



NOAA Technical Memorandum NMFS-NE-222

**Serious Injury and Mortality
Determinations for Sea Turtles in
US Northeast and Mid-Atlantic
Fishing Gear, 2006-2010**

**US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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Serious Injury and Mortality Determinations for Sea Turtles in US Northeast and Mid-Atlantic Fishing Gear, 2006-2010

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EXECUTIVE SUMMARY

The NMFS Northeast Sea Turtle Serious Injury Workgroup reviewed all sea turtle interactions recorded by the Northeast Fisheries Observer Program from 2006 to 2010 (n=145). The workgroup first determined if each interaction was fresh and then placed the affected turtle into one of three injury categories with associated postrelease mortality rates or provided justification for a 100% mortality determination according to the “Technical Working Guidelines for Assessing Injuries of Sea Turtles Observed in Northeast Region Fishing Gear” (Upton 2011). Sea turtle records were subsequently delineated by major gear type, resulting in 97 trawl records, 29 gillnet records, and 11 dredge records for which injury determinations were made. In addition, three cases had insufficient information to make a determination, two records described moderately to severely decomposed animals not attributable to the observed fishery, and three records were excluded because of confidentiality issues. Considering the 137 records with injury determinations, the resulting mortality rate for observable interactions in trawl gear is 47%, for gillnet gear is 58%, and for dredge gear is 80%. Additional factors that may influence sea turtle serious injury and mortality were considered, such as specific fishery (within an encompassing gear type), geographical area, sea turtle species, and life stage.

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NMFS NORTHEAST SEA TURTLE SERIOUS INJURY WORKGROUP

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BACKGROUND

In 2003 the National Marine Fisheries Service (NMFS) Northeast Regional Office (NERO) initiated an assessment of injuries to sea turtles from interactions with Atlantic sea scallop dredge gear. Based on a review of various types of observed sea turtle injuries in scallop dredge gear, NMFS NERO developed guidance for determining which injury types should be considered lethal or nonlethal interactions. That guidance was then applied to observed sea turtle captures in scallop dredge gear, with the results used in Endangered Species Act (ESA) section 7 consultations regarding the impact of the fishery on sea turtles.

After this guidance was prepared and applied to the scallop dredge fishery, it became apparent that consistent injury criteria were needed for all other fishing gear and sea turtle injury types. Therefore, in November 2009, the NMFS NERO and Northeast Fisheries Science Center (NEFSC) hosted a workshop to discuss sea turtle injuries in the Northeast Region (NER) fishing gear and associated postrelease survival (Upite 2011). The workshop convened various experts in sea turtle veterinary medicine, health assessment, anatomy, and/or rehabilitation to: (1) discuss case studies of sea turtles caught in fishing gear with varying levels of injuries, (2) critique the existing NMFS guidance and approach for evaluating postrelease survival, and (3) comment on the level of information collected by observers. Workshop participants discussed types of sea turtle injuries and associated survival, turtle behavior, and resuscitation, as well as specific information that should be collected by observers to better assess sea turtle injuries. The information gathered from individual participants at this workshop was then used by NMFS to develop “Technical Guidelines” for assessing sea turtle injuries in Northeast fishing gear (Appendix A). Those Technical Guidelines were then applied by the NMFS Northeast Sea Turtle Serious Injury Workgroup in review of all sea turtle interactions recorded by the Northeast Fisheries Observer Program (NEFOP) from 2006 to 2010 (n=145). The results of that review are provided here.

METHODS

The scope of the review of observed sea turtle interactions was determined to be 5 years, 2006 to 2010. The scope was also limited to only fisheries found in the NMFS NER (Maine through Virginia¹), excluding the longline fishery, which has a separate postinteraction mortality

¹ While the NMFS Northeast Region includes Maine through Virginia, the Northeast Fisheries Observer Program extends observer coverage into portions of North Carolina, and the NEFSC sea turtle bycatch estimates also include portions of North Carolina.

assessment (Ryder et al. 2006). This resulted in 145 sea turtle observer records. This time period was chosen to focus on recent records and to provide a sufficient sample size for review and determination.

Workgroup members reviewed each observer record and made independent injury determinations, which were then compared and discussed to come up with consensus determinations for each record. To carry out the reviews, a spreadsheet with a unique identifier for each observer record was distributed to each workgroup member. The workgroup members were granted access to the NEFOP database and individually evaluated all of the information available for each sea turtle record. Available information included the turtle capture photos, data, and observer comments included on the vessel and trip information logs, incidental take logs, sea turtle biological sample logs, and any preexisting veterinarian comments (not available for all records). Each member first determined if the turtle capture was “fresh,” by using the guidance in Upite (2011) and expert opinion. If fresh, then each member used the Technical Guidelines to evaluate any injuries and to place the turtle into one of the three categories with identified postrelease mortality rates or to provide justification for a 100% mortality determination. Note that all observer records were reviewed by four of the workgroup members; one member was unable to complete the review in the necessary time frame because of travel and other commitments. However, he had previously reviewed several of the records in his role as a contract veterinarian to the NEFOP, so his previous determinations were considered in the workgroup discussions.

After the individual determinations were made and sent to the NERO staff contact, the records were reviewed for consistency. For the majority of the cases, the initial injury determinations were consistent among members. The records with inconsistent determinations between workgroup members were flagged, and the workgroup members reviewed the case information again. Workgroup members then provided additional justification for their injury category determination, or modified their original determination as appropriate. After workgroup discussion and review occurred, consensus was reached for all cases.

Percent probability of mortality was calculated based on the Technical Guidelines (Upite 2011). Briefly, those animals in Category I were considered to have a 20% probability of postrelease mortality based upon their capture condition and assessment, animals in Category II had a 50% probability of postrelease mortality, and animals in Category III had a 80% probability of postrelease mortality. Turtles believed to be dead after the workgroup’s review (based upon observer logs and comments) or released into the water in an unresponsive state were given a 100% mortality rate. For applicability to subsequent management actions, the records were organized by major gear type.

Additional factors that may influence sea turtle serious injury and mortality were considered; however, substantial biases in the dataset precluded meaningful statistical comparisons. Nonetheless, key characteristics, such as specific fishery (within an encompassing gear type), geographical area, sea turtle species, and life stage, are included here to provide a detailed description of the dataset. It should also be noted that observer effort was not always evenly distributed. In some cases, there may have been focused effort in a particular area or fishery, which will be noticeable in the results.

Delineation of fishery within a gear type was based on the primary landed fish species by weight, as recorded by fishery observers. This approach recognizes that gear and environmental factors affect sea turtle incidental captures. The primary landed species was determined to be a better proxy for the actual fishery instead of trip or haul target, as the target recorded may not

reflect the fish species actually caught on the trip. For the purposes of this report, the primary landed fish species by weight is used synonymously with “fishery.”

The workgroup referred to the NMFS Northeast statistical areas to help describe geographic distribution (Appendix B). Sea turtle records were grouped by statistical area, which was calculated by the latitude/longitude position at the beginning of the haul for fixed gear, at the end of the haul for mobile gear, or at the sighting position as recorded on the observer logs.

Probability of mortality was considered the same for all sea turtle species based on the Technical Guidelines (Upton 2011); however, this recommendation was based on insufficient data to support species differences. Data for individual species were considered to detect any differences in injury category that would warrant further consideration of this approach.

The sizes of the observed turtles were evaluated to determine if one life stage was being disproportionately affected or if injury rate varied by life stage. For instance, would smaller sea turtles be more susceptible to serious injury (e.g., Category III or 100% mortality) when compared to larger/adult sea turtles? Categorization by size class was largely limited to loggerheads (*Caretta caretta*), given the predominance of this species in the records reviewed. Curved carapace length² (CCL) was measured by onboard fishery observers, and the workgroup made the assumption that all of the recorded sizes were accurate. Size class categories were developed from the 2008 loggerhead recovery plan (NMFS and USFWS 2008) but were modified so that individuals could be assigned into mutually exclusive groups (Table 1). These size class definitions are for the purposes of this report and are not intended to imply alteration to size classes defined in the recovery plan for other purposes. Furthermore, the workgroup recognizes that such definitions inevitably result in misclassification of some individuals given the variability in sea turtle life history.

Mortality rates in this report are determined for observable interactions, those that include animals brought on board the fishing vessel or that interact with the gear at the surface (Warden and Murray 2011). Mortality rates may be different for unobservable interactions, which include animals that interact with the gear exclusively subsurface or away from view, due to the design of the gear or the behavior of the animal.

Additional Considerations

Could not be determined

Injury category was not assigned if there was insufficient information on which to base the assessment.

Animals not boarded

There were several cases in which the turtle was not boarded for a variety of reasons (e.g., turtle fell from gear as net was hauled). In these instances, the observer did not engage in a hands-on assessment of the turtle. In some cases, however, observer observations and photographs were sufficient for the workgroup to assign an injury category.

² Curved carapace length of the turtle was measured as the distance between the center of the nuchal scute at the anterior of the carapace and the posterior tip of the longest marginal scute, following the curvature of the dorsal centerline.

Mortality not related to the gear interaction

No injury determination was made for any cases in which the interaction was not attributed to the observed haul/tow/set. For example, a moderately or severely decomposed turtle found in active fishing gear (e.g., trawls or dredges) likely died prior to the interaction, so the mortality was not assigned to the fishery nor considered in the analysis.

Pre-existing condition

The Technical Guidelines state that “[o]ld injuries determined to be unrelated to the current gear interaction or animals subject to adverse environmental conditions will be considered in the overall health assessment/survivability determination of the animal” (Appendix A). By reviewing the observer logs and photographs, the workgroup considered all documented injuries and postrelease condition and behavior of the turtle in making the final determination. It should be noted that the workgroup did review several records in which the existing condition of the animal and environmental conditions (e.g., water temperature upon capture and release) were factored into the injury determination. If a turtle was taken to a rehabilitation center (one record), the determination was made based on condition at capture, not outcome of rehabilitation. This approach was considered a more accurate accounting of real life situations in which a fisherman likely releases a turtle overboard in lieu of contacting a rehabilitation facility.

RESULTS AND DISCUSSION

All 145 observed sea turtle interactions in the NEFOP database from 2006 to 2010 were reviewed, including 97 trawl records, 29 gillnet records, and 11 dredge records for which injury determinations were made. Of the total 145 records, three fishery records were reviewed and injury determinations were made (two loggerheads in Category I; one Kemp’s ridley in Category III), but the results were excluded from this report because of confidentiality issues. There also were three trawl records with insufficient information to make a determination, and two records that described moderately to severely decomposed animals not attributable to the observed interaction.

Table 2 depicts the injury determinations and final mortality rates by gear type, as calculated by the workgroup. Of the total number of records reviewed and for which determinations were made and able to be presented in this report (n=137), the workgroup determined that 50% of the documented interactions were in Category I, 8% in Category II, 23% in Category III, and 19% with a 100% probability of mortality (Table 2). Trawl gear interactions were the most common in each of the injury categories, reflecting the fact that turtles were caught in trawl gear more often than in any other gear type. Scallop dredge interactions resulted in proportionately more Category III determinations (resulting in the highest mortality rate), whereas gillnet records were more evenly split between Category I and 100% mortality. This is not surprising, as a turtle interacting with a gillnet may be less likely to be injured by the gear itself (compared to a scallop dredge for instance), and instead is more likely to be found alive or dead due to forced submergence. It should be noted, however, that injuries, such as constriction wounds, can result from gillnet interactions.

Trawl Gear

The observer database indicates whether the gear in question was fish bottom otter trawl, scallop bottom otter trawl, or twin trawl. There were 92 observed interactions in fish bottom otter trawls, 7 interactions in scallop bottom otter trawls, and 1 interaction in a twin trawl during the 5 year time period reviewed. All trawl gear records were combined for applicability to section 7 consultations and are hereby referred to as “trawl gear.”

After the records with insufficient information were removed, injury category determinations were made for 97 interactions involving trawl gear. Numbers of records by species, injury category, and estimated probability of mortality are provided in Table 3. The resulting mortality rate for observable interactions in trawl gear is 47%.

Table 4 shows the injury category determinations by fishery for observed sea turtles in trawl gear from 2006 to 2010. Observers recorded the highest number of sea turtle interactions in the croaker fishery (64%). In that fishery, Category I determinations ranked the highest (56%), with a relatively even split between Category III (21%) and 100% mortality (18%) determinations. Summer flounder (with most cases in Category I [53%]) ranked second highest, followed by scallop (with most cases in Category I [67%]) and squid (with most cases in Category III [50%]).

For trawls, most of the interactions occurred in Statistical Area 635, off North Carolina, followed by area 621, off Delaware/Maryland (Table 5). Considering only those two areas (one from the most southern extent of the NMFS Northeast Statistical Areas and the other slightly more northward), the highest number of interactions was in Category I, followed by Category III.

In the trawl gear observer records from 2006 to 2010, there were 88 records with sizes noted for loggerheads. Most of the trawl gear interactions involved neritic immature turtles (n=66; Figure 1B). Of these neritic immature turtles, more than half of the records were in Category I. Similarly, Category I determinations ranked the highest in the other two life stages, but there was a more even split between the categories (Figure 1A and 1C). It is possible that this is a reflection of smaller sample sizes in the transitional immature and adult life stages. Overall, it does not appear that one size class is disproportionately affected by trawl gear injuries or mortalities. Note that there were no trawl interactions observed with immature oceanic loggerheads (8.5-46 cm CCL), and sizes were not recorded for three loggerheads.

For non-loggerheads, there were four animals with carapace sizes recorded in trawl gear. Two Kemp’s ridleys were observed with sizes of 27.2 and 33.5 cm CCL, both in Category I. One green with a size of 27.5 cm CCL was determined to be in Category III, and one leatherback with a size of 155 cm CCL was in Category II. All of these cheloniid sea turtles are considered immature, while the leatherback is likely an adult (using the adult size class of >145 cm CCL reported in TEWG 2007).

Gillnet Gear

All records were classified as “sink gillnet, fixed or anchored, other species” in the observer database and will hereby be referred to as “gillnet gear.” For gillnet gear, there were 29 records reviewed from 2006 to 2010. Numbers of records by species, injury category, and estimated probability of mortality are provided in Table 6. The resulting mortality rate for observable interactions in gillnet gear is 58%.

Table 7 shows the injury category determinations by fishery for observed sea turtles in gillnet gear from 2006 to 2010. Observers recorded the highest number of sea turtle interactions

in the southern flounder fishery, with Category I determinations composing more than half of those total interactions (62%).

For gillnet gear, most of the interactions occurred in NMFS Statistical Area 701, which was a result of the high observed bycatch in the southern flounder fishery off North Carolina in 2009 (Table 8). In Area 701, 59% of the records were in Category I compared to 32% of the animals with 100% mortality results.

Green turtles had the highest number of observed gillnet interactions, followed by loggerheads, Kemp's ridleys, leatherbacks, and unknown species (Table 6). This species breakdown is largely driven by the high observed captures in the southern flounder fishery off North Carolina in one year and is not likely reflective of the entire Northeast Region observed species composition. In the gillnet gear observer records from 2006 to 2010, there were 12 turtles with carapace sizes recorded. All of the green turtles measured (7 of 12) were immature animals with a size range of 27.6-34.3 cm CCL. Of these seven turtles, four were determined to have a 100% mortality probability, while two had a 20% mortality probability (Category I), and one had a 50% mortality probability (Category II). For loggerheads, carapace measurements were recorded for only two of the seven animals, and both of these turtles were immature animals (60.6 and 75 cm CCL). One of these turtles was found to have a 100% mortality probability and the other was determined to have a 80% mortality probability (Category III). Measurements were taken for three of the six Kemp's ridleys. The sizes were 27.5, 28, and 29.6 cm CCL, representing immature animals. Two of the Kemp's ridleys were determined to have a 20% mortality probability (Category I), while the other had an 80% mortality probability (Category III).

Dredge Gear

For dredge fishing gear, which only involved scallop dredges, 11 records were reviewed from 2006 to 2010. Numbers of records by species, injury category, and estimated probability of mortality are provided in Table 9. The resulting mortality rate for observable interactions in dredge gear is 80%.

For dredges, the highest number of interactions occurred in NMFS Northeast Statistical Area 615, which is offshore of New Jersey, followed by Area 621 (offshore of Delaware/Maryland) and then Area 626 (offshore of Virginia; Table 10). For most of the areas, the majority of injuries were determined to be Category III.

Loggerheads were the most common species with observed dredge interactions (10 of 11; Table 9). Carapace size measurements were recorded for eight of the loggerheads. The majority of these measured loggerheads were neritic immature turtles (n=6), with one injury determination in Category I, four in Category III and one with 100% mortality. One loggerhead was in the oceanic or neritic transitional phase with a Category III injury determination, and one adult was determined to be in Category III.

Beginning on September 25, 2006, chain mats were required in the scallop dredge fishery, south of 41° 9' N. latitude from May 1 through November 30 (71 FR 50361). Besides one interaction which was before the September 2006 requirement and another interaction that was north of the regulated area, chain mats were used on all of the dredges with observed sea turtle interactions. However, in at least three of the instances, the chain mats were improperly configured.

It should be noted that NMFS, in conjunction with the New England Fishery Management Council (NEFMC), has required a Turtle Deflector Dredge (TDD) in certain

Atlantic sea scallop (*Placopecten magellanicus*) fishery vessels west of 71° W longitude from May through October (77 FR 20728, April 6, 2012). Observations of interactions between turtle carcasses and the TDD suggest that the injury rate of the TDD is lower than a traditional dredge (Smolowitz et al. 2010). The NEFMC has estimated that the TDD dredge with chain mats has a maximum estimated serious injury rate of 28% (New England Fishery Management Council 2011). As such, after the TDD is required to be used (May 1, 2013), the workgroup will need to consider the injury rate calculated for that gear modification in the assessments of future scallop dredge interactions.

Species Differences

The majority of the observed fishery interactions from 2006 to 2010 involved loggerheads. For non-loggerheads, the sample size was too small to develop valid mortality rates for each species by gear type, and there were insufficient data to support species differences. Therefore, data for all species were combined to develop one average mortality rate by gear type (see Table 11 for species comparison). The differences in species survival from the various injuries encountered in NER fishing gear are likely so small that the combined mortality rate is applicable for all species.

CONCLUSION

The NMFS Northeast Sea Turtle Serious Injury Workgroup was convened to evaluate observed fishery sea turtle interactions and to determine which would result in serious injury or mortality. The workgroup considered the 2009 workshop discussion and applied the resulting Technical Guidelines (Upite 2011) while reviewing NEFOP sea turtle interactions from 2006 to 2010. The members first determined if the interaction was fresh, then reviewed any injuries and placed the turtle into one of the three Technical Guidelines categories with the identified postrelease mortality rates, or provided justification for a 100% mortality determination.

As noted, 145 sea turtle interaction records were reviewed. There were three cases with insufficient information to make a determination, and two records that were not attributable to the observed interaction. Injury determinations were made for three additional records, but excluded from this report because of confidentiality issues. The remaining 137 records were subsequently delineated by major gear type, resulting in 97 trawl records, 29 gillnet records, and 11 dredge records for which injury determinations were made. The resulting mortality rate for observable interactions in trawl gear is 47%, in gillnet gear is 58%, and in dredge gear is 80%.

When considering the impact of different fisheries on sea turtle populations, it is important to consider the total magnitude of interactions by gear type. Mortality rates reported in this document can be applied to estimates of observed interactions calculated for each gear type to determine the number of mortalities (i.e., removals from the population). Depending on bycatch rates and total fishing effort, the population level impact from a gear type with a high mortality rate may have the same or smaller impact compared to a gear type with a lower mortality rate.

One of the primary reasons for developing the Technical Guidelines, establishing the sea turtle serious injury workgroup, and reviewing these observer records is the potential use of these data in section 7 consultations, specifically in the development of the lethal and nonlethal incidental take estimates. It is the workgroup's recommendation that the calculated mortality percentages be applied to the observable portion of the total estimated incidental take for the

respective gear types in each Fishery Management Plan managed by the NERO, in order to develop a lethal incidental take estimate by gear type. For those gear types equipped with a bycatch reduction device, which prevent animals from being captured and observed, a separate mortality rate may need to be applied to the portion of interactions that are unobservable, yet quantifiable (Warden and Murray 2011). The workgroup recommends that the best available information be used to identify mortality rates (and lethal incidental take) for observable and unobservable interactions.

The information in this report represents the best assessment of injury and mortality for NEFOP sea turtle observer records from 2006 to 2010. The workgroup intends to review the latest year of sea turtle observer records annually and maintain a rolling 5 year average for gillnet, trawl, and dredge mortality rate calculations. It is possible that future regulations or other changes in interactions may require changes in the workgroup assessment process.

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Table 1. Loggerhead (*Caretta caretta*) size classes used for injury category determinations.

Size class for categorization by injury workgroup	Curved carapace length (cm)
Oceanic phase, immature	8.5-46.0
Transitional phase (oceanic or neritic), immature	46.01-64.0
Neritic phase, immature	64.01-87.0
Adult ³	>87.0

Table 2. The number of sea turtle observer records from 2006 to 2010 in each injury category by gear type, as well as the overall mortality percentage by gear type.

	Category I (20% mortality)	Category II (50% mortality)	Category III (80% mortality)	100% mortality	TOTAL	Overall mortality percentage
<i>Trawl</i>	53	10	22	12	97	47%
<i>Gillnet</i>	14	1	3	11	29	58%
<i>Dredge</i>	1	0	7	3	11	80%
TOTAL	68	11	32	26	137	

Table 3. The number and corresponding injury category of sea turtles observed captured in trawl gear from 2006 to 2010.

	Category I (20% mortality)	Category II (50% mortality)	Category III (80% mortality)	100% mortality	TOTAL	Mortality Percentage
<i>Loggerhead (Caretta caretta)</i>	50	9	17	12	88	
<i>Leatherback (Dermochelys coriacea)</i>	0	1	1	0	2	
<i>Kemp's ridley (Lepidochelys kempii)</i>	2	0	0	0	2	
<i>Green (Chelonia mydas)</i>	0	0	1	0	1	
<i>Unknown</i>	1	0	3	0	4	
TOTAL	53	10	22	12	97	
Percentage of turtles in each category	55%	10%	23%	12%		
Dead turtles (total * mortality %)	10.6	5	17.6	12	45.2	47%

³ The recovery plan has an additional category for adult males (>83 cm CCL), which overlaps with the size range for neritic immature loggerheads (46-87 cm CCL). The workgroup reviewed the available tail photographs of those loggerheads between 83-87 cm CCL to confirm that they should be considered in the immature neritic phase.

Table 4. Number of sea turtle trawl determinations in each category by fishery, 2006-2010.

		<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL
Fishery	<i>Atlantic croaker (Micropogonias undulatus)</i>	35	3	13	11	62
	<i>Horseshoe crab (Merostomata limulidae)</i>	3	0	0	0	3
	<i>Little skate (Leucoraja erinacea)</i>	0	1	0	0	1
	<i>Atlantic sea scallop (Placopecten magellanicus)</i>	4	2	0	0	6
	<i>Smooth dogfish (Mustelus canis)</i>	1	0	0	0	1
	<i>Squid⁴</i>	1	2	3	0	6
	<i>Summer flounder (Paralichthys dentatus)</i>	8	2	4	1	15
	<i>Unassigned</i>	1	0	0	0	1
	<i>Whiting (Merluccius bilinearis or Merluccius albidus)</i>	0	0	1	0	1
	<i>Winter flounder (Pseudopleuronectes americanus)</i>	0	1	0	1	2
	TOTAL	53	10	22	12	97

⁴ For the purposes of this report, the squid fishery includes both longfin inshore squid (*Loligo pealeii*) and northern shortfin squid (*Illex illecebrosus*).

Table 5. Number of sea turtle trawl determinations in each category by NMFS Northeast Statistical Area, 2006-2010.

		<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL
Statistical Area	537	0	0	2	0	2
	539	0	1	1	0	2
	561	0	0	1	0	1
	611	1	1	1	0	3
	615	3	1	0	0	4
	616	1	0	0	0	1
	621	10	2	5	1	18
	622	0	1	0	0	1
	625	2	0	2	1	5
	626	0	0	1	0	1
	631	1	0	0	2	3
	635	31	4	9	6	50
	636	4	0	0	2	6
TOTAL	53	10	22	12	97	

Table 6. The number and corresponding injury category of sea turtles observed captured in gillnet gear from 2006 to 2010.

	<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL	Mortality Percentage
<i>Loggerhead (Caretta caretta)</i>	3	0	2	2	7	
<i>Leatherback (Dermochelys coriacea)</i>	1	0	0	1	2	
<i>Kemp's ridley (Lepidochelys kempii)</i>	4	0	1	1	6	
<i>Green (Chelonia mydas)</i>	6	1	0	5	12	
<i>Unknown</i>	0	0	0	2	2	
TOTAL	14	1	3	11	29	
Percentage of turtles in each category ⁵	48%	3%	10%	38%		
Dead turtles (total * mortality %)	2.8	0.5	2.4	11	16.7	58%

⁵ The combined percentages do not equal 100%, due to rounding.

Table 7. Number of sea turtle gillnet determinations in each category by fishery, 2006-2010.

		<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL
Fishery	<i>Atlantic croaker (Micropogonias undulatus)</i>	0	0	1	0	1
	<i>Monkfish (Lophius americanus)</i>	0	0	1	2	3
	<i>Sandbar shark (Carcharhinus plumbeus)</i>	0	0	0	1	1
	<i>Southern flounder (Paralichthys lethostigma)</i>	13	1	0	7	21
	<i>Spanish mackerel (Scomberomorus maculatus)</i>	1	0	1	0	2
	<i>Winter skate (Leucoraja ocellata)</i>	0	0	0	1	1
	TOTAL	14	1	3	11	29

Table 8. Number of sea turtle gillnet determinations in each category by NMFS Northeast Statistical Areas, 2006-2010.

		<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL
Statistical Area	537	0	0	0	1	1
	612	0	0	0	1	1
	615	0	0	1	1	2
	625	1	0	0	1	2
	635	0	0	1	0	1
	701	13	1	1	7	22
	TOTAL	14	1	3	11	29

Table 9. The number and corresponding injury category of sea turtles observed captured in dredge gear from 2006 to 2010.

	<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL	Mortality Percentage
<i>Loggerhead (Caretta caretta)</i>	1	0	7	2	10	
<i>Leatherback (Dermochelys coriacea)</i>	0	0	0	0	0	
<i>Kemp's ridley (Lepidochelys kempii)</i>	0	0	0	1	1	
<i>Green (Chelonia mydas)</i>	0	0	0	0	0	
<i>Unknown</i>	0	0	0	0	0	
TOTAL	1	0	7	3	11	
Percentage of turtles in each category	9%	0%	64%	27%		
Dead turtles (total * mortality %)	0.2	0	5.6	3	8.8	80%

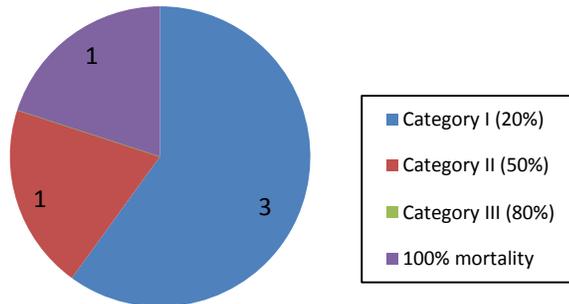
Table 10. Number of sea turtle dredge determinations in each category by NMFS Statistical Area, 2006-2010.

		<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL
Statistical Area	522	0	0	0	1	1
	615	0	0	3	1	4
	621	0	0	2	1	3
	622	0	0	1	0	1
	626	1	0	1	0	2
	TOTAL	1	0	7	3	11

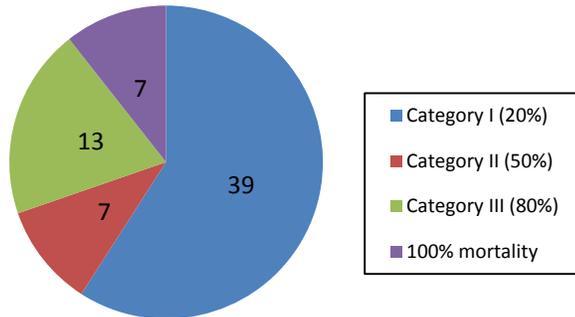
Table 11. Sea turtle determinations in each category by species for all gear types combined, 2006-2010.

	<i>Category I (20% mortality)</i>	<i>Category II (50% mortality)</i>	<i>Category III (80% mortality)</i>	<i>100% mortality</i>	TOTAL
<i>Loggerhead (Caretta caretta)</i>	54	9	26	16	105
<i>Leatherback (Dermochelys coriacea)</i>	1	1	1	1	4
<i>Kemp's ridley (Lepidochelys kempii)</i>	6	0	1	2	9
<i>Green (Chelonia mydas)</i>	6	1	1	5	13
<i>Unknown</i>	1	0	3	2	6
TOTAL	68	11	32	26	137

A. Transitional phase, immature



B. Neritic phase, immature



C. Adults

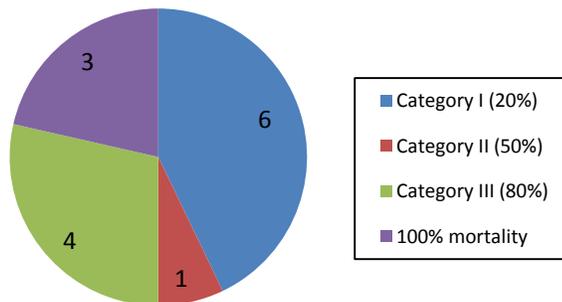


Figure 1. Workgroup size categories and injury determinations for loggerheads (*Caretta caretta*) captured in trawl gear, 2006-2010. (A) Transitional phase (oceanic or neritic), immature loggerheads (46.01-64.0 cm CCL); (B) Neritic phase, immature loggerheads (64.01 - 87.0 cm CCL); (C) Adult loggerheads (>87.0 cm CCL).

APPENDIX A. TECHNICAL WORKING GUIDELINES (FROM UPITE (2011)).

TECHNICAL WORKING GUIDELINES FOR ASSESSING INJURIES OF SEA TURTLES OBSERVED IN NORTHEAST REGION FISHING GEAR⁶

Category I – Low probability of mortality (20% mortality rate)

- Any shell fractures of the area of the marginal scutes, involving less than 50% of width of the underlying peripheral bone
- Superficial abrasions, chips, or scuffs to carapace or plastron
- Minor or superficial injuries to skin
- Animals with no apparent injuries and active normal behavior

Category II – Intermediate probability of mortality (50% mortality rate)

- Any shell fractures of the area of the marginal scutes, involving 50% or more of width of the underlying peripheral bone
- Injuries to flippers (including ligature wounds), which may impair movement or function
- Injuries to one eye
- Lethargic, but becomes active before release

Category III – High probability of mortality (80% mortality rate)

- Any shell fracture, excluding marginals
- Fractures or wounds penetrating the body cavity
- Evidence of bleeding from cloaca, nares, eyes, or oral cavity, unrelated to superficial wounds
- Skull or mandibular fracture
- Injuries to both eyes
- Injuries to neck (including ligature wounds) which affects the spinal cord, major blood vessels, or airway
- Amputation of half or more of one or more flippers
- Any open fracture of major long bones
- Behavioral abnormality, including circling, not using all four flippers appropriately, head tilting, not raising head, not breathing, eyes closed, listing/rolling, lethargic at release, inability to right itself in the water
- Unresponsive⁷, revived, and released
- Any remaining gear left on the animal at release

If an animal is found with multiple injuries in different categories, the animal should be placed in the category encompassing the most severe of the injuries.

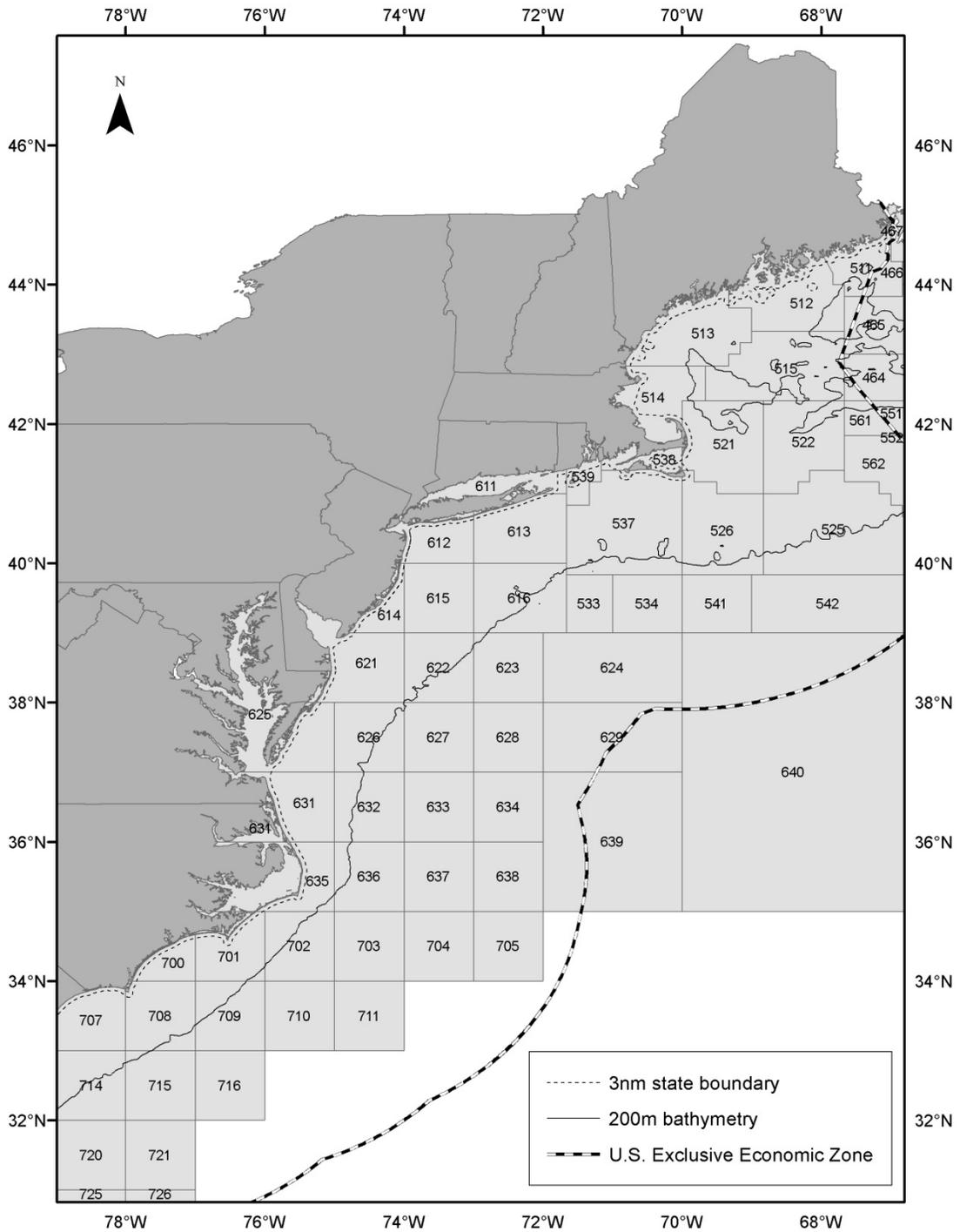
A 100% mortality rate will be assigned to any animal released into the water in a dead or unresponsive state regardless of its condition at first encounter.

Old injuries determined to be unrelated to the current gear interaction or animals subject to adverse environmental conditions will be considered in the overall health assessment/survivability determination of the animal.

⁶For the purposes of this guidance, Northeast Region fishing gear excludes longline gear.

⁷Unresponsive refers to an episode of lack of response to external stimuli at any time. Lack of response criteria may include bilateral eye reflex, bilateral front and rear flipper pinch, corneal reflex, or cloacal clasp.

APPENDIX B. NMFS NORTHEAST STATISTICAL AREAS.



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