offal being generated after sunrise are both expected to be rare.

This modification would continue to place data collection and administrative burden on the Pacific Islands Regional Observer Program in reviewing the offal discard data and reporting it to NOAA Office of Law Enforcement.

5 COUNCIL ACTION

At its 187th Meeting in September 2021, the Council will consider initial action on the regulatory amendment to allow the use of tori lines in lieu of blue-dyed bait and removing the strategic offal discharge requirement in the DSLL fishery. The Council may recommend a preliminary preferred option for further analysis, recommend further development of the range of options, recommend inclusion of additional options, or recommend no action be taken at this time. The Council may also provide further direction for analysis to prepare the regulatory amendment for final action at the December 2021 Meeting or another future meeting.

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APPENDIX A

Developing Draft Tori Line Specifications for the Hawaii Deep-set Longline Fishery

Prepared for the 186th Council Meeting

Appendix A

WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Developing Draft Tori Line Specifications for the Hawaii Deep-set Longline Fishery

186th Council Meeting
June 23-25, 2021
Web Conference

May 27, 2021

1. Overview

The Council is expected to take action on a regulatory amendment to modify seabird mitigation measures for the Hawaii deep-set longline fishery later in 2021, after the results of an ongoing Experimental Fishing Permit (EFP) study becomes available. As an interim step, the Council at its 184th meeting in December 2020 directed staff to work with the Action Team to develop draft regulatory specifications for tori lines in the Hawaii deep-set longline fishery for Council review.

This document presents draft preliminary specifications for tori lines in the deep-set fishery, as well as associated considerations and non-regulatory design guidance for Council discussion at the 186th meeting. The Council may consider further direction and considerations for refining these draft specifications, taking into consideration any advisory body recommendations. Revised specifications will be presented to the Council at the time of the Council action to modify the seabird mitigation measures.

2. Development of a Tori Line Design Suitable for the Hawaii Deep-set Longline Fishery

In 2019-2020, a joint cooperative research project by the Council, Hawaii Longline Association (HLA), NMFS Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO) was implemented to conduct 1) demonstration and trial of tori lines in the DSLL fishery to inform minimum standards specific to this fishery, 2) field trials of tori lines to collect data on operational practicality and seabird mitigation effectiveness in using tori lines under commercial fishing operations in the DSLL fishery. The results from the study indicate that tori lines are effective in reducing albatross contacts and attempts on baited hooks when used in conjunction with existing seabird bycatch mitigation measures in the DSLL. Specifically, the results indicate that albatrosses contacts are about 3 times less likely, and attempts about 2 times less likely when tori lines are used (Gilman et al. 2021a, 2021b).

During the initial phase of the cooperative research project, the project team developed a tori line design suitable for the Hawaii deep-set longline fishery based on industry input, expert advice, existing international standards and guidelines for tori lines, land trials, and sea trials. The final design selected for field trials under commercial fishing operations was a short streamer design with a 50 meter aerial extent using a light material (dyneema) backbone and 55 meter drag section (Figure 1, Figure 2). The short streamer design was selected due to their ease of deployment and retrieval, and having sufficient amount of streamers to deter seabirds from sinking baited hooks. The 50 meter aerial extent provides sufficient distance to cover the area

with sinking baited hooks in the DSLL (approximately 40 m from vessel stern), and allowed the design to meet existing tori line specifications for the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC).

The tori line design developed during the cooperative research project received overall positive feedback from participating captains and crew. The 2019-2020 cooperative research project final report (Gilman et al. 2021a) contains recommendations on considerations for tori line minimum standards, which will assist with the development of the regulatory specifications. The recommendations from the final report are excerpted in Appendix A. The full report is available online at: http://www.wpcouncil.org/wp-content/uploads/2021/02/Hawaii-DSLL-Tori-Line-Cooperative-Research-Report_January2021_FINAL-C.pdf

The same design is being used in the ongoing 2021 EFP study to test tori line efficacy in the deep-set fishery without the use of blue-dyed bait, which is expected to complete field trials by the end of June. No additional design changes were made for the EFP study, with the exception of modifying the material used for the tori line attachment to the pole. The ongoing EFP study is gathering additional feedback on the design from participants, and the design continues to receive positive feedback from fishermen.

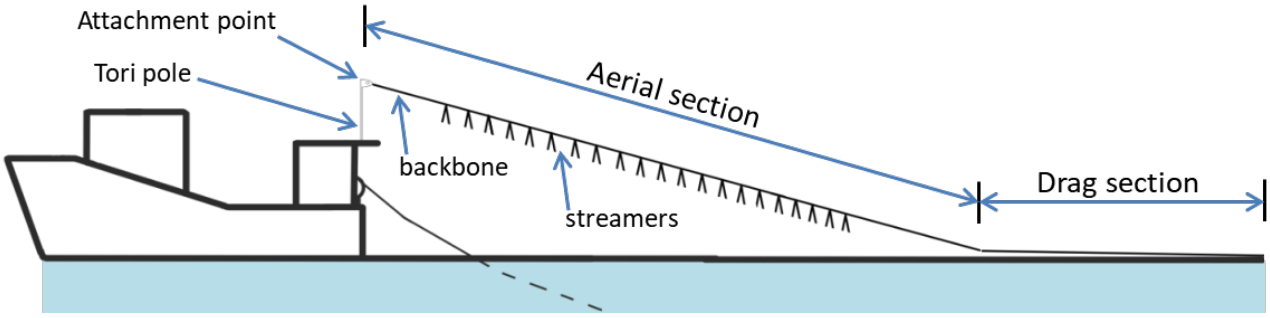

Figure 1. Components of a tori line.

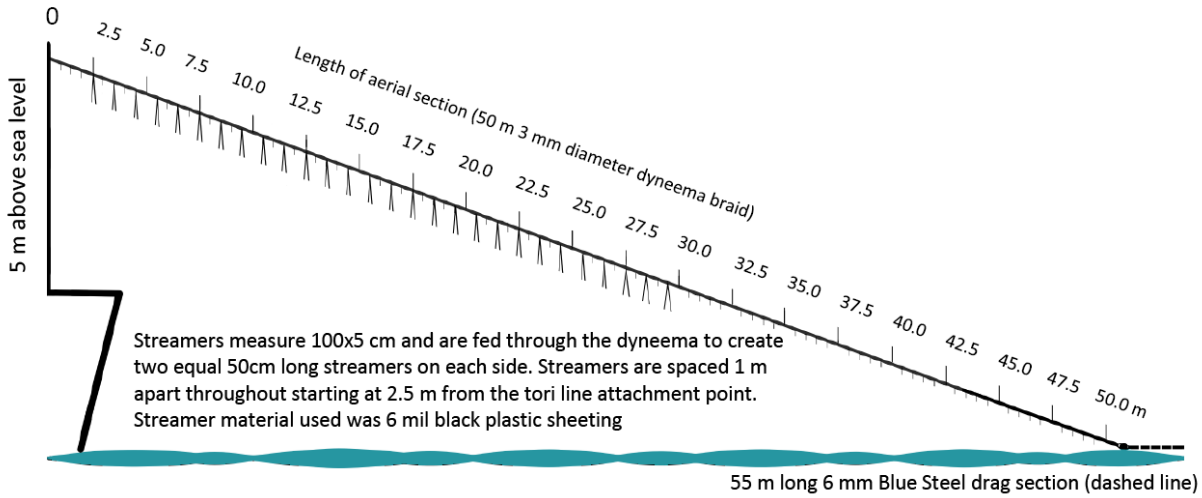

Figure 2. Schematic diagram showing the tori line design developed in the 2019-2020 cooperative research project (source: Gilman et al. 2021).

3. Preliminary Draft Regulatory Specifications and Additional Design Guidance

Below are preliminary draft regulatory specifications for tori lines for use in the Hawaii deep-set longline fishery for Council discussion at the 186th meeting. The tori line regulatory specifications may be complemented with additional non-regulatory design guidance, and these are also described below. Figure 1 shows the main components of a tori line.

This draft focuses on the design aspects of tori lines based on lessons learned from trials conducted in the Hawaii fishery. Details on the deployment and concurrent mitigation measures will be considered as part of the regulatory amendment to be developed for a future Council meeting.

Draft Regulatory Specifications

Regulatory specifications for tori lines should focus on the following aspects:

1) Minimum standards for tori line length and height of attachment point to achieve an aerial extent that covers a distance astern where baited hooks are available to seabirds; and
2) Minimum standards for the length and spacing of streamers.

General considerations for tori line regulatory specifications include the following:

- Regulatory specifications for the Hawaii deep-set longline fishery should be consistent with WCPFC and IATTC specifications as much as possible. However, at present, deep-set vessels would meet the seabird mitigation measure requirements without tori lines because all vessels use weighted branch lines and deep-setting line shooters. Any inconsistencies between the Hawaii deep-set longline fishery specifications and WCPFC/IATTC may be considered for future updates to the international specifications.
- Compliance monitoring for tori lines will likely include dock-side inspections, and thus the specifications should allow for measurements without having to deploy the tori line at setting speed.

Based on the above considerations and the findings from recent tori line trials in the Hawaii deep-set longline fishery, the **following is a preliminary list of regulatory specifications**. Additional considerations for each item are described in **Table 1**.

- **Tori line length**
  - **The tori line must have a minimum aerial section length of [40m *or* 50m], *AND***
    - **A minimum drag length of [TBD], *OR***
    - **A minimum total length of three times the total length of the vessel**
- **Attachment point height**
  - **Tori line should be attached to the vessel at a point a minimum of 5m above the water if attachment point is within 2m of vessel stern. If the attachment point is more than 2m from the stern, the attachment point height should be increased by 0.5m for every 5m distance from the stern.**
- **Streamers**
  - **Streamers must be 30cm minimum length and must be less than 1m apart; *AND***
  - **Streamers not required for the last 20m of aerial section [*or shorter if specifying 40m minimum aerial section length*] to minimize entanglements with buoys and fishing gear**

Table 1. Preliminary draft regulatory specifications and associated considerations for tori lines in the Hawaii deep-set longline fishery.

Tori line length	
Preliminary draft specifications: The tori line must have a minimum aerial section length of [40m *or* 50m], ***AND*** ▪ A minimum drag length of [TBD], ***OR*** ▪ A minimum total length of three times the total length of the vessel	***Considerations for the aerial section length:*** • 50m aerial section being used in the ongoing trials, provides ample coverage over the sinking hooks, and minimizes entanglement risk with fishing gear (98.6% of seabird attempts and contacts observed within 50m) • 40m covers the theoretical distance astern (94.6% of seabird attempts and contacts observed within 40m) ***Considerations for specifying drag or total length:*** • Specifying minimum drag length does not necessarily equate to an effective design that would keep the aerial section above water, because necessary drag length is design-specific and depends on the aerial section design and material • Specifying total minimum length would provide consistency with IATTC tori line specifications for short streamer designs (applies only to vessels >20m in length; total minimum length must be 100m or 3x the total length of vessel); WCPFC does not specify length for short streamer designs
Attachment point height	
Preliminary draft specifications: Tori line should be attached to the vessel at a point a minimum of 5m above the water if attachment point is within 2m of vessel stern. If the attachment point is more than 2m from the stern, the attachment point height should be increased by 0.5m for every 5m distance from the stern	***Considerations:*** • Consistent with WCPFC and IATTC (5m above water at the stern) • WCPFC and IATTC specifications also specifies placement of the attachment point on the "windward side of a point where the hookline enters the water". In the Hawaii trials, this was found to be impractical, and the attachment point was placed on the side of the vessel where baited hooks are deployed. Due to the difficulty in enforcing this aspect, this type of specification would be more appropriate for the design guidance (see next section). • The additional distance and height combination would facilitate dock-side inspection.
Streamers	
Preliminary draft specifications: Streamers must be 30cm minimum length and must be less than 1m apart; ***AND*** Streamers not required for the last 20m of aerial section [*or shorter if specifying 40m aerial section length*] to minimize entanglements with buoys and fishing gear	***Considerations:*** • Streamer length and spacing would be consistent with WCPFC and IATTC • WCPFC and IATTC specifications to not indicate whether streamers need to be attached for the full extent of the aerial section. The design created for the Hawaii trials did not place streamers in the last 20m of the aerial section where the backbone approaches the water surface and streamers may create entanglement risk (safety consideration).

Draft Design Guidance (Non-Regulatory)

In addition to the regulatory specifications described above, non-regulatory design guidance would help to standardize the tori line designs used in the Hawaii deep-set longline fishery, ensure the designs are effective in mitigating seabird interactions, and are practical and safe for the fishermen. These details are more appropriate as non-regulatory guidance so that they may be updated with lessons learned from fishermen's experiences while providing flexibility for fishermen to build their own tori lines.

The following draft design guidance is based largely on the recommendations contained in the 2019-2020 cooperative research project final report (Appendix A; Gilman et al. 2021a).

- **Include guidance on recommended materials for the tori line components, such as the following:**
  - **Aerial section:**
    - Use material that is light-weight, does not absorb water, does not hold energy, and does not tangle easily.
    - Ultra high molecular weight polyethylene, known as dyneema or spectra, is recommended based on trials conducted in the Hawaii deep-set longline fishery, but other similar materials may be available or become available in the future.
    - Monofilament material should not be utilized for the aerial section due to sagging concerns thereby reducing aerial coverage, nor should monofilament be used for drag sections as substantially more material is needed to create the amount of necessary drag.
  - **Drag section:**
    - Use braided material that does not tangle easily, does not absorb water, material that floats
    - Have a design that minimizes chances of tangles (e.g., rope only)
  - **Tori poles:**
    - Made of solid material that do not flex (marine grade stainless steel is recommended for safety and durability purposes).
    - Fiberglass poles should not be utilized.
    - Alternatively, tori lines can be attached to a sturdy fixed point on the vessel.
- **Attachment point for the tori line should be located on the side of the vessel where baited hooks are deployed** [*NOTE: this guidance differs from WCPFC/IATTC, which specifies placement on "windward side"; experience from recent trials in the Hawaii fishery indicate that placement on the side where baited hooks are deployed is sufficient for ensuring necessary tori line placement*]
- **Alternative streamer designs** (adding long streamers)
  - Adding longer streamers to the aerial section of the tori line close to the vessel stern may increase the seabird deterrence efficacy of the tori line.
  - If adding long streamers to an existing short streamer design tori line, the drag section should be extended to ensure the aerial section will remain above water.
- **Design guidance for breakaway mechanism and safety line** (for crew safety)

4. References

Gilman, E., Naholowaa, H.A., Ishizaki, A., Chaloupka, M., Brady, C., Carnes, M., Ellgen, S., Wang, J., Kingma, E. 2021a. Practicality and Efficacy of Tori Lines to Mitigate Albatross Interactions in the Hawaii Deep-set Longline Fishery. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii, 48pp.

Gilman, E., Chaloupka, M., Ishizaki, A., Carnes, M., Naholowaa, H., Brady, C., Ellgen, S. and Kingma, E.. 2021b. Tori lines mitigate seabird bycatch in a pelagic longline fishery. *Reviews in Fish Biology and Fisheries*, pp.1-14.

Appendix A: Excerpt from the 2019-2020 Cooperative Research Project Final Report on Recommendations on Considerations for Tori Line Minimum Standards

Excerpt from: Gilman, E., Naholowaa, H.A., Ishizaki, A., Chaloupka, M., Brady, C., Carnes, M., Ellgen, S., Wang, J., Kingma, E. 2021. Practicality and Efficacy of Tori Lines to Mitigate Albatross Interactions in the Hawaii Deep-set Longline Fishery. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii, 48pp.

4. RECOMMENDATIONS FOR TORI LINE MINIMUM STANDARDS FOR THE HAWAII DEEP-SET LONGLINE FISHERY

Tori line designs tested in Phases 1 and 2 of this project were based on experiences in similar fisheries (Katsumata et al. 2015, 2015, 2018, and 2019; Goad 2017; Pierre et al. 2016; Sato et al. 2012; Melvin et al. 2013), expert advice, and existing international standards and guidelines. The short streamer design with 50 m aerial section selected for Phase 2 meets existing specifications under the two RFMOs applicable to the Hawaii deep-set longline fishery, the WCPFC and IATTC (Table 1).

Under the current WCPFC measure (WCPFC, 2018), when fishing north of 23° N., vessels of all sizes can use a long streamer tori line design that meets the following specifications:

- Minimum length: 100 m
- Must be attached to the vessel such that it is suspended from a point a minimum of 5m above the water at the stern on the windward side of the point where the hookline enters the water
- Must be attached so that the aerial extent is maintained over the sinking baited hooks
- Streamers must be less than 5m apart, be using swivels and long enough so that they are as close to the water as possible
- If two (i.e. paired) tori lines are used, the two lines must be deployed on opposing sides of the main line [sic]

Otherwise, vessels can opt to use a short streamer tori line design. For vessels ≥ 24 m total length, the short streamer design specifications are:

- Must be attached to the vessel such that it is suspended from a point a minimum of 5m above the water at the stern on the windward side of a point where the hookline enters the water
- Must be attached so that the aerial extent is maintained over the sinking baited hooks
- Streamers must be less than 1m apart and be 30 cm minimum length
- If two (i.e., paired) tori lines are used, the two lines must be deployed on opposing sides of the main line

And for vessels < 24 m total length, the short streamer design specifications are:

- Must be attached to the vessel such that it is suspended from a point a minimum of 5m above the water at the stern on the windward side of a point where the hookline enters the water
- Must be attached so that the aerial extent is maintained over the sinking baited hooks

- If streamers are used, it is encouraged to use the streamers designed to be less than 1m apart and be 30cm minimum length
- If two (i.e., paired) tori lines are used, the two lines must be deployed on opposing sides of the mainline.

Under the current IATTC measure (IATTC, 2011), when fishing north of 23° N., plus the area bounded by the coastline at 2°N, west to 20°N-95°W, south to 15°S-95°W, east to 15°S-85°W, vessels ≤ 20 m length overall are not required to employ seabird bycatch mitigation measures. Vessels > 20 m length overall can use tori line design that meets all of the WCPFC long streamer design, plus one additional specification of: "If the tori line is less than 150 m in length, must have a towed object attached to the end so that the aerial extent is maintained over the sinking baited hooks." Otherwise, vessels > 20 m length overall can use a 'light streamer' tori line design with the following specifications:

- Minimum length of tori line: 100 m or three times the total length of the vessel
- Must be attached to the vessel such that it is suspended from a point a minimum of 5 m above the water at the stern on the windward side of a point where the hookline enters the water
- Must be attached so that the aerial extent is maintained over the sinking baited hooks
- Streamers must be less than 1m apart and be 30 cm in minimum length
- If two (i.e. paired) tori lines are used, the two lines must be deployed on opposing sides of the main line

Table 1. Tori line standards when fishing north of 23° N under seabird measures of IATTC (2012) and WCPFC (2018).

	WCPFC			**IATTC**	
	Long Streamer	**Short Streamer (large vessels)**	**Short Streamer (small vessels)**	**Long Streamer**	**Light Streamer**
Required	No	No	No	No	No
Vessel size	Any size	≥24 m	<24 m	>20 m	>20 m
Minimum length	100 m	n/a	n/a	100 m	100 m or 3x the total length of the vessel
Attachment point	5 m above water at stern on windward side of where hookline enters water			5 m above water at stern on windward side of where hookline enters water	
Min Aerial Extent	Over sinking baited hooks			Over sinking baited hooks	
Streamer length	Long enough to be as close to the water as possible	30 cm minimum length	Optional: if used, 30 cm minimum length encouraged	Long enough to be as close to the water as possible	30 cm minimum length
Minimum Streamer Distance	< 5 m apart	< 1 m apart	Optional: if used, <1 m apart encouraged	< 5 m apart	< 1 m apart
Towed Object Required	No	No	No	If tori line is <150 m in length	No
Two tori lines	Optional: If used, must be deployed on opposing sides of mainline			Optional: If used, must be deployed on opposing sides of mainline	
Swivels required	Yes	No	No	Yes	No

Minimum tori line standards for the Hawaii deep-set fishery would need to be consistent with the two RFMO measures if tori line is used as one of the measures to meet international compliance. See WPRFMC (2019), *Considerations for Developing Draft Minimum Standards for Tori Lines in the Hawaii Longline Fishery*, for summaries of tori line measures of other tuna RFMOs, the CCAMLR (for demersal longline), national measures, and the Agreement on the Conservation of Albatrosses and Petrels. Additional considerations of relevance to the Hawaii longline fisheries are discussed in WPRFMC (2019). A subset of these previously identified considerations that could inform Hawaii tori line specifications based on this project's experiences are described here.

Tori Line Length

The tori line should have an aerial extent that covers a distance astern where baited hooks are accessible to Laysan and black-footed albatrosses. A theoretical estimate of this distance for the deep-set fishery is 28 m astern (see Section 3.3.3 for details). Observations from the EM analyst during the Phase 2 experiment were that: (a) the 50 m aerial section (which translates into 49.7 m of horizontal distance covered when the tori line is attached at 5 m height at vessel stern) covered 99.7% of the observed distances astern of attempts and contacts by Laysan and black-footed albatrosses; and (b) over half of seabird interactions occurred within 10 m of the stern. With only 0.3% of interactions occurring beyond 50 m of the vessel stern, there would be limited conservation gain from tori lines with aerial coverage longer than the design used in the experiment.

The total length of the tori line is a function of the aerial section length and design, which in turn determine the length of the drag section (see Section 2). Specifying minimum total length in addition to aerial section length could aid in assessing compliance through dockside assessment. Minimum aerial section length could also be assessed by EM systems, for example, if two stern-facing cameras are used, or if identification marks are added to the tori line backbone at specified distances astern (e.g., see Ames et al., 2005; Piasente et al., 2012; Pierre, 2018).

The 105 m long tori line used in the Phase 2 experiment (50 m aerial section with a 55 m Blue Steel braided rope drag section) would comply with the minimum length specification under the IATTC, which requires that the total length either be 100m or three times the vessel length. Vessels operating under the Hawaii longline limited entry permit have a maximum length of 101ft (30.8 m), such that a 90 m minimum total length could ensure consistency with international measures.

Height of tori line attachment point to vessel

For this project, tori lines were attached to a pole located near the vessel stern with an attachment point at 5m above the sea surface. This configuration worked well for maintaining the desired aerial extent and is consistent with WCPFC and IATTC specifications. Because tori poles or other structures to attach the tori line to the vessel may be located forward from the vessel stern, specifying the minimum height of the tori line at the stern would not be feasible to assess dockside. However, assuming that the tori line is mounted to the vessel close to the vessel stern, if the height above the sea surface at the point of the tori line attachment to the vessel is at least 5 m, then the height of the tori line at the stern will be only slightly shorter and not likely

affect the length of the aerial portion of the tori line. Minimum standards could specify that if the tori line is attached within, for example, 2 m of the vessel stern, then the height of the tori line at the point of attachment to the pole must be at least 5 m above the sea surface, otherwise, if the point of attachment is > 2 m from the stern, then the point of attachment to the tori pole must be 5.5-6 m above the sea surface.

Specifications for Streamers

Tori line design used in Phase 2 had two 50cm streamers attached every 1 meter, consistent with WCPFC and IATTC specifications that call for streamers to be less than 1m apart and be 30 cm in minimum length. The Phase 2 tori line design attached the first streamer within 2.5 m of the attachment point. Findings from the experiment were that > 30% of seabird interactions occurred within 5 m of the stern. Using longer streamers on the aerial section of the tori line close to the vessel stern might also increase the seabird deterrence efficacy of the tori line. However, due to longer streamers affecting the overall tori line weight, additional design improvements should take into consideration fishermen preferences for ease of use. As the short streamer design was effective at reducing interactions, a minimum standard with short streamer specifications consistent with WCPFC and IATTC would be sufficient.

Tori line placement on windward side of a point where the hookline enters the water, maintained over the sinking baited hooks

These two specifications are part of the WCPFC and IATTC measures. Specifying the placement of the tori line on the windward side of where hook enters the water, and the position of the tori line in relation to baited hooks, could be accomplished by making the tori line position to be adjustable to run along both the port and starboard side of the mainline depending on the wind direction in relation to the vessel's setting direction. Alternatively, if this is deemed to be too restrictive, as it does go beyond the minimum specifications of WCPFC and IATTC, then the tori line may be attached to a pole or an existing structure on the vessel in a static position so that the tori line would run along either the port or the starboard side of the mainline. For this project, tori pole placement was determined based on the side that crew threw the bait during setting operations (e.g., if bait were thrown on the port side, poles were installed between the location of the line shooter and the port rail so bait would be covered as it were dragged toward the mainline coming from the line shooter).

Type approval process

An alternative to specifying minimum standards for tori lines would be to establish a type approval process for tori lines that meet minimum performance standards. This approach may encourage innovation by fishermen by allowing use of their own tori line design after being evaluated through an established approval process. Once multiple tori line designs have been approved, fishermen would also have a choice of approved tori line designs. The approval process along with the performance standards for evaluation would need to be developed.

Other Considerations Not Recommended for Inclusion in Minimum Standards for the Hawaii Deep-set Longline Fishery

- **Materials**: Specifications for tori line materials would be suited for inclusion in design guidelines, which could include recommended materials that have been trialed and demonstrated to be practical and effective. While the use of towed objects at the end of

the drag section has been found to increase entanglement risk with longline gear, we do not recommend prohibiting the use of towed objects. Design guidance based on the experience of this project include the following:

  - Aerial section should use material that is light-weight, does not absorb water, does not hold energy, and does not tangle easily. This project used ultra high molecular weight polyethylene, known as dyneema or spectra, but other similar materials may be available or become available in the future. Monofilament material should not be utilized for the aerial section due to sagging concerns thereby reducing aerial coverage, nor should monofilament be used for drag sections as substantially more material is needed to create the amount of necessary drag.
  - Drag section should use braided material that does not tangle easily, does not absorb water, material that floats, and have a design that minimizes chances of tangles.
  - Tori poles should be made of solid material that do not flex (marine grade stainless steel is recommended for safety and durability purposes). Specifically, fiberglass poles should not be utilized. Alternatively, tori lines can be attached to a sturdy fixed point on the vessel.

- **Breakaways**: Specifying the use of breakaways as part of the minimum standards/regulations is not recommended as it does not affect the efficacy of the design, but could be recommended as it improves the practicality of the design.
- **Extreme weather**: No exemption is recommended for extreme weather conditions where use of a tori line might be unsafe. Vessels could plan for this situation by having an alternative seabird bycatch mitigation method available to use if they determine that using the tori line would not be safe. During the Phase 2 trips, there were some sets in high wind/rough conditions where the fishers found the tori line used in the trials could be deployed safely.