WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Pelagic Plan Team Working Group
SSLL Turtle Trip Interaction Limits Fishery Performance Review

REPORT
Endorsed at the May 2024 Pelagic Plan Team
May 31, 2024

Executive Summary
A Pelagic Plan Team Working Group conducted a review of the Hawaii shallow-set longline fishery performance under the loggerhead and leatherback turtle trip interaction limits measure implemented in September 2020 under the Pelagic Fishery Ecosystem Plan Amendment 10. The Working Group reviewed data through 2023, which includes three years of post-implementation period. Amendment 10 has been successful in maintaining a year-round supply of swordfish as it has allowed the fishery to operate without a closure. While there have been a few cases of SSLL vessels reaching the loggerhead or leatherback trip limit, the fishery has not reached the fleet-wide hard cap limit for leatherback turtles, and there is no fleet-wide limit for loggerhead turtles. The data for loggerhead and leatherback turtle interactions in the SSLL fishery since the trip limit implementation in September 2020 are still limited, and comparisons of pre- and post-measure implementation data are also confounded by the short seasons in the two years preceding the trip limit measure as well as the 'new normal' in higher loggerhead turtle interaction rates around 2017 that limit the pre-measure comparison to the three years prior to implementation. The working group finds that additional years of monitoring is warranted before the Council considers any revisions to the number of loggerhead or leatherback turtle trip limits.

1 INTRODUCTION

In response to a recommendation from the Pelagic Plan Team, the Council at the 197th meeting in June 2023 directed staff to form a working group of Pelagic Plan Team members and Council staff to initiate a detailed review of fishery performance under the loggerhead and leatherback turtle trip interaction limits in the Hawaii shallow-set longline fishery (SSLL). The Council directed that the review include data since implementation of the trip limits in September 2020 through the 2022-2023 fishing season, and that the working group take into account loggerhead and leatherback turtle interaction patterns as they relate to oceanographic factors, potential effect of population trends on interaction trends, and industry feedback received at the November 2022 Ecosystem-Based Fisheries Management (EBFM) Spatial Decision Making Workshop. The Council further directed the working group to provide a report to the Pelagic Plan Team at the May 2024 meeting.

This document presents the working group's review report for consideration at the Pelagic Plan Team, June SSC and Council meetings, and any other associated advisory group meetings.

2 OVERVIEW OF THE SSLL TURTLE TRIP INTERACTION LIMITS

Since 2004, the SSLL fishery operated under a fleet-wide interaction limit ("hard cap") for loggerhead and leatherback turtles, which, if reached, would trigger the closure of the fishery for the remainder of the calendar year. The hard caps were implemented as part of the Pelagic Fishery Management Plan Regulatory Amendment 3, to reduce impacts to sea turtles by requiring the use of large circle hooks and mackerel-type bait.

The average annual number of observed interactions for the 2005-2016 period following the adoption of the 2004 mitigation measures was 9.9 loggerhead turtles (range = 0-17) and 7.8 leatherback turtles (range = 2-16) per year. In 2017–2019, loggerhead turtle interactions in the Hawaii shallow-set longline fishery were higher than levels previously observed since the fishery reopened in 2004. A total of 21 loggerhead interactions were observed in 2017, 33 loggerhead interactions were observed from January 2018 to the fishery closure in May, and 20 loggerhead interactions were observed from January 2019 to the fishery closure in March. Nearly all sea turtles observed in this fishery are released alive and in accordance with proper handling protocol to maximize post-hooking survival.

In response to the higher number of loggerhead turtle interactions in the shallow-set fishery, the Council in 2018 developed management measures to provide managers and fishery participants with the necessary tools to respond to and mitigate fluctuations in loggerhead and leatherback turtle interactions, and to ensure a continued supply of fresh swordfish to U.S. markets, consistent with the conservation needs of these sea turtles.

At its 179th Meeting in August 2019, the Council took final action to amend the Pelagic FEP to modify sea turtle mitigation measures for the shallow-set fishery, incorporating provisions required under the 2019 Biological Opinion Reasonable and Prudent Measures (RPMs) and Terms and Conditions 1a and 1b (NMFS 2019). Specifically, the Council recommended 1) setting an annual fleet-wide hard cap limit on the number of leatherback turtle interactions at 16, consistent with RPMs and Terms and Conditions 1a under the 2019 Biological Opinion; 2) not setting an annual fleet-wide hard cap limit on the number of North Pacific loggerhead turtle interactions; and 3) establishing individual trip interaction limits for loggerhead and leatherback turtles for the shallow-set fishery, consistent with RPMs and Terms and Conditions 1b under the 2019 Biological Opinion. NMFS published the Notice of Availability for Amendment 10 on January 23, 2020 (85 FR 3889) and the proposed rule on February 4, 2020 (85 FR 6131). Amendment 10 became effective on April 22, 2020, and the regulations implementing the amendment became effective on September 17, 2020 (85 FR 57988).

Pelagic FEP Amendment 10 established the SSLL turtle trip interaction limits for leatherback and loggerhead turtles as follows:

1. Establish individual trip interaction limits for loggerhead and leatherback turtles for the Hawaii longline limited entry permit vessels that declare their trips as a shallow-set trip, consistent with RPMs and Terms and Conditions 1b under the 2019 BiOp as follows:
    i. Set limits of 5 loggerhead turtles and 2 leatherback turtles per trip.
    ii. Upon determining that a vessel has reached either the loggerhead or leatherback turtle trip interaction limit based on data from NMFS observers, shallow-set vessels will be required to return to port without making additional sets.

iii. The vessel will be prohibited from engaging in shallow-set longline fishing for 5 days after returning to port.
iv. Vessels that reach the trip limit for either leatherback or loggerhead sea turtles twice in a calendar year shall be prohibited from shallow-set longline fishing for the remainder of the calendar year. In the following calendar year, such vessels shall have an annual vessel limit equivalent to a single trip limit for that species in which two trip limits were reached.
v. The Council may make recommendations to NMFS to revise the individual trip limits upon periodic review of the effectiveness of the limits and consistent with the RPM of the current valid BiOp.

As part of Amendment 10, the Council also recommended an annual review of the fishery's performance under the trip interaction limits in the Pelagic FEP Annual SAFE Report. The SAFE Report now includes a table that summarizes the number of SSLL trips by the number of loggerhead and leatherback turtle interactions per trip for that reporting year. At its May 2023 meeting, the Pelagic Plan Team recommended a detailed review of fishery performance under the SSLL trip limit measure, utilizing three years of post-implementation data.

3 SSLL EFFORT, PARTICIPATION AND CATCH TRENDS

Following the reopening of the SSLL fishery in 2004, the participation in the SSLL fishery peaked at 35 vessels in 2006 although the fishery closed in March completing only 57 trips and 848 sets due to reaching the fleet-wide loggerhead interaction limit (Figure 1). Effort in this fishery peaked at 114 trips and 1,871 sets in 2010 then declined to its lowest level of 25 trips and 754 sets in 2019. The effort was the lowest in 2018 and 2019, years in which the fishery was closed in the May 2018 pursuant to a settlement agreement and in March 2019 due to reaching a court-ordered lower loggerhead interaction limit. The effort remained low in 2020 mainly due to COVID restrictions but increased the following years into 2023 after the trip limits went into effect in September 2020.

Swordfish catch has a similar pattern as effort (Figure 2) but the CPUE trend shows a decline from early in the time series with the lowest level in the four most recent years (Figure 3). The availability of air freight, foreign supply entering the U.S. and the level of domestic demand was responsible for the recent increased interest in the shallow-set longline affects Hawaii's swordfish price but these factors need further investigation.

Number of vessels making 3 or more shallow-set trips during 2021-2023 was 12.0 vessels per year, much higher compared to the three-year period (2017-2019) prior to the implementation of trip limit regulation (7.7 vessels per year)(Figure 4). There were about the same numbers of vessels making 1 to 2 trips per year during 2017-2019 (7.3 vessels per year) compared to 2021-2023 (8.0 vessels per year). There were more shallow-set trips made during 2021-2023 compared to 2017-2019 (186 vs 119, respectively). Perhaps a follow-up study on why vessels are making more shallow-set trip per year recently would help understand if it is indeed the interaction trip limit that is the reason for the increased participation in this fishery.

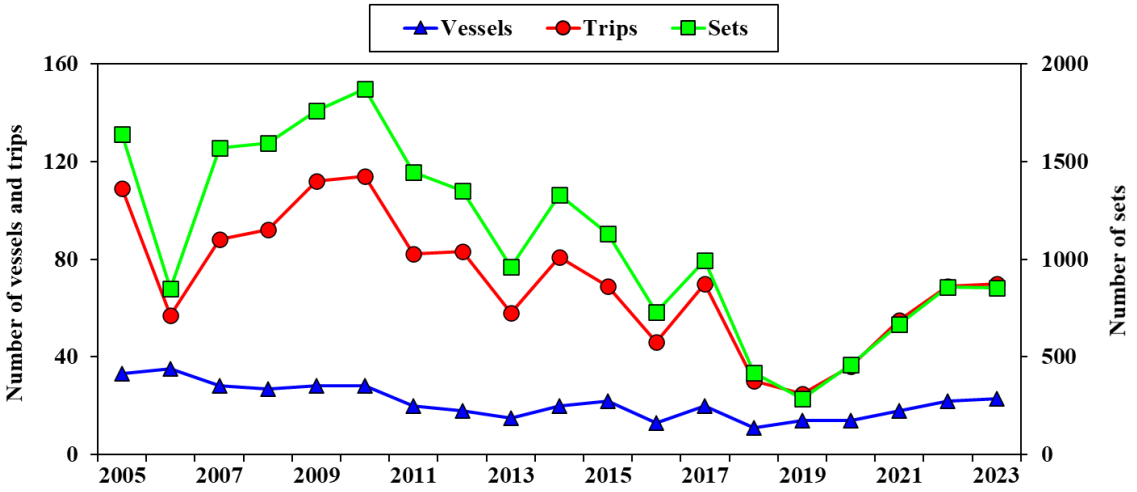


Figure 1. Number of shallow-set longline vessels and trips based on date of haul, 2005-2023.

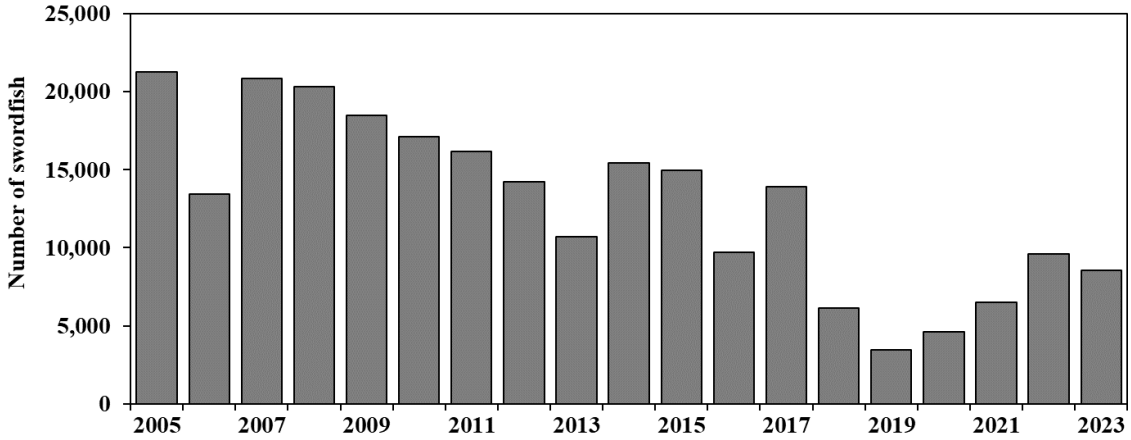
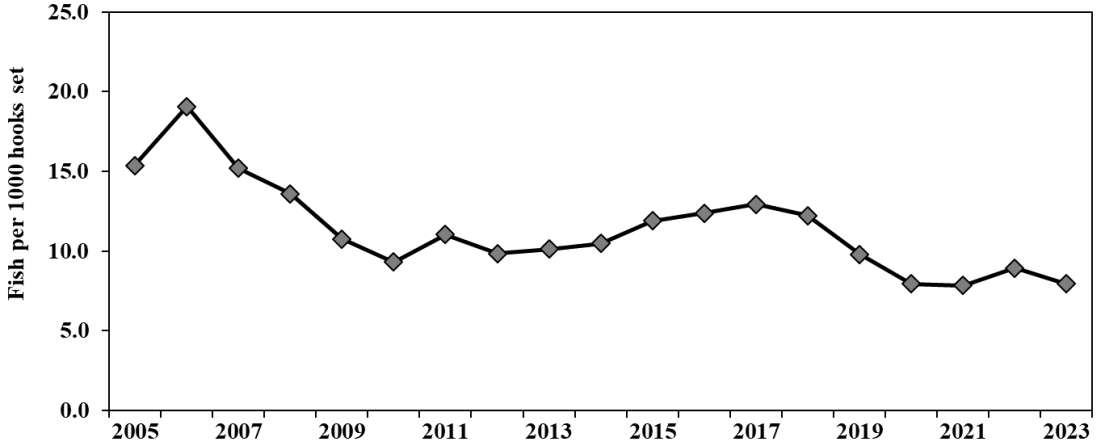


Figure 2. Shallow-set longline catch based on date of haul, 2005-2023.



*The shallow-set longline fishery was closed in the early months of 2006, 2018 and 2019.

Figure 3. Shallow-set longline swordfish CPUE based on date of haul, 2005-2023.

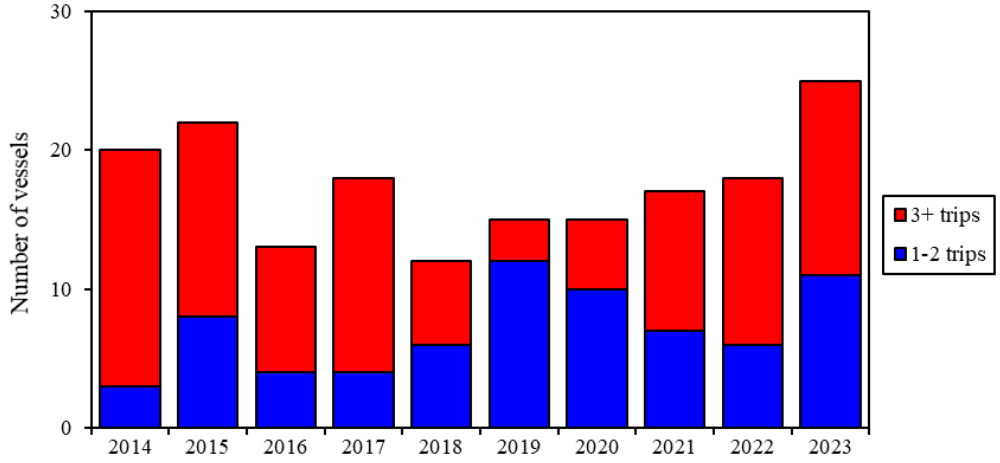
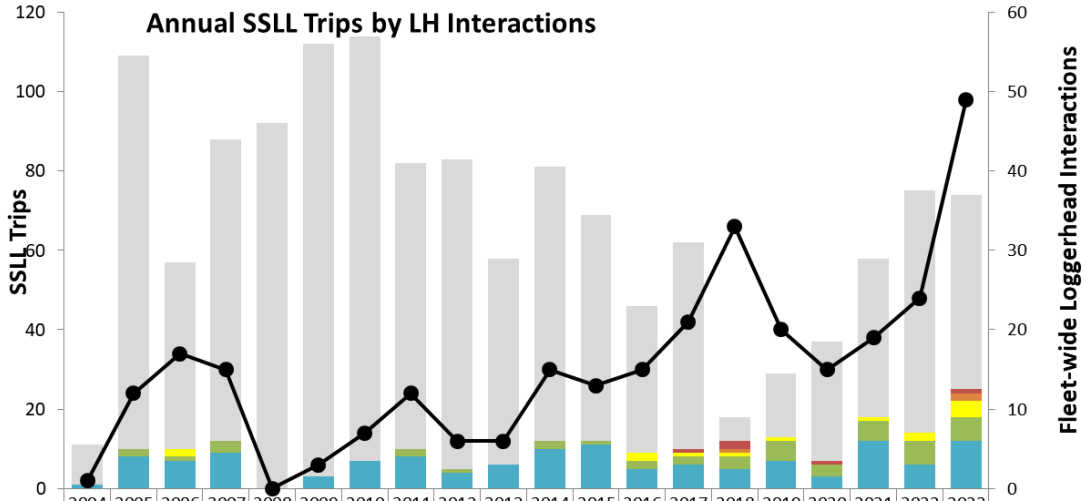


Figure 4. Number of shallow-set longline vessels by number of trips (based on date of landing), 2014-2023.

4 LOGGERHEAD TURTLE INTERACTIONS BEFORE AND AFTER TRIP LIMIT IMPLEMENTATION

The annual fleet-wide loggerhead turtle interactions and distribution of interactions by trip is summarized in Figure 5. The SSLL fishery operated under a loggerhead turtle hard cap of 17 interactions per year from 2004 to 2012 and 2018-2020, and a higher hard cap of 34 interactions from 2012 to 2018. The total number of observed loggerhead turtle interactions in 2023 was 49 (Figure 1; including one unidentified hardshell turtle), the highest observed in any given year since the SSLL fishery reopened in 2004. However, when grounded in effort, or the number of hooks set by the fishery, 2023 had a lower loggerhead catch rate or catch per unit effort (CPUE) than in 2018 and 2019 both annually and for quarter 1 (Figure 6). It is likely that if the fishery had not been closed in May of 2018 and March of 2019, a similar or possibly even higher number of interactions would have been observed in these years.

Loggerhead turtle CPUE for quarter one appear to have started increasing as early as 2016 (Figure 6), and the proportion of SSLL trips with two or more turtle interactions has increased since 2016 (Figure 5). Before 2016, only 4 trips had interactions with 3 loggerhead turtles and 2014 was the first year that a vessel was observed interacting with more than 3 turtles in a year. In 2023, there were 7 trips with 3 or more loggerhead interactions. Since the implementation of trip limits in September 2020, one trip reached the loggerhead trip limit (2023).



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
trips w/ 0 LH	10	99	47	76	92	109	107	72	78	52	69	57	37	52	6	16	30	40	61	49
trips w/ >5 LH	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	1
trips w/ 4 LH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
trips w/ 3 LH	0	0	2	0	0	0	0	0	0	0	0	0	2	1	1	1	0	1	2	4
trips w/ 2 LH	0	2	1	3	0	0	0	2	1	0	2	1	2	2	3	5	3	5	6	6
trips w/ 1 LH	1	8	7	9	0	3	7	8	4	6	10	11	5	6	5	7	3	12	6	12
LH interactions	1	12	17	15	0	3	7	12	6	6	15	13	15	21	33	20	15	19	24	49

Figure 5. Fleet-wide loggerhead turtle interactions and distribution of trips by the number of loggerhead turtle interactions per trip in the SSLL fishery, 2004-2023.

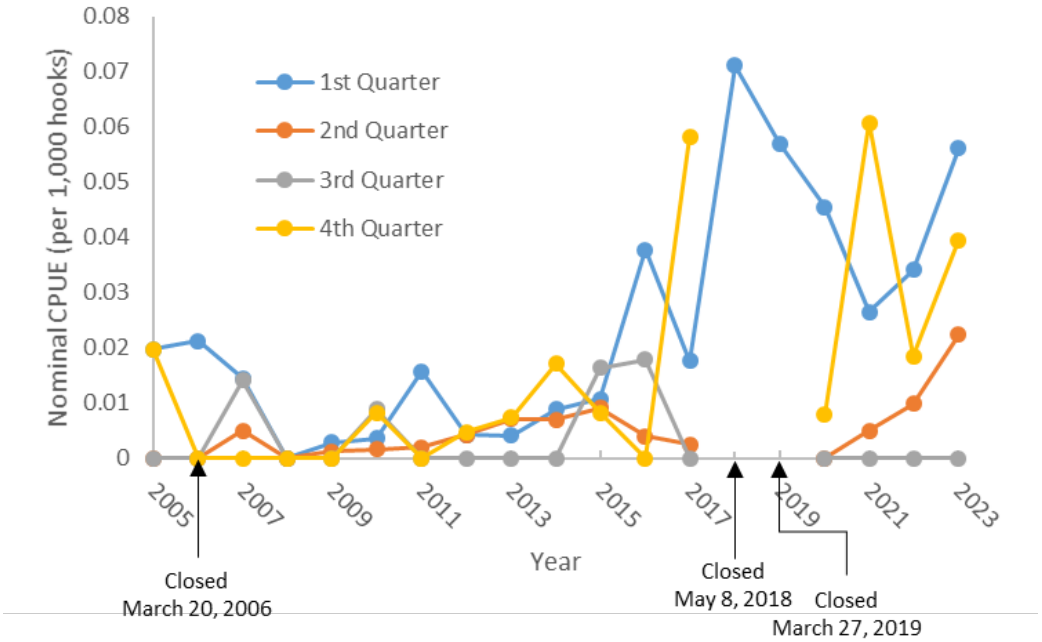


Figure 6. Nominal CPUE (captures per 1,000 hooks) for loggerhead sea turtles by quarter. Arrows highlight years when the fishery closed in 2006, 2018 and 2019.

Despite 2023 not being an anomaly, it is clear that something has changed either in the fishery, oceanographically, or in the population that has been driving a new normal of higher catch rates in this fishery. Using 2017 as the new normal for interactions with loggerhead sea turtles in the SSLL fishery, we took a look at the effectiveness of different management strategies in this fishery from 2017 through 2023 (managing with a loggerhead hard cap prior to August of 2020 and with trip limits after).

Currently the difference in loggerhead interaction rates are not significantly different when comparing the year before the switch to trip limits and following the switch. In the sequence of plots below observer data from January 1 2017 to December 31 2023 was used and each set was categorized as occurring pre or post switch to trip limits September 17 2020. There is an apparent not yet significant increase in the number of loggerhead turtle interactions accumulated during the year following the switch to trip limits (Figure 7). This pattern is influenced by the closures in 2018 and 2019 that could have resulted in a greater number of cumulative interactions and as a result shifted the hard cap mean line to higher interaction levels.

If the same data is used to explore the pre and post trip limit pattern at the quarter scale, there is no significant difference in the interaction rates except potentially in quarter 2 where the interactions post adoption of trip limits is significantly different (Figure 8). The pre trip-limit data however, is influenced by the fishery closures which occurred May 04 2018 and March 27 2019.

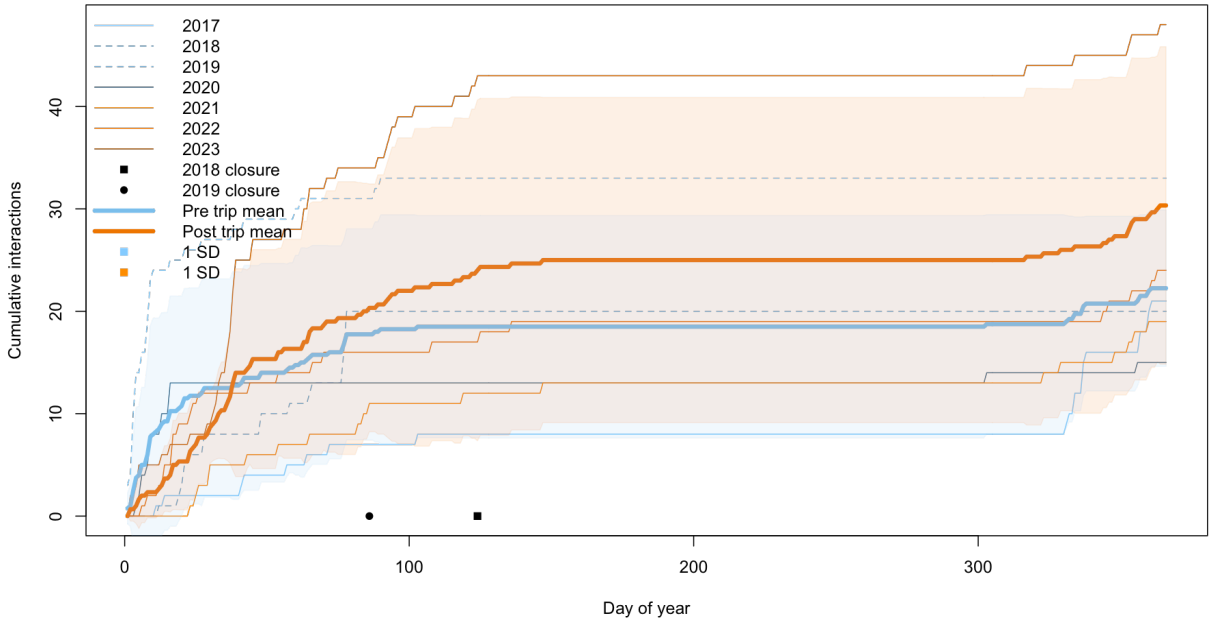


Figure 7. Cumulative number of loggerhead turtles interactions in the SSLL by year. Interactions before change to trip limits in blue shades. The change occurred 9/17/2020 so coloration is only an approximation. Interactions after the implementation of trip limits are in orange. 2018 and 2019 had fishery closures. The shaded polygons represent 1 standard deviation.

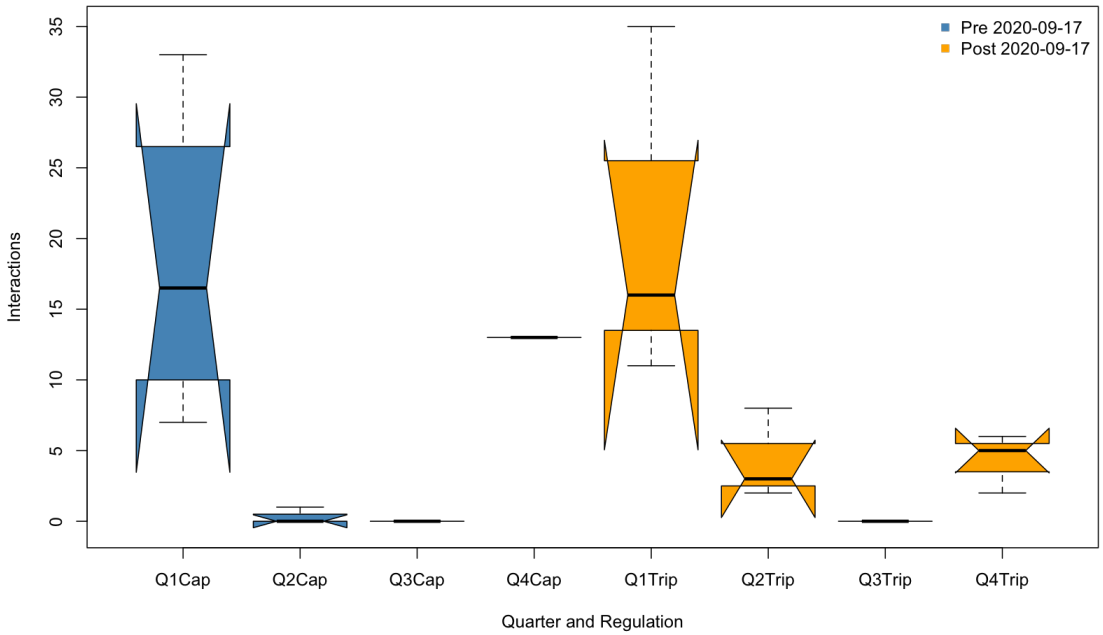


Figure 8. Loggerhead turtle interactions by quarter pre (blue) and post (orange) implementation of trip limits. The boxes demark the first and third quartiles with the solid line indicating the median. Overlapping notches suggest no significant difference.

Currently there does not appear to be significant changes in the distance fishers move between sets in response to turtle interactions. In Figure 9 there is no significant increase in the distance traveled between sets calculated as the haversine distance between the haul end and the next set start. This lack of difference holds when turtles are interacted with or not. The total number of turtles encountered on a set also does not appear to influence the distance to the next set (Figure 10). Neither does the cumulative number of turtles encountered on a trip (Figure 11). There is some indication that, post implementation of the trip limit, some vessels may be moving greater distances between sets.

The Working Group reviewed the observer data for vessel behavior in 2022 and 2023 with a focus on vessels that were approaching a turtle trip limit to see if vessels appear to be responsive to turtle interactions by altering fishing behavior to avoid hitting a limit. From 2022-2023, a total of 9 trips (out of a total of 103 trips) had 3 or more loggerhead interactions during a single trip (2 in 2022 and 7 in 2023) out of a interaction limit of 5, and a total of 19 trips had at least 1 leatherback interaction (10 in 2022 and 9 in 2023) out of a limit of 2. Out of the 9 trips with 3 or more loggerhead interactions in a single trip, the Working Group found that:

- 4 trips may have moved after 3 or 4 LH interactions, but moving did not guarantee no LH capture on subsequent sets
- 3 trips may have cut trips short without reaching limit, although their decision may be related to non-turtle factors such as low swordfish catch or poor weather conditions
- 3 trips with 3 or more LH interactions switched to DSLL on next trip, although motivation for switching is unknown

A vessel is prohibited from engaging in shallow-set longline fishing for 5 days after reaching a trip limit and returning to port. As part of the management measure, PIRO Sustainable Fisheries

Division meets with the captain of a vessel that reaches a turtle trip limit while the vessel is in port. During this meeting, the captain is asked if fishing behavior was altered during the trip to avoid reaching the limit or if they think that reaching the limit will alter the number of shallow-set trips they plan on making that year. The results of these meetings cannot be reported at this time due to MSA confidentiality requirements.

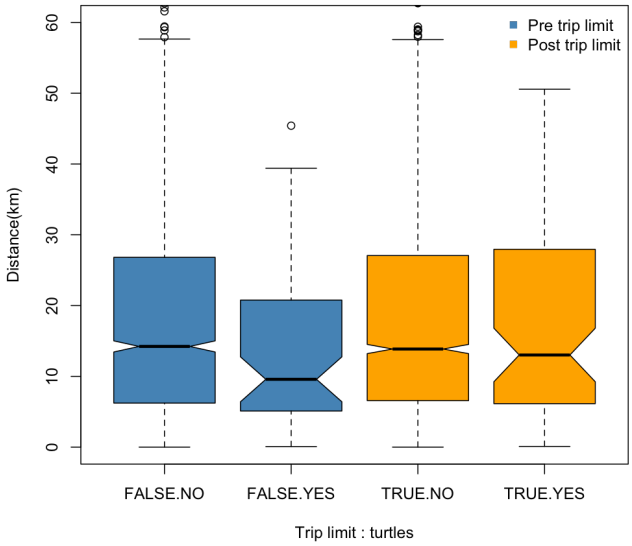


Figure 9. Distance to the next set with (YES) and without (NO) loggerhead turtle interactions by pre (FALSE:blue) and post (TRUE:orange) implementation of tip limits. The boxes denmark the first and third quartiles with the solid line indicating the median. Overlapping notches suggest no significant difference.

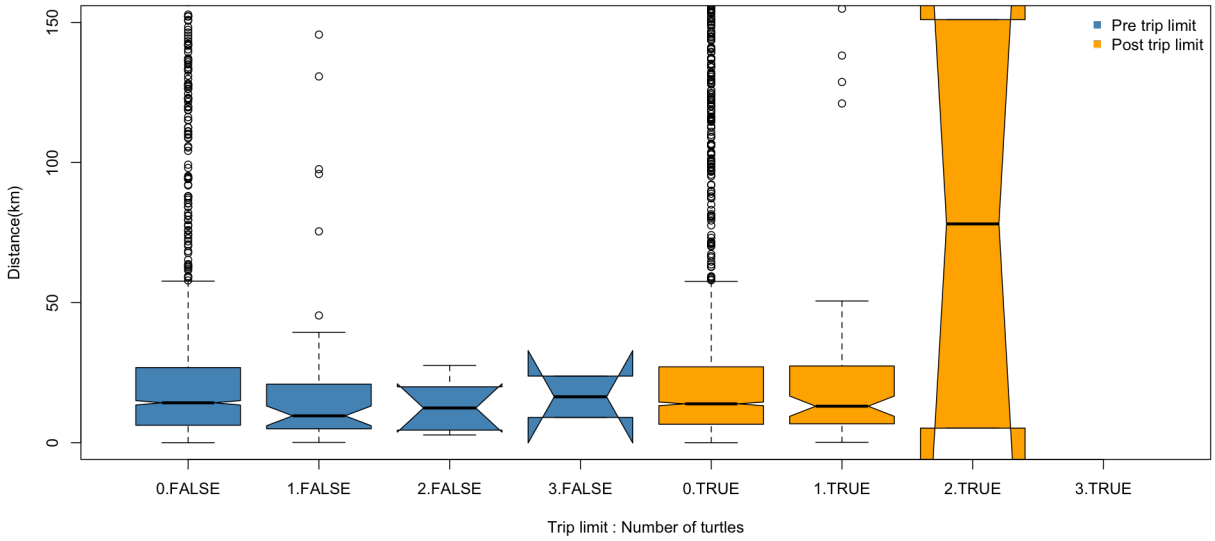


Figure 10. Distance to the next set following loggerhead turtle interactions by pre (FALSE:blue) and post (TRUE:orange) implementation of tip limits. X axis labels 0-3 indicate the number of turtles encountered on a set.

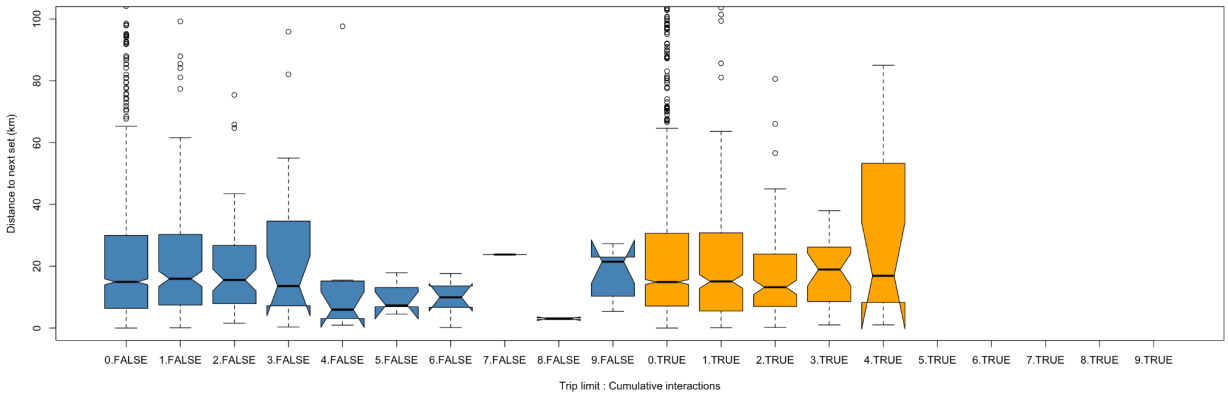


Figure 11. Distance to the next set following loggerhead turtle interactions by pre (FALSE:blue) and post (TRUE:orange) implementation of tip limits. X axis labels 0-9 indicate the number of turtles encountered up to that point on the trip.

5 LEATHERBACK TURTLE INTERACTIONS BEFORE AND AFTER TRIP LIMIT IMPLEMENTATION

Since the implementation of trip limits in September 2020, three trips reached the leatherback trip limit (1 in 2022; 2 in 2023). Pre- and post-trip limit implementation comparisons of the cumulative number of leatherback turtle interactions by year, leatherback turtle interactions by quarter, and distance to the next set following leatherback turtle interactions are shown in Figures 12-16. Similar to the loggerhead turtle data, there are no statistical differences between the pre- and post-implementation at this time, although the pattern is influenced by the closures in 2018 and 2019.

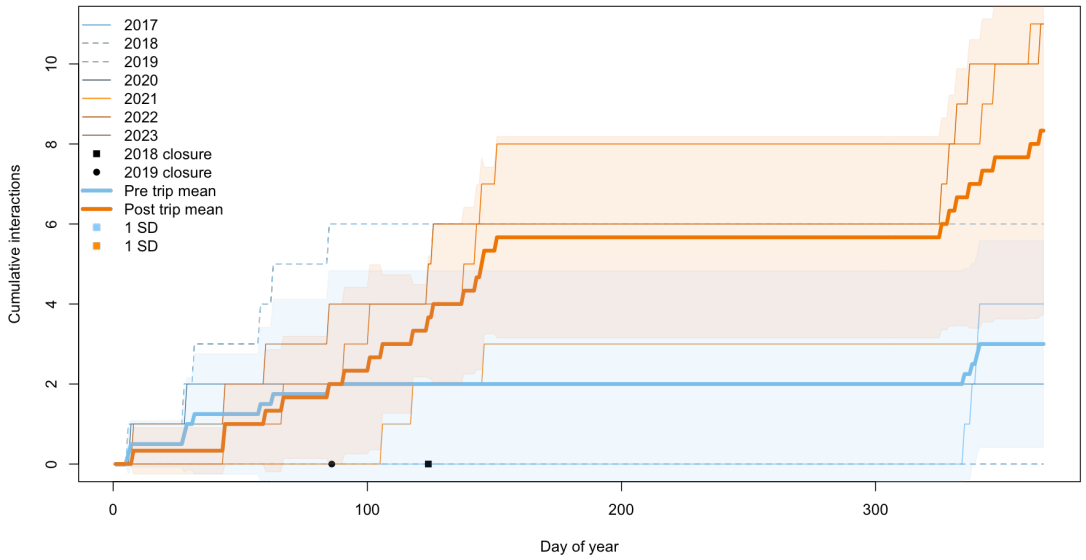


Figure 12. Cumulative number of leatherback turtles interactions in the SSLL by year. Interactions before change to trip limits in blue shades. The change occurred 9/17/2020 so coloration is only an approximation. Interactions after the implementation of trip limits are in orange. 2018 and 2019 had fishery closures. The shaded polygons represent 1 standard deviation.

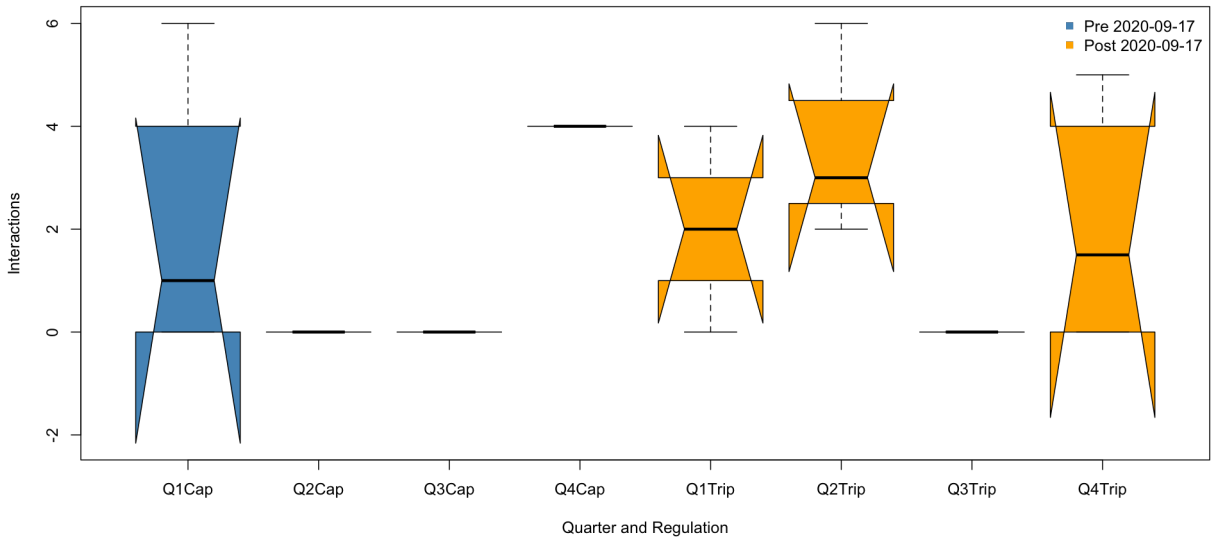


Figure 13. Leatherback turtle interactions by quarter pre (blue) and post (orange) implementation of trip limits. The boxes demark the first and third quartiles with the solid line indicating the median. Overlapping notches suggest no significant difference.

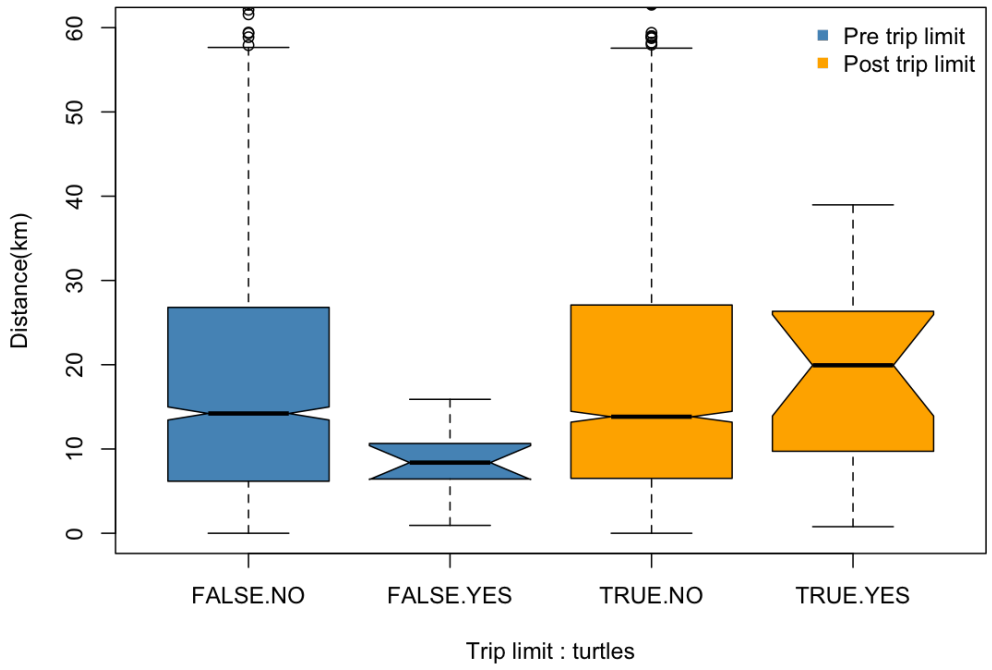


Figure 14. Distance to the next set with (YES) and without (NO) leatherback turtle interactions by pre (FALSE:blue) and post (TRUE:orange) implementation of tip limits. The boxes denmark the first and third quartiles with the solid line indicating the median. Overlapping notches suggest no significant difference.

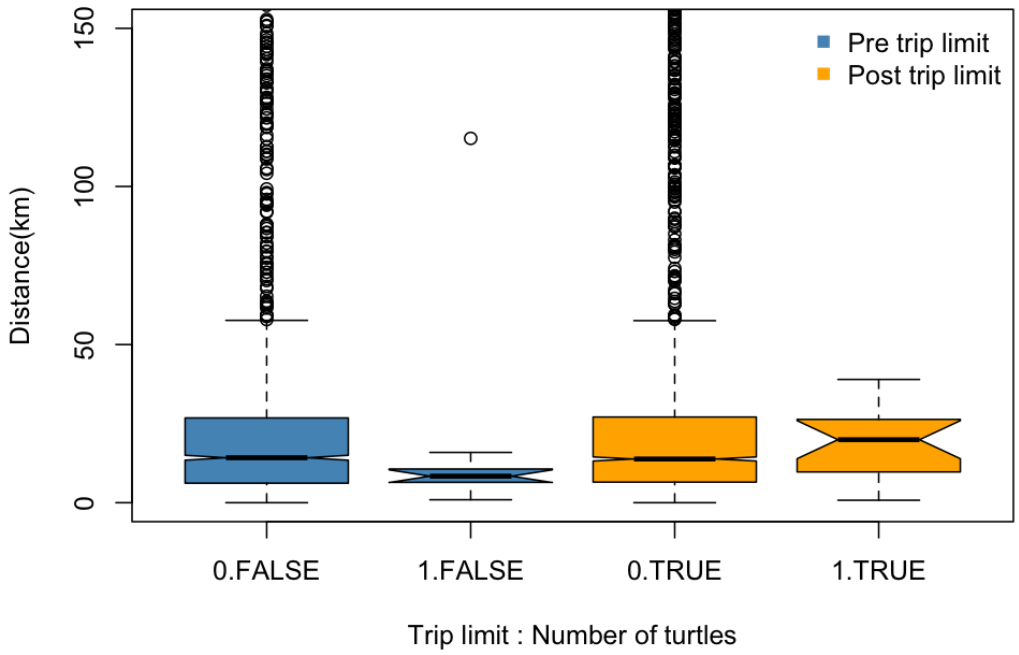


Figure 15. Distance to the next set following leatherback turtle interactions by pre (FALSE:blue) and post (TRUE:orange) implementation of tip limits. X axis labels 0-1 indicate the number of turtles encountered on a set.

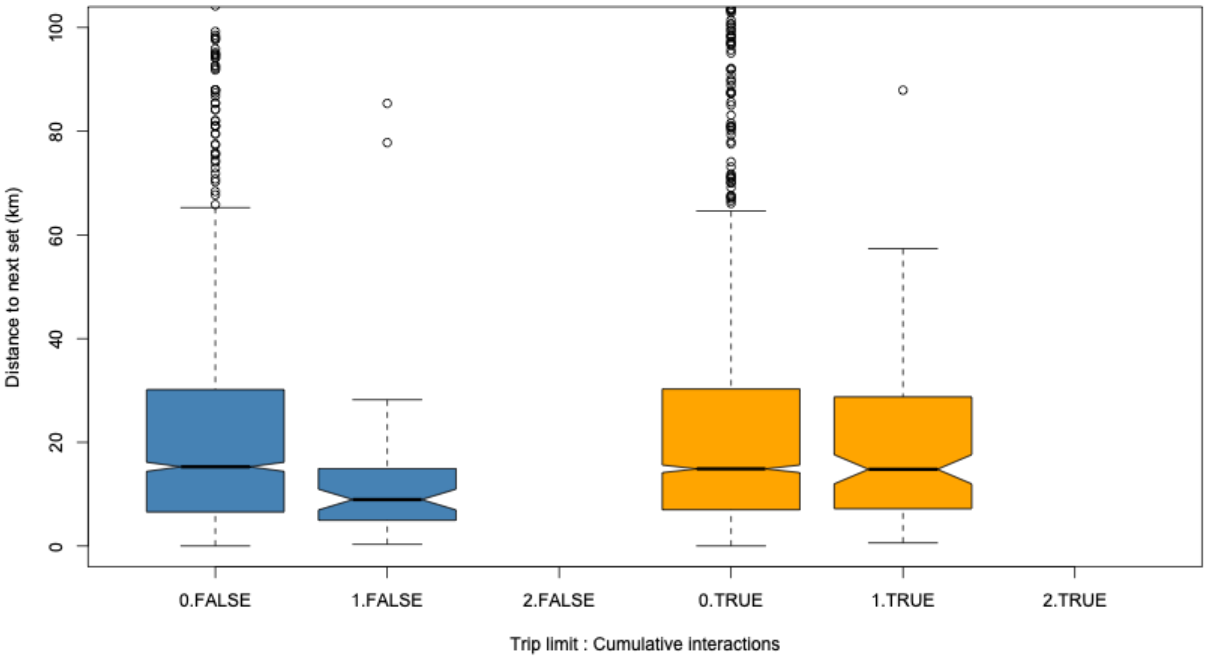


Figure 16. Distance to the next set following leatherback turtle interactions by pre (FALSE:blue) and post (TRUE:orange) implementation of tip limits. X axis labels 0-2 indicate the number of turtles encountered up to that point on the trip.

6 IMPACT OF POPULATION TRENDS AND OCEANOGRAPHIC FACTORS

The most recent population assessment for the North Pacific loggerhead turtle using nesting beach data through 2015 estimated that this population is increasing at 2.3% per year (Martin et al. 2020). The rate of increase in the SSLL loggerhead turtle interactions appears to exceed this long-term population trend, especially in terms of the 'new normal' interaction rates starting around 2016. Loggerhead turtle nest counts in Japan increased steadily from 2,064 nests in 1997 to 5,167 nests in 2005, then increased substantially to over 10,000 nests in 2008, after which high nesting years continued through 2014 with a record of 15,396 nests in 2013 (NMFS 2019). The higher level of nesting since 2008 likely resulted in a substantially higher hatchling production compared to the decade prior. Most of the loggerhead turtles observed interacting in the Hawaii shallow-set longline fishery are in the range of 40-60 cm straight carapace length (SCL), which is estimated to be approximately 3-10 years in age based on skeletochronology (Turner-Tomaszewicz et al. 2015) and consistent with the period of high nesting in Japan. The extent to which the cohort effect from the increase in hatchling production since 2008 is having on the SSLL loggerhead turtle interaction rate is unknown at this time.

PIFSC is collaborating with loggerhead turtle nesting data holders in Japan to update the population model, which would allow an assessment of the linkage of loggerhead turtle interactions in the SSLL fishery to hatchling production. Further work is also ongoing to evaluate the extent to which oceanographic features (e.g., contraction in the TurtleWatch band) are impacting the SSLL loggerhead turtle interaction rates. An update to the Protected Species Ensemble Random Forest (PSERF) Model with data through 2023 is pending.

7 CONSIDERATIONS FOR TRIP LIMIT MEASURE IMPLEMENTATION

Based on the review of fishery performance with data through 2023, the working group finds that the SSLL trip limit measure has been successful in maintaining a year-round supply of swordfish as it has allowed the fishery to operate without a closure. While there have been a few cases of SSLL vessels reaching the loggerhead or leatherback trip limit, the fishery has not reached the fleet-wide hard cap limit for leatherback turtles, and there is no fleet-wide limit for loggerhead turtles. The data for loggerhead and leatherback turtle interactions in the SSLL fishery since the trip limit implementation in September 2020 are still limited, especially for trips that had one or more interactions of each species. Comparisons of pre- and post-measure implementation data are also confounded by the short seasons in the two years preceding the trip limit measure (2018-2019 due closures in first or second quarters) as well as the 'new normal' in higher interaction rates around 2017 that limit the pre-measure comparison to the three years prior to implementation. **The working group finds that additional years of monitoring is warranted before the Council considers any revisions to the number of loggerhead or leatherback turtle trip limits.**

The working group also discussed the potential impact of reduced observer coverage in the SSLL on the implementation of the trip limit measure. The SSLL fishery has been observed at 100% coverage since the fishery reopened in 2004. At the time the trip limit measure was considered under the Pelagic FEP Amendment 10, the Council in its final action recommendation specified that the determination of whether a limit is reached would be based on data from NMFS observers. The Council's consideration for this action was based on NMFS continuing to place federal observers at 100% coverage for the foreseeable future and relied on the NMFS observer

protocol that instructs observers to report sea turtle interactions using a satellite phone after each observation. While the implementing regulations at 50 CFR 665.813 do not specify that the determination be based on NMFS observers, departure from these protocols would warrant discussion through the Council process to determine whether a modification in the trip limit monitoring is necessary. Due to increased program costs, NMFS has recently reduced observer coverage on the Hawaii deep-set longline fishery, and future federal funding is uncertain at this time. **The Council may wish to consider options for alternative trip limit implementation and monitoring methods under a possible reduced observer coverage level.**

8 PLAN TEAM, SSC AND COUNCIL CONSIDERATIONS

The Council tasked the working group to provide a report to the Pelagic Plan Team at the May 2024 meeting. The Pelagic Plan Team was asked to consider the following:

- Endorse the working group report for review by SSC, Council and any other applicable Council advisory groups;
- Based on the analysis conducted by the working group, consider recommendations to the Council on whether the loggerhead and/or leatherback turtle trip limits warrant a revision at this time;
- Consider timing for the next trip limit measure review;
- Consider recommendations to the Council on next steps for the SSLL trip limit implementation and monitoring, including considerations for potential impacts from a potential reduced observer coverage in the future.

The Pelagic Plan Team at the May 2024 meeting made the following recommendations to the Council:

- Endorsed the Working Group report for review by the SSC, Council, and any other applicable Council advisory Groups.
- Concurred with the Working Group that revisions to the trip limits are not warranted at this time, and recommends the next review of the trip limit measure to be conducted in 2-3 years, pending update of the loggerhead turtle population model.

The SSC and other applicable advisory groups are asked to consider the following:

- Based on the analysis conducted by the working group, consider recommendations to the Council on whether the loggerhead and/or leatherback turtle trip limits warrant a revision at this time; and
- Consider recommendations to the Council on next steps for the SSLL trip limit implementation and monitoring, including considerations for potential impacts from a potential reduced observer coverage in the future.

9 PELAGIC PLAN TEAM WORKING GROUP MEMBERS

- Lynn Rassel, PIRO SFD
- Melissa Snover, PIRO PRD
- Russ Ito, PIFSC
- Rob Ahrens, PIFSC

- T. Todd Jones, PIFSC
- Asuka Ishizaki, WPRFMC staff

10 REFERENCES

Martin, S.L., Z. Siders, T. Eguchi, B. Langseth, R. Ahrens, and T.T. Jones. 2020. Assessing the population-level impacts of North Pacific loggerhead and western Pacific leatherback turtle interactions in the Hawaii-based shallow-set longline fishery. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-PIFSC-95. 183 p. doi: 10.25923/ydp1-f891.

NMFS. 2019. Biological Opinion on the Continued Authorization of the Hawaii Pelagic Shallow-Set Longline Fishery Honolulu, HI: 506.

Turner-Tomaszewicz, C. N., J. A. Seminoff, L. Avens, L. R. Goshe, S. H. Peckham, J. M. Rguez-Baron, K. Bickerman, and C. M. Kurle. 2015. Age and residency duration of loggerhead turtles at a North Pacific bycatch hotspot using skeletochronology. Biological Conservation. 186:134-142.