

Comments on the Number of Interactions Between Loggerhead Turtles and Reef-Fish Longline Gear in the Gulf of Mexico

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for

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Introduction

In September 2008, NMFS SEFSC produced an analysis of 18 interactions (“takes” in the terminology of the ESA) between turtles and reef-fish longline gear in the Gulf of Mexico. Those 18 records were the fruit of two observer programs, respectively the SBLOP and the RFOP, conducted during July 2006 through December 2007. The analysis led to an estimate that the longline fleet in the eastern Gulf had had 902 interactions with hardshell turtles, most or all of them loggerheads, during the 18-month period (NMFS 2008). While that number is not trivial, its meaning has been grossly exaggerated, not only throughout the Gulf States but also in Washington.

No final statement of the impacts of the longline fishery on the loggerhead populations can be offered here. Such a statement would need analysis of data that are not yet available to the public. Indeed, it would need data that have yet to be collected. This brief document merely attempts to correct some of the misinformation that is circulating and seeks to place the September 2008 estimate in the context of, firstly, other estimates of turtle interactions with reef-fish longlines and, secondly, the numbers of loggerhead that die from other causes.

Datasets

Several different datasets exist which might allow estimates of the numbers of interactions. Taken in chronological order, those known to the author are:

Gulf & South Atlantic Fisheries Foundation / University of Florida Commercial Shark Fishery Observer Program: 1994–2005

Beginning in 1994, a voluntary program placed observers aboard shark-fishing boats in the Gulf of Mexico and the South Atlantic Bight. From its commencement until 1998, the program was coordinated out of the Gulf & South Atlantic Fisheries Development Foundation, though operated in conjunction with the University of Florida. Thereafter, it was run exclusively by the University. For the first several years, participation in the program was voluntary for fishermen while the observers solicited operators for permission to join trips. From 2002, carrying an observer became compulsory and NMFS selected the boats randomly (with certain safety-related exceptions). The program was replaced by the NMFS-operated Shark Bottom Longline Observer Program with effect from July 2005.

In the early years, only shark-directed trips were observed. From 1994 through 1996, for example, 16,589 shark-captures were observed but only 135 grouper were taken on those trips¹. In later years, however, trips on which an incidental catch of large coastal sharks was expected were supposed to be observed. The observers were trained in turtle-handling procedures (Morgan & Burgess 2005) and were very likely required to keep records of all protected species. Thus, this program should have gathered some useful data on turtle “takes” on longlines set for reef-fish between 2002 and its replacement with a NMFS program in mid-2005.

Between January 2003 and June 2005, 173 longline sets were observed in the Gulf of Mexico, with seven loggerhead captures recorded (NMFS 2007) but it remains unclear how many of those sets were directed towards reef fish and how many, if any, of the turtles were taken on those sets.

Those data do not appear to have yet been extracted and analyzed.

SEFSC Reef-Fish Observer Program: 1994–95

SEFSC, in cooperation with the GMFMC and the fishing industry, deployed observers on reef-fish vessels in the mid-1990s. 13 longline trips (including 317 sets and some 230,000 hook-sets over 112 sea-days) and 22 trips aboard vertical-line boats were observed. Turtles were seen in the water but none were captured on either kind of fishing gear (NMFS 2005: pp. 61-62).

While the data were limited and any estimate built on them must be highly uncertain, the only possible estimate from these 1994–95 observations is that the reef-fish fishery had zero interactions with turtles.

¹ *Commercial Shark Fishery Observer Program 1996*, Final Report on MARFIN Award NA57FF0286, Gulf & South Atlantic Fisheries Development Foundation Inc.: iv+94 p.

Supplementary Discard Data Program

2001–2004

Logbook records have been required from all commercial Gulf reef-fish vessels since 1993. Beginning in August 2001, captains of a stratified random sample of 20% of the vessels have been required to also complete a supplemental form with information on discards. From then until July 2004, captures of 20 turtles were reported, nine on longline gear and 11 on vertical lines, with a maximum of two per trip. Those takes reportedly included one leatherback, one green, four loggerhead and 14 unidentified turtles. NMFS (2005) reviewed these data but could not discern any seasonal or spatial patterns in the distribution of the interactions with longline gear, beyond the effects of the known concentration of the fishery in “zone five”, off Tampa Bay, and the adjacent zones “four” and “six”. Of the nine turtles caught on longlines, eight were released alive but one was dead. At least nine of the 11 taken on vertical lines were released alive (NMFS 2005: pp. 13, 62-64).

NMFS (2005) undertook to estimate fleet-wide turtle “takes” based largely on these SDDP data. Their final estimate was that the reef-fish fisheries as a whole would see about 321 turtle interactions in three years (114 longline, 96 commercial vertical-line and 111 recreational). The longline sector specifically would “take” 85 loggerheads (i.e about 30 annually), of which about half would be killed and the rest would survive. The remaining captures on longlines were expected to be 26 green turtles, two Kemp’s ridley and one leatherback per three years. Those estimates must carry the caveat that they were based on fishermen’s self reporting of turtles that they released. Unlike bycatches of fish, reef-fish fishermen are likely to notice and make a mental note of any turtles that they encounter, simply because that is a rare experience. They may, however, under report what they have seen.

2005 onwards

The SDDP has continued after 2004 but little information is available on any reported turtle takes. SEFSC staff have stated that zero takes were recorded during the 18 months July 2006 to December 2007.

The potential for bias in these SDDP data is obvious but bias, of itself, does not prevent fisheries data from being useful – though they may have to be used to track temporal trends rather than providing absolute values. (Almost all fishery resource surveys give severely biased estimates of abundance but they are nevertheless regarded as the best available foundation for management. Similarly, the counts of turtle nests on index beaches are the best available indications of loggerhead abundance, though they give only biased estimates of either total nest numbers or the number of breeding females.) Rather than bias itself, the bigger problem is bias that is variable from year to year. Yet even that simply introduces uncertainty into any estimates – uncertainty which may well be smaller than the uncertainties arising from imprecision in some unbiased (and hence very likely expensive) dataset, the very expense meaning that sample sizes are small and precision correspondingly low.

Hence, although the SDDP data are less than ideal and perhaps less comfortable for biologists than are observer data, they do have value in understanding the pattern of turtle takes by reef-fish longliners. They must be included in any comprehensive analysis.

Mote Marine Laboratory Longline Sampling: 2004 onwards

Starting in 2004, Mote Marine Laboratory began placing observers aboard reef-fish longliners. Of the first ten observed trips, only one (a deepwater grouper trip in May 2004) had any turtle interactions. It took two, one in 52 fm and the other in 54 fm (NMFS 2005: pp. 64-65). It is not immediately known how long this observer program continued nor whether other turtle captures were seen.

Shark Bottom Longline Observer Program 2005–2006

Beginning in 2005, NMFS Panama City laboratory took over the task of placing observers aboard vessels engaged in the shark fishery from the University of Florida, with a specific SBLOP commencing in July of that year. From the beginning, observers were put aboard boats that had shark permits, whether or not their current trip was directed towards sharks. In 2006, coverage was expanded to include all bottom-line trips, without regard to the vessel's participation in the shark fishery (Hale & Carlson 2007).

Between July 2005 and December 2006, four trips in the Gulf of Mexico that were directed towards grouper or a grouper/shark mix were observed. There were 34 observed sets with an average of 1264 hooks per set (for a total of nearly 43,000 hook-sets: Hale & Carlson 2007). 27 of those sets were directed towards grouper alone and were observed between July 2006 and the end of that year. One trip in that period took seven loggerhead (NMFS 2008). No turtles were taken on any of the remaining seven observed sets made before December 2006 (Hale & Carlson 2007) but the available published reports do not make clear whether those seven sets were shark-directed on mixed trips (and thus can be excluded from calculations of take rates in the reef-fish fishery) or whether they were grouper-directed sets made before July 2006 and thus were arbitrarily excluded from the estimations made by NMFS (2008).

If the latter, the record of the SBLOP would change from NMFS's (2008) 8 turtle takes in 205 observed sets during 2006–07 to 8 in 212 during 2005–2007. Clearly, that would only be a small shift.

2006–2007

SBLOP records from July 2006 through December 2007 formed one of the two datasets used in the analyses of NMFS (2008). The observers noted the target species for each set, which sometimes changed during a trip. NMFS (2008) therefore selected out the observations made on sets directed towards reef-fish. In 2006, there were SBLOP data

from only 27 sets, which amounted to 1.57 trips. In 2007, those totals were 178 and 8.91 respectively.

One of the trips observed in 2006 captured the remarkable total of 7 loggerheads on 6 different sets (out of a total of at least 21). Four were recorded as “dead / unresponsive” when discarded, one was alive when released and the state of the other two is unknown. While there seems no reason to doubt that the observer correctly recorded what happened on that trip, it appears to have been a highly unusual, if not unique, event and in no way representative of the normal experience in reef-fish longlining. Unfortunately, with such small sample sizes as the available observer data provides, a single outlier like that seven-turtle trip can seriously perturb statistical estimates.

In 2007, in contrast to the previous year, only one loggerhead was taken in any of the 178 observed sets. That low take rate of 1 per 178 sets contrasts very strongly with the 1 per 4 sets of the previous year. Such extreme fluctuations are to be expected when monitoring a rare event, like a turtle interaction with bottom longline gear, using small sample sizes. They should, nevertheless, be a warning of the uncertainty in any estimates generated from these data.

2008

No formal report of SBLOP observations in 2008 has yet appeared. It is believed that no turtle interactions were observed while SBLOP observers were deployed on trips that targeted reef fish.

Further consideration of the 2008 SBLOP data is, however, best combined with examination of the RFOP data from the same year.

Reef Fish Observer Program

2006–2007

The RFOP only commenced in July 2006. Records from its first 18 months were included in the analyses of NMFS (2008). In the second half of 2006, observers were deployed on 12 longline trips which made 200 sets. Through the whole of 2007, there were 11 observed trips and 154 observed sets. When combined with the SBLOP records for the same period, approximately 1.5% of reef-fish longline sets were observed. Observers were also deployed aboard commercial vertical-line boats, though they did not see any turtles taken during the 18 months.

The 200 observed sets in 2006 produced only three records of turtle interactions, at least two and likely all three involving loggerheads, all three animals being released alive. Two of the three were taken on the same set. The take rate that year was thus 1 per 67 sets. In 2007, there were seven observed interactions (at least six with loggerheads) on four different trips. Three were released alive, two were recorded as “dead / unresponsive” and two were in unknown condition when returned to the water. The observed take rate that year was, therefore, 1 per 22 sets.

2008

No formal report of RFOP observations in 2008 has yet appeared but data provided by SEFSC indicate that three turtle interactions with longline gear were observed during the first half of the year. A total of 393 reef-fish longline sets were observed by a combination of the RFOP and SBLOP during the first eleven months of 2008, indicating a combined take rate of 1 per 131 sets – which compares to 1 per 23 sets in the second half of 2006 (RFOP and SBLOP combined) and 1 per 42 sets in 2007 – or 1 take per 31 sets for the whole period combined.

The RFOP also recorded a single turtle caught on commercial reef-fish vertical-line gear during 2008.

Other Observers

There have been some other observers deployed. In 2007, for example, one MARFIN project recorded three turtles taken on reef-fish longline gear, though the number of observed sets is not immediately known.

Anecdotal Reports

Fishermen's informal reports of discards cannot be relied upon for quantitative estimates. Most commercial fishermen focus their attention on the catch they will keep and spare little for what they discard. If pressed for numbers, they have every incentive to under report. However, it may be possible to bound the range of plausible estimates using anecdotal information.

NMFS (2005: pp. 65) noted an unconfirmed report of a single reef-fish trip in 2004 that took 35 to 40 turtles. That report was said to have been seen as highly unusual, even incredible, by other fishermen. The Service wisely judged that such high numbers are not indicative of normal levels of turtle interactions. The captain on the trip in question was said to have been a transient fisherman, not one who regularly fished in the Gulf of Mexico. Inexperience may have led to higher levels of bycatch and lower catch rates of the target grouper.

A survey and summary of anecdotal reports from reef-fish fishermen might prove informative, particularly in placing the observed “seven takes” trip into a broader context.

Estimates of Annual Losses

Only NMFS (2005) and NMFS (2008) have yet attempted to estimate the fleet-wide annual number of turtle interactions with the reef-fish longline fishery, though an earlier estimate of zero can be swiftly made from the 1994–95 reef-fish observer data. NMFS (2005), using SDDP data to 2004, suggested a “take” of 85 loggerheads in three years or

about 30 annually, plus another 29 turtles of other species per three years or about 10 annually. NMFS (2008) in contrast, based on the July 2006 through December 2007 SBLOP and RFOP data, estimated 902 hard-shell turtle interactions in the eastern Gulf (plus some others in the western Gulf, from where there were no observer data). That corresponds to an annual “take” of around 600 turtles, most or all of them loggerheads.

The estimates prepared by NMFS (2008) have the great advantage that they were accompanied by formal 95% confidence limits, which were 410.6 to 1983.2 hard-shell turtles taken in the eastern Gulf in 18 months or about 275 to 1320 annually. The upper bound, while statistically valid in so far as the analyzed data are concerned, is not consistent with common experience in the fishery. It supposes an average of rather more than one turtle caught per trip. The lower bound is more plausible and indicates the minimum number of interactions that must occur. It should be understood, however, that that minimum is an indication, not an absolute limit. Firstly, the true value of the “take” in 2006–07 is expected to fall outside the quoted 95% limits one time in twenty. Secondly, those quoted limits are themselves only estimates and are subject to the vagaries of sampling – which vagaries are large when the sample sizes are as small as they are in the observer data. Finally, NMFS (2008) necessarily assumed that all observed sets were drawn from the same statistical “population” of sets, with the per-set number of turtle takes following a delta lognormal distribution. That was the right way to run the analyses but it is nevertheless imperfect. With the small number of observed “takes”, NMFS (2008) deemed that the “data are not likely to fit a critical assumption of the delta lognormal model” and warned that “the extrapolated estimates [...] should not be assumed to be reasonable”. I would be more concerned that the real fishery did not have some 25,000 replicate sets per year, like some giant science-directed survey. Rather, each longline captain fished rather different gear in rather different ways – and indeed will not always have fished in the same way on every trip. Thus, the data should not be seen as drawn from a single delta lognormal distribution but from a few hundred different distributions. The data are clearly grossly inadequate for estimating “takes” by individual boats and NMFS (2008) had no choice but to structure the analysis as was done. The estimate of some 600 takes per year would likely not have been much affected anyway but the confidence limits around that estimate are less robust. They are likely a good deal narrower than they would have been if they could have been based on a more-realistic model.

Taking these many complications together, the lower bound of about 275 takes per year should be regarded as indicative, not firm. There seems little doubt that the true level of takes in 2006–07 far exceeded the 30 per year authorized by NMFS (2005) but it could have been in the range of 150 to 200, rather than 275 or higher.

As noted above, there are other existing datasets which could support useful alternative estimates of annual interactions but only one such estimate can be offered here: The 2008 SBLOP and RFOP data suggest a take rate of 1 per 131 sets, compared to 1 per 31 for the 18 months ending in December 2007. For an initial estimate, it may be assumed that the distribution of observed trips across the fishery remained constant across those years, while the total reef-fish longline effort in the Gulf did not change. With those

assumptions, the estimated “take” in 2008 would be 31 / 131 that in 2006–07 or about 150.

Combining these various estimates suggests annual hard-shell turtle takes by reef-fish longline gear of zero (1994–95), 40 (2001–04), 600 (2006–07) and 150 (2008). It is certain that the true number varies from year to year and it is possible that that variation includes a gradual increase over time. It is, however, most unlikely that the true number of takes spiked upwards in the middle of this decade, increasing by an order of magnitude, before dropping back by 75%. It is sure that no analysis could demonstrate such a spike, with any reasonable confidence, given the limited available data. In any case, for management purposes, it would be better to estimate a long-term average annual take, perhaps weighted towards more recent observations. That is the only number that has value for management purposes as measures to protect turtles cannot be adjusted annually in advance of data on take rates each year.

A simple average of the four above estimates would be very close to 200. While that is an extremely uncertain estimate, I suggest that it is indicative of the typical number of annual takes by the reef-fish longliners in the Gulf.

NMFS (2005) estimated that about half of the turtles captured on reef-fish gear would survive the experience. Detailed records of the 18 interactions observed by SBLOP and RFOP during July 2006 through December 2007 (tabulated by NMFS 2008) suggests that that estimate was about right. Eight turtles were released alive and six were recorded as “dead / unresponsive”, while the state of the remaining four is unknown. Some comatose animals may have recovered but there will be some post-release losses of turtles that were active when returned to the water.

Of the 18 observed “takes”, data on curved carapace lengths are available for only six turtles. Those were 61, 73, 74, 77, 81 and 93 cm respectively. The length at sexual maturity of female Florida loggerheads is taken to be 87 cm (Bjorndal *et al.* 2000, NMFS & USFWS 2008), hence five of the six with recorded lengths were immature sub-adults. The data are clearly inadequate for determining the proportion of mature animals amongst the turtles which interact with reef-fish longline gear but a first estimate might be 20%.

The sexes of the turtles taken are unknown, since their sex cannot be determined in the field. They might be all male, all female, an equal mixture around or any unequal mixture.

Thus, the annual fleet-wide loggerhead “take” by the reef-fish longliners might be the 600 estimated by NMFS (2008) or the 200 suggested here. The corresponding estimates of numbers killed annually would be half of the “take” – 300 or 100. The numbers of adults killed can thus be very imprecisely estimated at either 60 or 20, with the number of adult females being no higher and perhaps much lower. Those estimates are clearly very uncertain and would be better expressed in rather more vague terms. It might be best to

say that the reef-fish longliners kill a dozen or a few dozen adult loggerhead per year and a total of a hundred or a few hundred turtles.

Context

The death, or even disturbance short of death, of a single turtle is a matter of concern but loggerhead are a threatened species, not a critically endangered one. While the different causes of death are cumulative and every extra death slows recovery, loggerhead will not be driven to extinction by one more death, nor by an additional dozen or hundred deaths. Thus, it is important to consider the dozens or hundreds killed by reef-fish longliners in some context.

Lewison *et al.* (2004) compiled the first global assessment of losses of turtles to fishing. They concluded that pelagic longliners kill in excess of 200,000 loggerhead annually, with the estimate for the Atlantic alone being at least 150,000. With the Florida beaches the only major loggerhead nesting ground left in the Atlantic basin, most of those 150,000 will have come from the same populations as are vulnerable to the Gulf of Mexico reef-fish longliners². Additional turtles are caught by other fishing gears, including trawls and gillnets (NMFS & USFWS 2008). As recently as 2002, it was estimated that the shrimp fisheries of the southeastern U.S. were taking over 160,000 loggerhead annually, with more than 60,000 of them being killed. The introduction of TEDs was expected to increase the number of interactions but to reduce fatalities to some 4,000 annually (Epperly *et al.* 2002). The numbers taken by that fishery have indeed been much reduced by conservation measures and by the downsizing of the shrimp industry but they remain considerable. Putting all of those numbers together, it can be said that the reef-fish longline fleet is responsible for very roughly 0.1% of loggerhead losses to fishing.

Almost the only quantitative data on trends in the loggerhead populations of the western Atlantic population of loggerheads comes from annual surveys of nests on beaches in the southeastern U.S. Nest numbers in the “Northern Recovery Unit” (Georgia to Virginia) have been declining slowly for a quarter century. Numbers on the Dry Tortugas appear to be trending down also, though the decline is not yet statistically significant (NMFS & USFWS 2008). By far the greatest number of nests, however, are in the “Peninsular Florida Recovery Unit”. A standard set of index beaches (representing nearly 70% of the loggerhead nests in the State) has been routinely surveyed by FWRI since 1989. For the first decade, the data suggested a slow but encouraging upward trend. However, between 1998 and 2004 the estimates dropped from above 60,000 to below 30,000. Averaging the

² Curiously, the current draft of the *Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle* cites Lewison *et al.* (2004) and has one author in common with that paper, yet offers an estimate (its Table A2-1) of losses to pelagic longliners of “only” 30,000.

Because the pelagic longline fisheries mostly operate in oceanic waters, they tend to take smaller and younger turtles than those taken in coastal waters. In terms of their reproductive potential, one turtle caught on a reef-fish longline is perhaps “worth” about eight taken on pelagic longlines.

estimates for a few years at either end of that decline suggests that nest numbers fell by about 25,000 over a period of five to ten years. Through to the 2007 survey, the estimates continued to decline but the 2008 data suggest a “recovery” to some 40,000 nests³. Whether that was an anomalously-high estimate or an indication of the beginning of a new resurgence cannot be known for a few years.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Annual Total Nest Counts for Loggerheads on Florida Index Beaches

A recent and, as yet, unpublished study by FWRI scientists (Witherington *et al.* 2009) has concluded that the fall in estimated numbers of nests resulted from a decline in the numbers of adult females, with bycatch in fisheries being seen as the most likely cause of the deaths. Adult female loggerhead do not nest every year but, when they do, they make multiple nests. They average about one nesting season per three years and 4 nests per season (NMFS & USFWS 2008). The 25,000 fall in estimated nest numbers on the index beaches thus equates to a loss of about 19,000 adult females from the population –or nearly 2,000 per year for a decade– which is over and above the normal rate of deaths that is balanced by recruitment of juveniles reaching maturity.

In contrast to that troubling rate of loss, the reef-fish longline fishery likely kills around a dozen adult female loggerhead annually. If NMFS’s (2008) estimate of 600 “takes” per year were thought to be representative of the normal performance of the fishery (which would contradict all available data aside from the SBLOP and RFOP records from one selected 18-month period) and if all the adult loggerhead caught were assumed to be

³ http://research.myfwc.com/features/view_article.asp?id=27537

females, the number killed annually might be five dozen. Those alternative estimates represent an insignificant 0.5% and 3% respectively of the rate of decline in nesting females.

Conclusion

Where threatened species are concerned, no losses should be taken lightly and all practicable means of reducing the number of loggerhead caught on reef-fish longlines, as well as the proportion of those caught which die as, must be taken – as the Magnuson-Stevens Act requires. However, reef-fish longlining is only a very minor contributor to the range of threats facing the loggerhead. Besides the many other causes of death, this one fishery accounts for perhaps 0.1% of loggerhead killed by fisheries. It may have been responsible for 0.5% of the loss of breeding females from the Florida beaches in the past decade. While those estimates are necessarily highly uncertain, they are sufficient to show that reef-fish longlining is only a distraction from the real causes of the serious declines in the loggerhead populations.

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