

Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, FL 33702
(727) 570-5312, FAX 570-5517

F/SER3:EGH

Mr. David A. Balton
Director, Office of Marine Conservation
OES/OMC Room 5806
U.S. Department of State
Washington, D.C. 20520

RE: Recommendation for an Exemption to Allow 6-Inch Bar Spacing on Costa Rican Shrimp Trawlers' Turtle Excluder Devices (TEDs)

Dear Mr. Balton:

Costa Rica was first certified as adopting a national TED program in 1996. In 1997, the Government of Costa Rica (GOCR) approached the U.S. Government via its embassy in San José, requesting that shrimp trawlers operating in Costa Rican waters be exempted from the U.S. TED-requirement which authorizes a maximum permissible spacing of 4 inches between the deflector bars. On February 11, 1997, the GOCR Fisheries Ministry (INCOPECSA) presented a formal request to the United States for permission to modify TEDs by shrimpers in Costa Rican waters to allow 8-inch bar spacing. INCOPECSA supported its request with limited shrimp trawl fishery observer data gathered by an independent biologist affiliated with the University of Costa Rica and Earth Island Institute, Mr. Randall Arauz. GOCR and biologist Arauz concluded that his 1996 summary analysis of four studies (Rice 1973; Power and Moertel 1980; Arauz 1994; Arauz *et. al* 1996) which recorded 194 incidental takes of sea turtles by Costa Rican shrimp trawlers from 1973 to 1996, proved conclusively from measurements taken on all 194 sea turtles captured that "only adult sea turtles occur," predominantly olive ridleys (Arauz 1996).

NMFS reviewed the INCOPECSA/Arauz data and concluded that there was insufficient information to authorize a bar spacing increase to 8 inches. NMFS biologists from the Pascagoula Laboratory and the Southeast Regional Office then worked with the INCOPECSA Chief of Research, biologist Mr. Antonio Porrás, to review his design of a study which could gather the minimum amount of data required to determine if Costa Rican sea turtles would be adversely affected by a proposed bar-spacing increase. It was determined that the study should consist of at least 20 observed trawls in which the vessel deployed two shrimp trawl nets,

simultaneously fishing one naked net (no TED installed) as the control net and an experimental net with a TED of 6-inch bar spacing installed.

Between October 16 and November 7, 1998, INCOPECSA biologists aboard a commercial shrimp vessel carried out the study of the effects of 8-inch bar spacing, completing 65 successful paired tows using a naked net and an 8-inch TED net (Borras 1999). Between October 21, 1998 and January 28, 1999, the study was repeated and consisted of 60 successful paired tows using a naked net and an 6-inch TED net (Araya 1999). Both studies replicated normal fishing conditions (tow times averaged approximately 4.7 hours) on traditional Costa Rican shrimping grounds for white, pink, and brown shrimps. The tows were carried out by commercial fishermen on their own vessels selecting their own trawl sites, times, and trawl durations. The reports resulting from the studies were transmitted electronically in Spanish to the NMFS Southeast Regional Office (SERO) on June 25, 1999 and were immediately forwarded to your office for translation. Official Department of State translations were received by NMFS on September 10, 1999. Incidental turtle captures during the INCOPECSA studies are comparable with Arauz' (1996) data showing very high capture rates of olive ridleys when fishing for pink shrimp, *Penaeus brevirostris*, (0.2-0.6 turtles/hr) at 25-45 fathoms while catch rates in shallow waters are considerably lower (0.06 turtles/hr). Turtles are also apparently caught by Costa Rican shrimpers at depths of 70-80 fathoms but "never beyond 100 fathoms" (Arauz pers. comm. 1996a).

The INCOPECSA studies incorporated more than the required minimum number of tows to obtain statistically significant comparisons of shrimp and fish capture in the naked nets compared to the experimental (i.e., TED) nets. As well, the data on incidental capture of turtles, at first glance, supported Costa Rica's request for an increased bar spacing of up to 6 inches, but not for an increase to 8 inches as requested. NMFS believed that it would be prudent and valuable to gather additional data on size and species of sea turtle frequenting Costa Rican waters. At the time, a fisheries research vessel, the NOAA Ship DAVID STARR JORDAN, was operating in the Eastern Tropical Pacific, including coastal and pelagic waters off Central America. NMFS decided to wait for the data on sea turtle captures that NMFS scientists aboard the vessel were gathering and would provide at the end of the cruise, to supplement the INCOPECSA/Arauz trawl data and other trawl data sets. The DAVID STARR JORDAN data, consisting entirely of olive ridley captures (N=99 *Lepidochelys olivacea*), were received by NMFS on January 13, 2000 (Kopistky, Pitman and Dutton, in prep., 2000).

As a result of the subsequent NMFS statistical analyses on the available sea turtle data sets, NMFS has determined that a 6-inch bar spacing will not adversely affect Costa Rican sea turtle populations. NMFS bases these conclusions on statistical analyses conducted by the NMFS Pascagoula Laboratory (Dr. Arvind Shah and John Mitchell) on 113 turtles (with body depth 6-inches or greater) from the DAVID STARR JORDAN survey data (N=98) and INCOPECSA bar spacing studies (N=15). These analyses support the conclusion that *fewer than 3% of turtles*, of

any species, captured by the Costa Rican shrimp trawler fleet will be susceptible to capture by 6-inch TEDs (i.e., will pass through the bars of a 6-inch TED).

Analyses were conducted on 114 turtles, all olive ridleys, for which body depth data was available from the DAVID STARR JORDAN (N=99) and INCOPECA studies (N=15). NMFS did not use the additional trawl data capture sets available because they did not include body depths and the NMFS predictive equation to extrapolate body depth was not adequate (i.e., the resultant equation was not a strong predictor of olive ridley body depth due to significant variability in body depth for a given carapace length and the absence of small turtles in the data). Sea turtles captured offshore by the DAVID STARR JORDAN included one hatchling (body depth 2.7 inches).

Using the exact test for one proportion and including the hatchling in the data set analyzed (N=114) resulted in *non rejection* of the null hypothesis that there are 3% or more turtles with carapace depths of 6 inches or less in Costa Rican waters (p value = 0.140) and thus susceptible to passing through the bars of a 6-inch TED. Thus, there is a lack of evidence to conclude that Costa Rica has fewer than 3% small turtles in their population, and thus their 6-inch TED would *not* be as efficient as NMFS' (which has a sea turtle exclusion rate of 97%) and hence exemption must be denied.

However, NMFS has opted to reject the lone data point of the incidentally taken offshore olive ridley hatchling. Available data and anecdotal evidence indicate that hatchlings and juveniles, because of their pelagic lifestyles, are unlikely to be encountered and are uncharacteristic of the turtle populations found on Costa Rican shrimping grounds (Arauz 1996; Arauz, pers. comm. 1996a; Pritchard 1997).

Using the exact test for one proportion and excluding the hatchling from the data set analyzed (i.e., N=113) resulted in *rejection* of the null hypothesis that there are 3% or more turtles with carapace depths of 6 inches or less in Costa Rican waters (p value = 0.032). This p value would be even *lower* if the other trawl capture data sets totaling 194 sea turtles (N=57, Rice 1973; N=18, Power and Moertel 1980; and N=119, Arauz 1994 and 1996) had been included in the analysis; however, they were excluded because body depths were not provided.

Nesting beach data from turtles nesting on the Costa Rican beaches of Ostional and Nancite, provided by Arauz and Ballesterro (1997) (N=132) and Kalb (1999a, unpublished) (N=445), respectively, were excluded from the data set analyzed, *though shrimp trawlers operating nearshore of Costa Rican nesting beaches incidentally capture and drown significant numbers of females* (Kalb, pers. comm. 1999). NMFS excluded nesting females from the analyses out of concern that the true range of turtle sizes in Costa Rican waters susceptible to trawling might not be accurately represented with those data sets included—i.e., the narrow age-size distribution of sexually mature nesting female olive ridleys might bias the statistical analyses. Nevertheless,

NMFS SERO analysis of nesting data provided by Arauz and Ballestero from Ostional indicates that greater than 99% of females nesting there will have body depths greater than (or equal to) 7 inches, and thus will *not* be adversely affected by the proposed increase in bar spacing to 6 inches, but could be adversely affected by an increase to 8-inch bar spacing. The same conclusion holds true for Nancite beach nesters: analysis of Kalb's (1999a) data shows a mean (N=445) curved carapace length *greater* than the mean (N=132) curved carapace length of Ostional nesters, implying a *larger* overall size for Nancite nesters and hence less susceptibility to potential adverse effects of 6-inch bar spacing.

During INCOPECA's 6-inch and 8-inch TED studies from October 1998 through January 1999, 15 turtles were taken, all *Lepidochelys olivacea*. As well, all DAVID STARR JORDAN turtle captures during the ship's transect line surveys in the Eastern Tropical Pacific were olive ridleys. However, NMFS analyses also considered the possibility of sea turtle captures of species other than *L. olivacea*. Arauz's 1996 summary data showed incidental captures of Eastern Pacific green turtles (*Chelonia agassizi*) as well. Arauz's summary data of sea turtle captures (N=194) during commercial shrimping operations off Costa Rica between 1973 and 1996 lists 14 *Chelonia agassizi* captures and 180 *Lepidochelys olivacea* captures. Hawksbills (*Eretmochelys imbricata*) are only rarely taken (approximately 0.5% percent of turtle captures) (Arauz, pers. comm. 1999).

NMFS analyzed these 14 trawl-captured green turtles, applying a predictive equation derived by NMFS Southeast Fisheries Science Center scientists (Epperly and Teas 1999) to the *smallest* green taken, to convert known body length and width to body depth; the result was that the smallest trawl captured green turtle on record had a calculated body depth of approximately 6.9 inches (Mitchell, pers. comm. 2000). Based on this, NMFS believes that green sea turtles in Costa Rican waters are unlikely to be adversely affected by increasing allowable TED bar spacing to 6 inches. Hawksbill sea turtles, *Eretmochelys imbricata*, are so rarely encountered that they are also unlikely to be adversely affected.

In summary, based on the NMFS review and statistical analysis of GOCR data on the range of sea turtle sizes captured during shrimp trawling operations, NMFS believes that an increase in the maximum spacing between deflector bars from 4 inches is justified.

Considerations When Building 6-Inch TEDs:

NMFS has no experience regarding the durability of a 6-inch, single grid TED design. With a reduction in the number of deflector bars from the standard 4-inch TED, the primary design concern with a 6-inch TED is structural soundness. The design and construction of the 6-inch NMFS TED was much different than the single grid style TEDs which are predominant in the U.S. shrimping industry today. The NMFS TED design was exceptionally durable because it was constructed from steel pipe and had a box-like frame. Frame distortion and bend deflector bars were not observed during commercial evaluations. However, the heavy construction of the

NMFS TED ultimately caused it to lose favor with the shrimping industry because of handling problems. Single grid TEDs were easier to handle on deck and cheaper to build, thus they became the industry's TED of choice. NMFS developed construction criteria for 4-inch, single grid TEDs based on commercial evaluations of a variety of designs and materials. While single grid, steel pipe TEDs have been used by U.S. fishermen, they are not popular owing to their excessive weight. In addition to handling problems, these TEDs require substantial flotation in order to prevent chafing on the sea floor while fishing.

NMFS Pascagoula Laboratory, Harvesting Systems and Engineering Branch (HSEB), advises that in order to ensure rigidity, a 6-inch TED constructed from steel pipe or solid steel rod would need to be built from stock with a minimum material diameter of 0.75 inches (1.9 cm). The weight of such a TED would exceed 30 pounds (13.6 kg). In addition to the handling problems, if such a device were fished in a bottom opening configuration it would require significant flotation to ensure seafloor clearance and turtle exclusion. The amount of flotation required would be in excess of that which is currently required by U.S. regulations. Without conducting NMFS standard methods of evaluating the fishing configuration of a new TED design, including a determination of the amount of flotation necessary to sufficiently maintain bottom clearance of such a TED, NMFS cannot endorse its use.

Insuring Optimum Performance of a 6-Inch TED:

Contrary to what some fishermen believe, TEDs work best for turtles and shrimp when the exit hole and flap are oversized so that large objects can slide out of the device easily. After reviewing the GOCR turtle data, it is clear that large adult turtles are the primary size class which are encountered by shrimp trawlers. Additionally, Costa Rican fishermen have expressed their desire for a greater than 4-inch TED because of excessive bottom debris encountered on the fishing grounds. U.S. fishermen who have been required to use a larger than normal escape opening due to high leatherback sea turtle concentrations have reported improved shrimp retention and cleaner catches (see attached Instructions for Leatherback Turtle Escape Opening, Single Grid Hard TEDs). NMFS has developed a simple procedure for installation of the leatherback flap modification on many different TED styles.

Unresolved Concerns:

NMFS experience with TEDs greater than 4-inch bar spacing is limited. During the early 1980s, turtle exclusion evaluations of a 6-inch NMFS TED design were conducted. The NMFS TED design was a top opening, hooped frame with a hinged door. While the 6-inch NMFS TED worked well for the exclusion of large turtles, it was not evaluated extensively and therefore a limited range of turtle sizes were encountered. Additionally, the NMFS TED was a top opening design, which subsequent TED testing has shown is superior to a bottom opening TED in excluding turtles. Thus, NMFS has no experience with which to provide comment on the turtle exclusion performance of a bottom opening TED with greater than 4-inch bar spacing. Based on many hours of underwater observations of turtles attempting escape through a 4-inch TED,

NMFS knows that turtles use their flippers to push against the deflector bars in order to maneuver toward the escape hole. This type of behavior is increased when turtles attempt to escape through a bottom opening TED. Because a 6-inch TED will have fewer deflector bars, hence less surface area for turtles to contact with their flippers, NMFS is concerned about the potential negative effect this may have on turtle exclusion in a bottom opening TED.

If a 6-inch bar-spacing is to be allowed by GOCCR, then other associated TED design regulations, including construction standards, escape opening sizes and flotation, should also be changed by GOCCR to ensure that the TEDs will work. TEDs must remain sufficiently strong to withstand commercial shrimp trawling operations, and must effectively exclude the excess debris that is the claimed justification for wider bar spacing. For example: 1) Construction materials: Steel rod should not be allowed. Thin steel rod is not strong enough and thick steel rod makes the TEDs excessively heavy, making them dangerous when swinging above the deck in heavy seas and requiring excessive amounts of flotation to keep them from riding hard/chafing on the sea bottom; 2) Grid size: Larger grid size is necessary, as grids 30 inches or smaller would have only 4 bars; minimum grid size should be 32 inches so that there will be at least 5 bars per grid for greater TED strength and for better turtle (and debris) exclusion (small grids will clog even with wider bar-spacing); 3) Escape openings: Larger escape openings (35 inches by 16 inches) are necessary to increase turtles' chances of escaping from the net since turtles will have a more difficult time navigating on and pushing themselves off from the wider bars; 4) Flotation: The necessary minimum amounts of flotation must be required to keep the new, heavier, 6-inch designs from dragging across the sea bottom (thus impeding turtles from escaping bottom opening TEDs); 5) Bottom opening TEDs should be discouraged in favor of top opening TEDs.

NMFS strongly believes that GOCCR has a fundamental stake in and should be required to develop its own comprehensive TED regulations, including the 6-inch bar spacing. GOCCR should not simply follow the U.S. regulations. The interest in Costa Rica for wider bar spacing stems in large measure from other technical problems that the fishermen there have been unwilling to hear about or deal with wholeheartedly or effectively because they have gotten fixated on, and convinced that, wider bar spacing is the answer to all their problems. It is unlikely that 6-inch bar spacing will satisfy them for long. If GOCCR does not simultaneously (or fails to) address those technical problems as well, preferably via new regulations, it will render the wider bar spacing useless.

Recommendations:

1. NMFS recommends that the exemption to the GOCCR initially be granted on a *provisional* basis, for a 2-year period, during which time additional data on incidental capture rates of sea turtles with 6-inch TEDs should be gathered by INCOPECSA (and independent) observers. At the end of the 2-year period, INCOPECSA should prepare a report for NMFS with the results of their findings. If the findings are as expected (that 6-inch spacing is not harmful to turtles), NMFS would issue a letter recommending that the exemption be permanent.

2. NMFS recommends that, at a minimum, 5% of the active Costa Rican commercial shrimp trawler fleet be monitored by INCOPESCA-approved observers during the aforementioned 2-year period, to document and gather data on any incidental captures of sea turtles by trawlers using 6-inch TEDs.
3. NMFS recommends that INCOPESCA advise Costa Rican shrimpers to switch all their TEDs to the top opening configuration, as NMFS believes this will help minimize shrimp loss through the turtle escape opening.
4. Concomitant with the authorization of a 6-inch TED, NMFS strongly urges the GOOCR to promote/require the use of the leatherback TED modification to ensure maximum protection of sea turtles and to improve the overall performance of TEDs in the Costa Rican shrimp fishery.
5. NMFS very strongly recommends *against* construction of a 6-inch, single grid TED from steel pipe or solid steel rod and has developed the following construction guidelines (*recommended requirements*) for a 6-inch, single grid TED frame which incorporate the need for durability while keeping the TED frame weight to a minimum (see 4 attached schematics of 6-inch aluminum TEDs):

TYPE 1

- Construction material: Solid aluminum rod, minimum outside diameter of 0.75 inches (1.9 cm)
- Frame requirements: Minimum outside diameter = 34.5 inches (87.6 cm)
 Minimum number of deflector bars = 4
 Maximum space between deflector bars, and deflector bars and outer frame = 6 inches (15.2 cm)

TYPE 2

- Construction material: Hollow aluminum pipe, minimum outside diameter of 1.5 inches (3.8 cm) and a minimum wall thickness of 1/8-inch (0.32 cm)
- Frame requirements: Minimum number of deflector bars = 4
 Maximum space between deflector bars, and deflector bars and outer frame = 6 inches (15.2 cm)

Conclusion:

Based on the NMFS review and statistical analysis of GOOCR data on the range of sea turtle sizes captured during shrimp trawling operations, NMFS believes that an increase in the maximum spacing between deflector bars from 4 inches is justified. NMFS Harvesting and Systems Branch gear specialists from the Pascagoula Laboratory have studied the technical issues associated with wider bar spacing than the 4-inch spacing mandated for U.S. shrimp trawlers. NMFS believes that 6-inch spacing will work safely, based on: 1) the original testing conducted by NMFS with the 6-inch NMFS TED (a top opening design); and 2) the sea turtle size data available. Drawing from NMFS TED testing experience under commercial and experimental conditions, and in consideration of the GOOCR data, NMFS supports an increase in the maximum spacing between the TED deflector bars to 6 inches. NMFS recommends that an exemption be granted to the GOOCR to allow shrimpers operating in Costa Rican waters to use TEDs with a maximum of 6-inch bar spacing, *contingent upon guidelines to be implemented and enforced by the GOOCR that require the use of stronger construction standards than those required of U.S. 4-inch TEDs.*

In response to GOOCR's request for a bar spacing of 8 inches, NMFS gear specialists believe that a bar spacing wider than 6 inches may not work for technical reasons, even if the turtle body depths were even larger, based on observations of turtles in trawls and their need to have hard surfaces to maneuver on to find exit, increased difficulty of escaping if too many extremities go between the bars, and structural problems with wider bar-spacing (i.e., weakening of TEDs).

If you have any questions on our conclusions or recommendations, please contact me at 301/713-1401, Charles Oravetz or Eric Hawk at 727/570-5312, or John Mitchell at 228/762-4591.

Sincerely,

Donald R. Knowles
Director, Office of Protected Resources

Attachments (5)

cc: F/SEC4 - J. Mitchell, A. Shah
DOS OMC - D. Hogan
INCOPECA - H. Nanné, R. Gutiérrez
Sea Turtle Restoration Project - R. Arauz

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