

2018 GulfMAP Annual Report

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Sabrina R. Stevens¹, Amelia R. Martinez¹, Jenny A. Litz²

1. University of Miami
Cooperative Institute for Marine and Atmospheric Studies
Rosenstiel School for Marine and Atmospheric Science
4600 Rickenbacker Causeway
Miami, FL 33149

2. Southeast Fisheries Science Center, SEFSC
Protected Resources and Biodiversity Division
75 Virginia Beach Dr. Miami, FL 33149
Email: jenny.litz@noaa.gov

GulfMAP Introduction

This report summarizes the second complete calendar year of data entered into the GulfMAP database. GulfMAP is a pilot project of the Marine Mammal Health Monitoring and Analysis Platform (HealthMAP). The goal of HealthMAP is to develop a comprehensive information system to collect, curate, and distribute data on marine mammal health. Health data will be standardized in this platform. This dataset will give the public, scientists, and resource managers the ability to detect and visualize public and animal health risks, and to prioritize management and conservation efforts. Due to similar priorities of HealthMAP and the Gulf Environmental Benefit Fund (GEBF) managed by National Fish and Wildlife Foundation (NFWF), it was decided that a pilot project would take place in the Gulf of Mexico to develop and test a GulfMAP database using the stranding network GEBF grant recipients. The goal of this report is to summarize the current data in GulfMAP until it can be moved to a web-based platform from which managers would be able to query and visually display the information directly.

GulfMAP Database Status

The database is currently programmed in Microsoft ACCESS with each stranding network agency housing a local copy of their own agency's data. At the end of each month, each agency uploads a copy of the database that contains all of the agency's stranding data. The data diplomat audits the data based on the field definitions in the user's manual and near real-time reports filed at the Southeast Fisheries Science Center (SEFSC). An export of the audited data is created and imported into the National Marine Mammal Health and Stranding Response Database (hereafter referred to as the National Database) monthly by the data diplomat. This auditing process has increased the communication between stranding agencies and National Oceanic and Atmospheric Administration (NOAA) and has improved data consistency across agencies. The stranding network has been able to ask questions and receive timely responses from the data diplomat regarding data entry and data field definitions. In addition, the network is receiving monthly feedback on the data entered. This feedback has begun to improve the quality of data entered, reducing the auditing burden over time. After each network agency's database has been audited, all databases are combined into a central GulfMAP database housed by the SEFSC, which is backed up in two separate secure locations.

GulfMAP is being released in stages with subsequent modules that add data entry forms and functions to the original version. The first module of GulfMAP released in late 2016 included basic stranding data, which included the Level A data (see [Marine Mammal Stranding Level A](#) for more information). The Level A data in GulfMAP is exported into the National Database. GulfMAP has additional data fields not previously gathered by NOAA through the Level A form such as location accuracy, life stage, and how species, sex, and life stage were determined. In late 2017, the *Samples and Sample Tracking* module of GulfMAP was released. Subsequently, this module was altered to reduce data entry burden on the network, and re-released in July 2018.

The GulfMAP results module was released in September 2019 with a module to house analytical results such as blood chemistry and hematology, cytology, biotoxin, age determination, genetics, and basic pathogens. Entry of results data began in 2019 and therefore, are not included in this report. Future modules will incorporate more detailed laboratory results (example: culture results and pathogen sequencing), public health categories, gross necropsy findings, and histopathology. Each of these modules will increase the type of stranding data available to managers and researchers through a centralized database.

Training and introduction to the database began in October 2016 with the majority of the NFWF grant recipients in Alabama (AL) and the Gulf coast of Florida (FL Gulf) receiving training by November 2016. Emerald Coast Wildlife Refuge (ECWR) discontinued their GEBF grant in 2017 and did not enter data into GulfMAP during 2018, generating a gap in stranding data along the Florida panhandle east of the Alabama state line. Agencies in Mississippi (MS) and Louisiana (LA) received training in March 2018. Mississippi agreed to enter data for the complete calendar year of 2018, while Louisiana agreed to enter data on a voluntary basis as

they were not GEBF grant recipients. Ultimately, only four of the 39 strandings that occurred in Louisiana in 2018 were entered into GulfMAP. During 2018, the University of Florida was actively building public stranding and reporting awareness in their stranding response area, yet no new strandings were reported. Through these activities however, a stranding that was first seen in 2017 was consequently reported (it is not included in data of this report). For this report, stranding and sample data will be summarized for strandings recorded by GEBF grant recipients in 2018 along the Gulf of Mexico from Mississippi through Monroe County, FL. Since such a small proportion of Louisiana strandings from 2018 are housed in GulfMAP, those data will not be reported in most tables and figures of this report.

Major Stranding Events during 2018

A mass stranding of pygmy killer whales occurred on August 29th, 2018, in Clearwater, Pinellas County, FL. Two animals stranded and were transferred to rehabilitation at Mote Marine Laboratory, though neither survived. Three additional animals were observed swimming nearby but did not come ashore.

Beginning in mid-July 2018, an increase in common bottlenose dolphin strandings occurred on the central portion of the FL Gulf coast from Pinellas through Collier Counties. This increase in strandings corresponded with a bloom of *Karenia brevis*, the dinoflagellate often referred to as red tide. After consultation with a group of marine mammal experts (the Working Group on Marine Mammal Unusual Mortality Events), NOAA declared this increase to be an Unusual Mortality Event (UME; see [the UME website](#) for more information): “2018 – 2019 Bottlenose Dolphin Unusual Mortality Event Southwest Florida” hereafter referred to as the SWFL UME. Though the cause of this event is still being investigated, it is suspected to be associated with the red tide bloom, as samples from stranded dolphins have tested positive for the brevetoxin released by *Karenia brevis*. Exposure to additional toxins from a blue-green algae bloom that occurred at the same time is also being investigated.

Summary of 2018 Cetacean Strandings Entered in GulfMAP

A total of 301 stranding records were entered into GulfMAP during 2018, including the 4 strandings entered by Louisiana. Of the 297 entered by GEBF grant recipients, the majority of stranding events occurred in MS, AL, and the central portion of the FL Gulf coast (Figure 1). The absence of strandings adjacent to AL, on the western most coast of FL, is due to lack of entry by ECWR. By county, Florida’s Pinellas County had the highest number of strandings, followed by Collier and Lee Counties, FL (Figure 2). Harrison County, MS also had higher numbers of strandings recorded compared to other nearby counties (Figure 2).

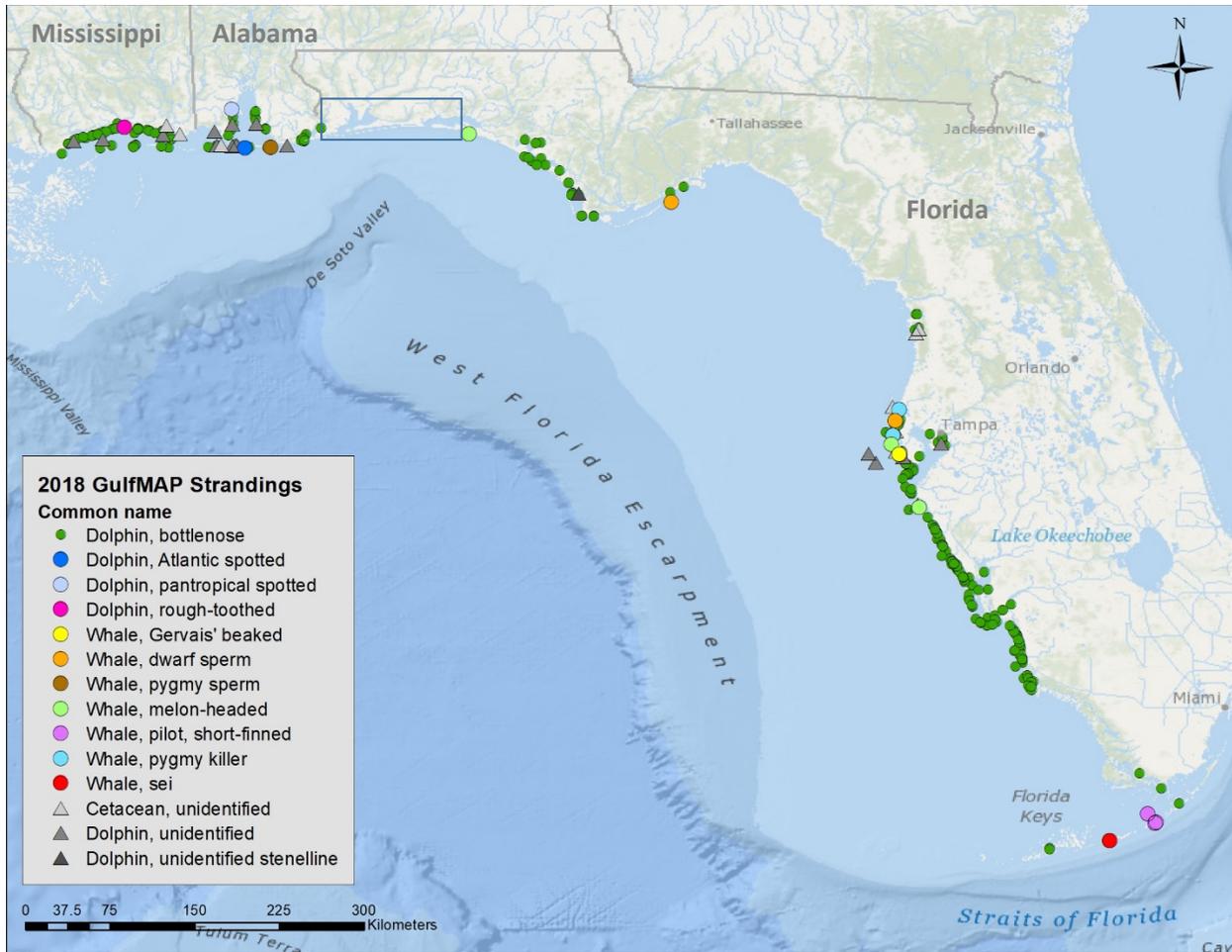


Figure 1. Location of the 297 cetacean strandings occurring in 2018 and entered into GulfMAP by GEBF grant recipients. Common names of cetaceans are represented by different colors. Note: the absence of stranding data on the western panhandle of FL, within the blue box, is due to lack of GulfMAP participation, not lack of stranding occurrence.

The majority of the 297 cetaceans that stranded were bottlenose dolphins, *Tursiops truncatus*, accounting for 257 or 87% of strandings (Figure 2, Appendix Table A1 and A2). The two highest months of bottlenose dolphin strandings occurred in August and November during the SWFL UME (Figure 3, Appendix Table A1). From July through December, a total of 134 bottlenose dolphin strandings were attributed to the SWFL UME, accounting for 82% of strandings in the affected area (134 of 164) and 45% of strandings recorded in GulfMAP in 2018 (Figure 3). There was also an increase in strandings in February, March, and April (Figure 3, Appendix Table A1) which is consistent with the historical March peak in bottlenose dolphin strandings occurring in the Gulf of Mexico (Mattson et al., 2006; Venn-Watson et al., 2015; Colegrove et al., 2016).

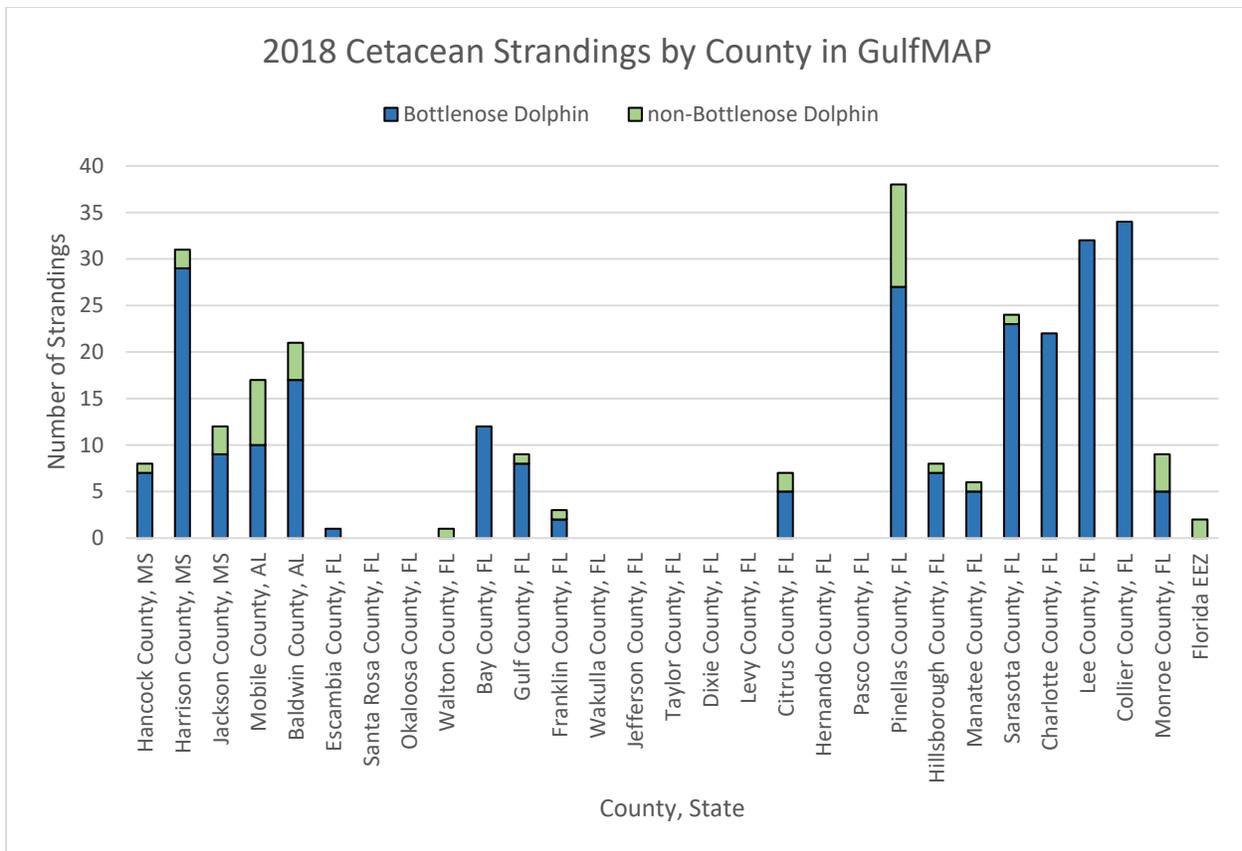


Figure 2. Count of all 2018 cetacean strandings entered into GulfMAP by GEBF grant recipients, separated by county. Counties are arranged in clockwise order (west to east, north to south) from Mississippi through the Florida Keys. FL EEZ represents those strandings reported 3 – 200 nautical miles from shore. Strandings of species other than bottlenose dolphins are highlighted in green. Note: the low to absent stranding in Escambia through Walton Counties FL is due to lack of entry in GulfMAP.

Life History

Sex was recorded for 211 of the 297 stranded cetaceans entered in GulfMAP by GEBF grant recipients in 2018. Of the 211, 83 were females and 128 were males (Appendix Table A3). The GulfMAP database includes a field to record the method of sex determination, which is ranked from most to least confident as follows: genetic testing, hormone testing, internal gross examination, associated with offspring, external morphology (in-person), external morphology (remote; for example using a photo), ultrasound imaging, and other. This is a new data field that was added to the GulfMAP database and was not previously available in the Level A data. For those strandings whose sex was recorded, internal gross exam was the most common method (n=155 animals) followed by external morphology (in person) (n=45 animals; Appendix Table A4). These data can be used to estimate the level of confidence of sex data in the dataset.

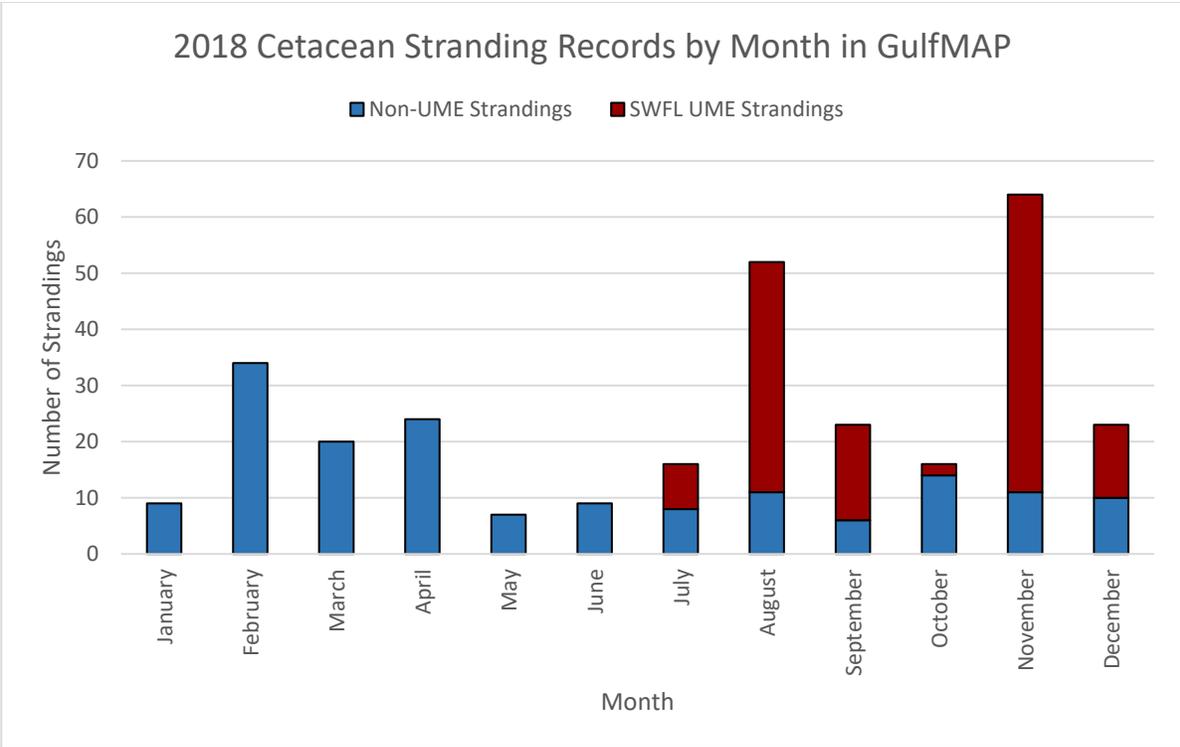


Figure 3. Count of all 2018 cetacean strandings by month entered into GulfMAP by GEBF grant recipients. Strandings attributed to the SWFL UME are highlighted in red.

Life stage was recorded for 131 of the 297 stranded cetaceans entered in GulfMAP by GEBF grant recipients in 2018 (Appendix Table A5). Life stage reflects the sexual maturity of the animal and is used to determine if the animal was part of the breeding population. The methods for life stage determination are also ranked from highest to lowest confidence: known age, internal gross examination, associated with offspring, external morphology (in-person), external morphology (remote; for example using a photo), ultrasound imaging, and other. Life stage and how it was determined are also new data fields added to GulfMAP. Of the stranding cases where life stage was recorded, 82 animals were sexually immature and 49 were sexually mature (Appendix Table A5). Since bottlenose dolphins are the most frequent stranding in GulfMAP, the majority of life stages recorded were from this species. Life stage was recorded for 47% of bottlenose dolphins and 23% of all other species (Appendix Table A5). Of those whose life stage was recorded, internal gross exam was the most common method (n=89 animals) followed by external morphology (in-person) (n=35 animals; Appendix Table A6).

Human Interactions

Accurately documenting evidence of interactions between marine mammals and humans is of great importance to managers. While the kinds and duration of human interactions (HI) can vary widely, it is important to note that evidence of HI does not necessarily

indicate that the interaction was the cause of death or the cause of the stranding. Strandings recorded as HI Yes exhibit evidence that some type of human interaction occurred at some point in the animal's history, possibly even post-mortem. Strandings recorded as HI No mean the animal was fully examined (including the entire gastrointestinal tract) for evidence of human interaction and no evidence was found. Finally, strandings where the occurrence of HI could not be determined as having occurred or not are recorded as HI CBD (Could not Be Determined). HI CBD includes cases that were too decomposed, not fully examined, or that may have shown inconclusive evidence. The network has been instructed to be conservative when determining if HI occurred, thus HI CBD is the most frequently recorded determination (Figure 4a, Appendix Table A7). As the network receives more support and increases the proportion of cases receiving full necropsies, there may be more cases where HI is determined to be Yes or No rather than CBD when decomposition is minimal. For instance, a small increase in HI No occurred from six animals (2.3%) in 2017 to 11 animals (3.7%) in 2018 (Stevens and Litz, 2018). Finally, live stranded animals can only be recorded as HI No if they die or are euthanized and then receive a complete internal exam.

Thirty-three (11.1%) of the 297 cetacean strandings in 2018 entered by GEBF grant recipients had signs of human interaction (HI Yes, Figure 4a). HI Yes strandings are further categorized into four main types: Fishery Interaction (FI), Shot, Boat Collision, and Other. There was a policy change in 2018 in which live stranded animals that were released by the public without authorization or direction from NOAA or the stranding network are considered to be HI Yes, type Other. Due to this change, HI Other was the most commonly reported type of HI in 2018 followed closely by FI (Figure 4b; Appendix Table A7). This policy change should be taken into account when comparing 2018 HI Other cases with previous years. The HI Other category also includes incidence of ingestion of marine debris and mutilation as well as many others. Three animals recorded in GulfMAP exhibited signs of more than one type of HI, two of which were a combination of HI Other and FI (Figure 4b). Of the HI Other cases, 41% were live animals released by the public without authorization. FIs are further categorized into three main types: Hook and Line gear, Trap/Crab pot gear, and FI line markings (Figure 4c). When an animal strands with some type of fishing gear still attached to the body, the stranding is recorded in one of the first two types dependent on the gear present. If an animal strands free of gear, but with either fresh or healed markings indicative of interaction with fishing line or net, it is recorded as FI line markings. Because ropes can come from both fisheries related (ex. crab pot) and non-fisheries related (ex. dock line) sources, an animal that strands with fresh or healed markings from a rope with no gear present is recorded as HI Other.

Occasionally, free-swimming animals entangled in fishery gear or other items are reported to the stranding network. If it is determined that the entanglement is life threatening, NOAA may make the decision to intervene and attempt to disentangle or otherwise assist the animal. Sometimes the public takes it upon themselves to disentangle the animal prior to reporting it or they may disregard the stranding network's advice. There were five live animals reported as entangled in fishing gear during 2018. Three of these were disentangled: one

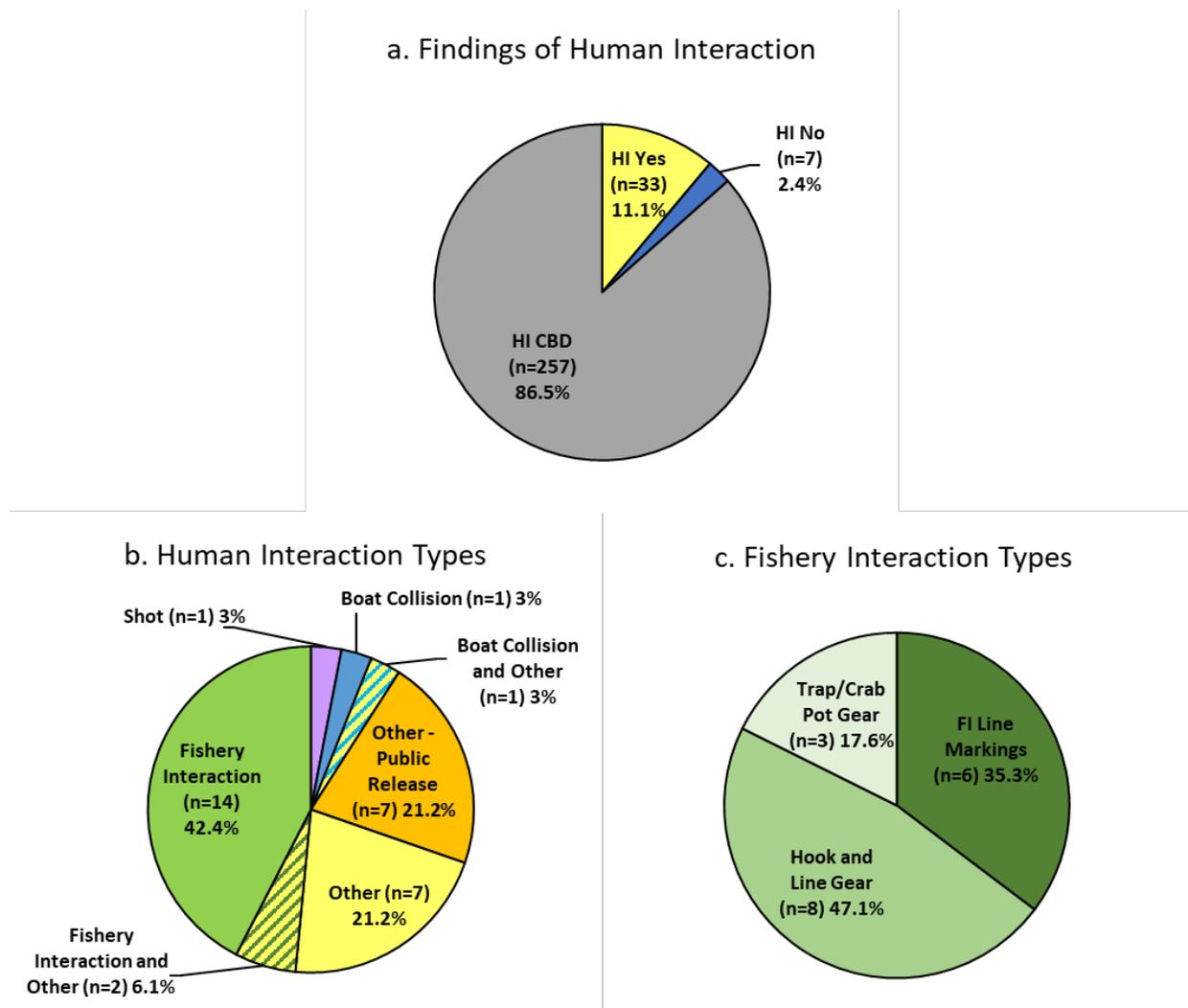


Figure 4. a. Findings of human interaction (HI) for the 297 cetacean strandings entered into GulfMAP by GEBF grant recipients in 2018. b. Break down of human interaction types from the 33 cetacean cases with signs of human interaction. Public release is highlighted separately from Other for clarity. c. Type of fishery interactions identified in the 16 cases with findings of fishery interactions using notes entered into GulfMAP by the stranding network.

animal was disentangled by the public without consent from the network or NOAA, another was disentangled by the network, and the third animal was disentangled by law enforcement. Disentanglement was deemed necessary for the two remaining entangled animals, however, neither was seen during 2018 disentanglement efforts.

The location of all stranded cetaceans entered into GulfMAP by GEBF grant recipients is mapped in Figure 5 with the HI types represented by different colors. The absence of strandings just east of the AL state line is due to lack of data entry. The two most prevalent types of HI, FI and HI Other, were distributed throughout the GulfMAP response area. Almost half of HI Other

– Public Release strandings occurred in Pinellas County, just west of Tampa on the FL Gulf coast. The breakdown of HI findings as well as HI types varies across each state (Figure 5 and 6). Alabama had the largest proportion of HI Yes cases recorded compared to FL Gulf and Mississippi (Figure 6a), while FL Gulf had three animals exhibiting evidence of two types of HI (Figure 6b). Florida had both the highest proportion of HI Other cases excluding public release and the highest proportion of public releases (Figure 6b). In MS and AL, fisheries interactions were the most commonly reported type of HI (Figure 6b). Despite FL Gulf recording the lowest percentage of strandings with FI, all FI types were represented (Figure 6c). Since Louisiana entered so few strandings into GulfMAP, the HI pie charts were not completed for this state.

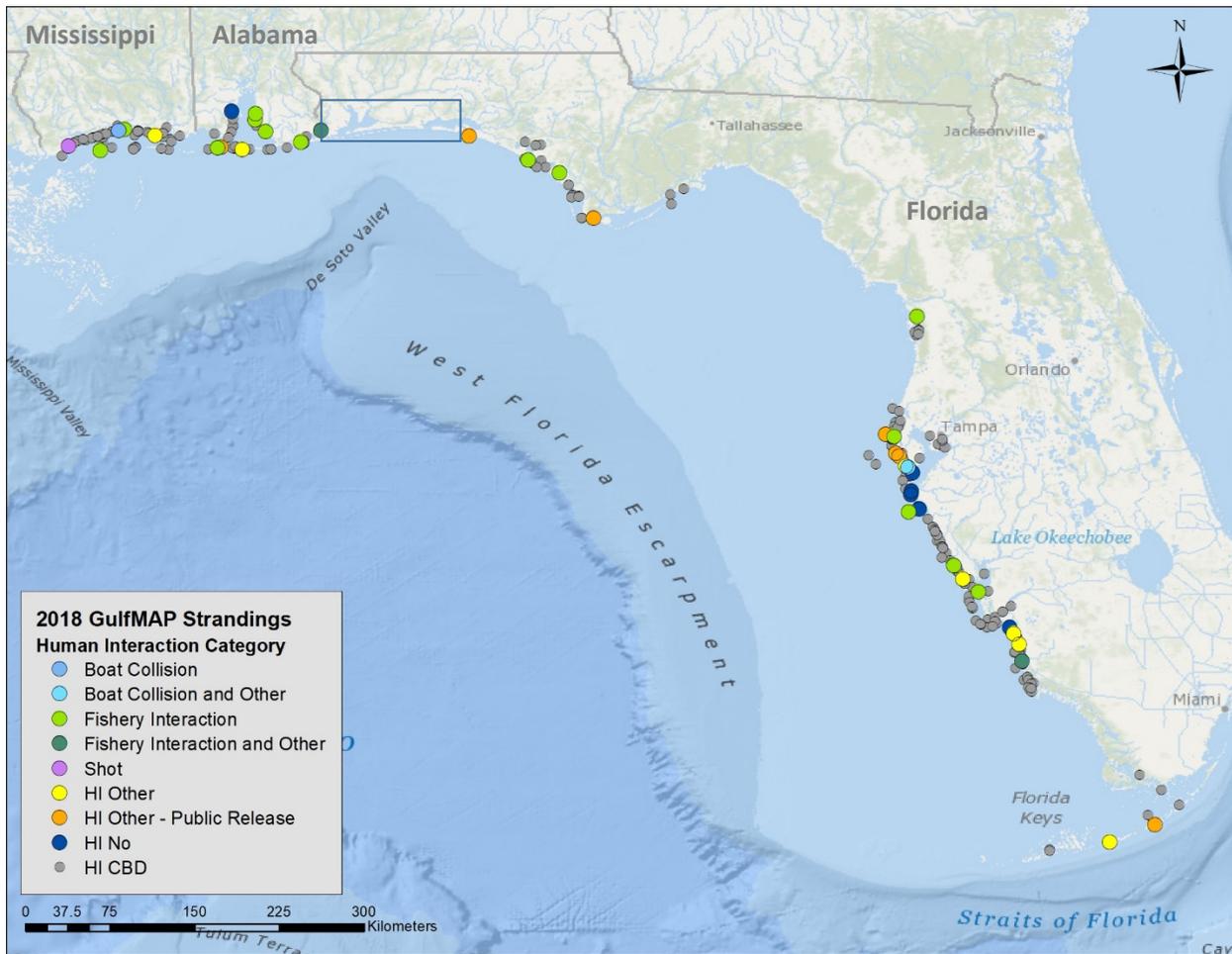


Figure 5. Location of all cetacean strandings in 2018 entered into GulfMAP by GEBF grant recipients. Colors represent findings of human interaction (HI). HI does not indicate cause of death. HI No animals were fully examined for evidence of human interaction and none was found. HI CBD indicates that evidence of human interaction could not be determined which may indicate that the animal was not fully examined, was too decomposed, and/or there may have been some inconclusive evidence. Note: the absence of stranding data on the western panhandle of FL, within the blue box, is due to lack of GulfMAP participation, not lack of stranding occurrence.

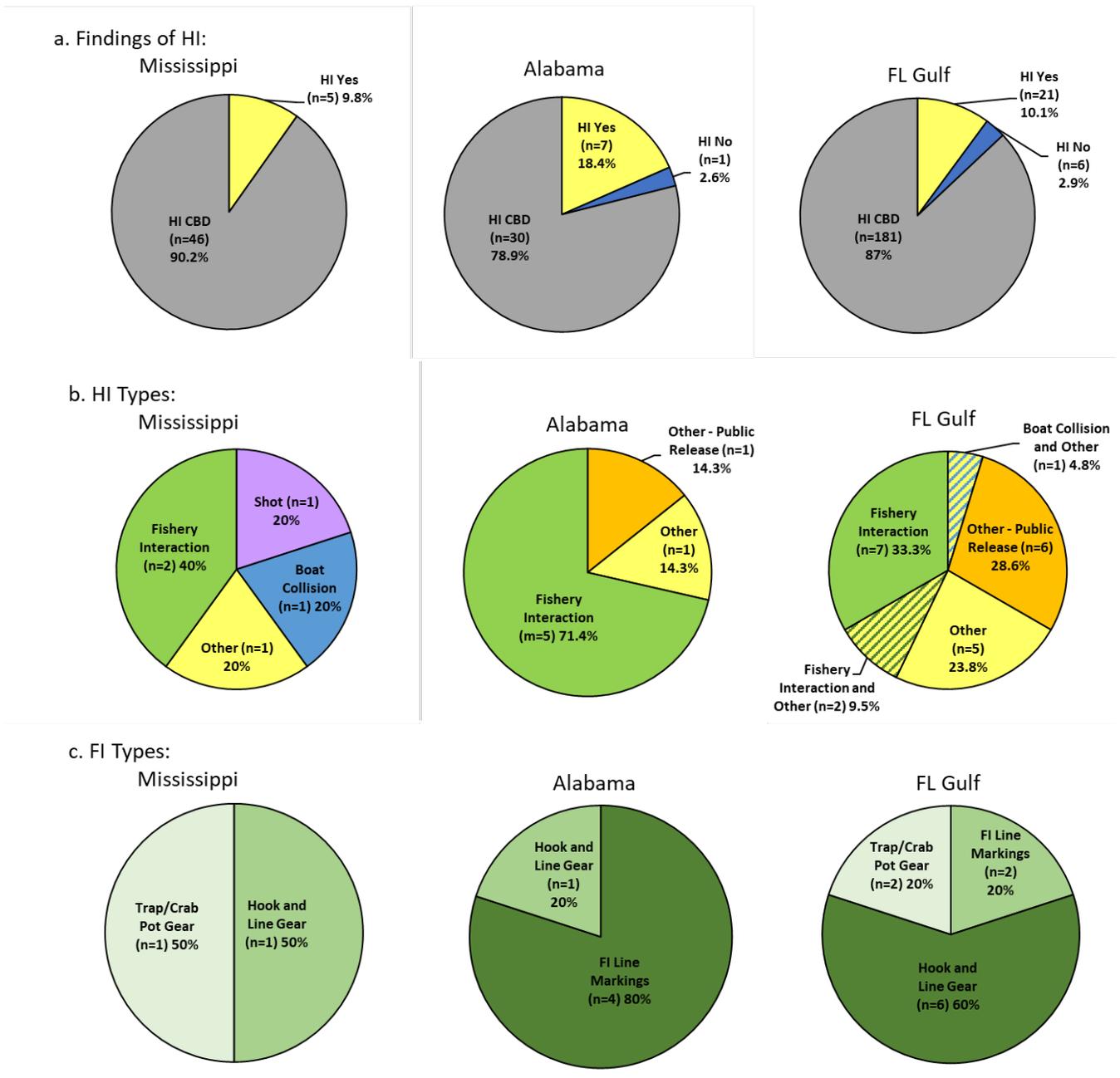


Figure 6. a. Findings of human interaction (HI) by state for the 297 cetacean strandings entered in to GulfMAP by GEBF grant recipients in 2018. b. Breakdown of human interaction types by state from the cetacean cases with signs of human interaction. Public release is highlighted separately from HI Other for clarity. c. Types of fishery interactions identified using notes entered into GulfMAP by the stranding network.

The 131 cetacean strandings with Life Stage recorded were separated by state and Life Stage, then divided further by HI findings (Figure 7). It is important to note that Life Stage was recorded for less than half the strandings entered in GulfMAP (43%) and that samples sizes for each category are small. For 166 animals, Life Stage was either not recorded or could not be determined, therefore those animals are not included in Figure 7. Proportions were used since not all categories had an even number of strandings. MS had the lowest proportion of HI Yes findings for immature animals while also having the highest proportion of HI Yes findings for mature animals (Figure 7).

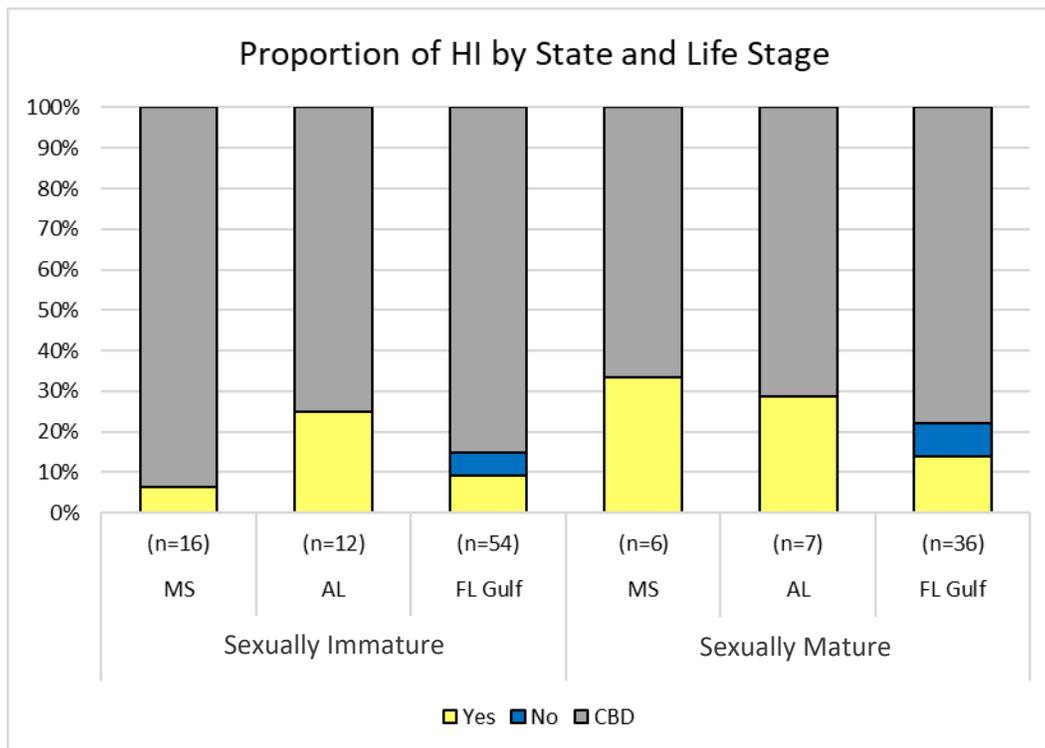


Figure 7. The proportion of Human Interaction (HI) findings separated by stranding state and life stages: sexually immature and sexually mature. Cetacean strandings where Life Stage was either unable to be determined or not recorded are not included. This figure includes all species and levels of exam. The number of strandings for each state and life stage are given in parentheses below each bar. HI does not indicate cause of death. Note: FL Gulf data only represent strandings recorded by GEBF grants recipients.

The 210 strandings where sex was recorded were separated by state and sex, then by HI findings (Figure 8). For 86 animals, sex was either unable to be determined or not recorded, therefore those animals are not included in Figure 8. The proportion of HI findings in females is similar across states. Male animals in MS and AL showed a higher proportion of HI Yes findings than FL Gulf (Figure 9). The proportion of HI No is smaller for males than females within each respective state. However, it is also important to note that samples sizes for this category are small.

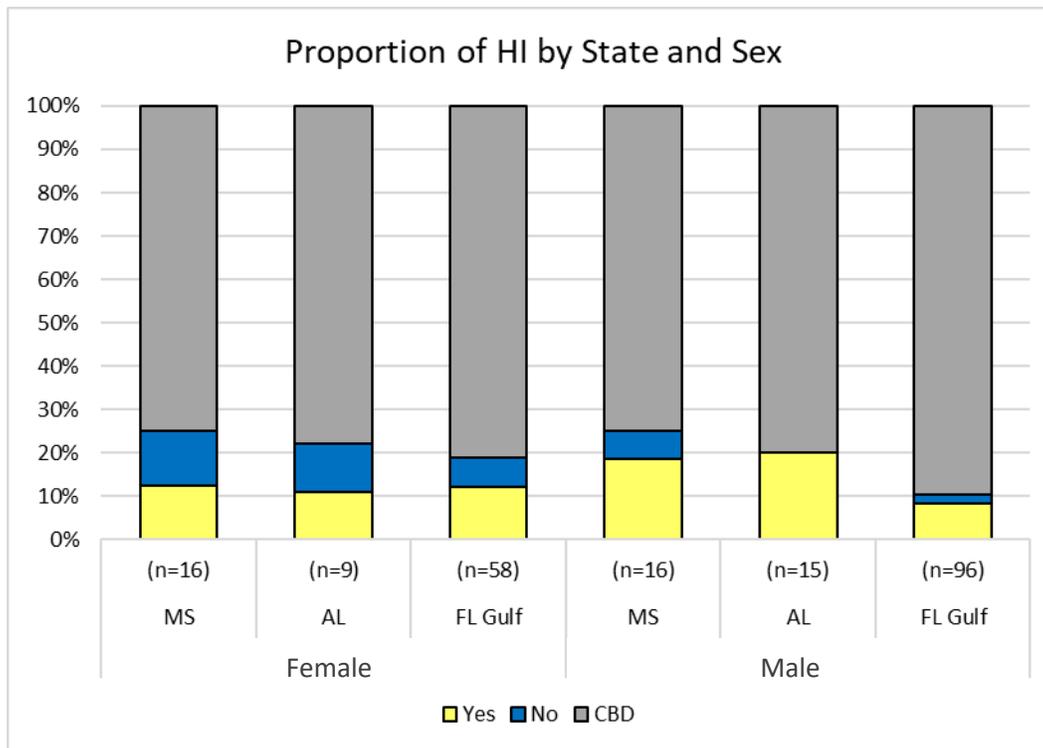


Figure 8. The proportion of Human Interaction (HI) findings separated by stranding state and sex. Cetacean strandings where the sex was not recorded or unable to be determined are not included. This figure includes all species and levels of exam. The number of strandings for each state and sex are given in parentheses below each bar. HI does not indicate cause of death. Note: FL Gulf data only represent strandings recorded by GEBF grants recipients.

Response Effort

The level of exam, sampling, and necropsy depends on multiple factors. Sometimes physical conditions such as weather or location can inhibit the level of exam, other times the animal’s level of decomposition limits the level of exam the responders are able to conduct. If an animal strands alive then dies or is euthanized, it typically receives a complete necropsy, as do most animals that strand fresh dead. Moderate decomposition and advanced decomposition cases are also examined; however, decomposition not only limits the level of necropsy, but also the ability to determine HI, and the quality of samples collected (e.g. several organs may be decomposed or missing).

In 2018, stranding network agencies examined 83% and necropsied 67% of strandings entered in GulfMAP. Table 1 shows the condition code frequency by state. The condition codes of stranded cetaceans are: alive, fresh dead, moderate decomposition, advanced decomposition, mummified/skeletal, and dead-condition unknown (see the [Examiner’s Guide](#) for detailed definitions of each condition). The highest percent of live strandings were reported in Alabama, though this state

also had the lowest number of strandings (Table 1). In all states, the most frequent condition code recorded across all strandings was moderate decomposition (Table 1).

Table 1. Frequency of initial observation condition code of all cetacean strandings presented by state and total number of strandings entered in GulfMAP in 2018 by GEBF grant recipients.

Initial Observation Condition Code	Mississippi (n=51)	Alabama (n=38)	FL Gulf (n=208)	Total (n=297)
Alive	3.9%	13.2%	10.1%	9.4%
Fresh Dead	9.8%	18.4%	4.3%	7.1%
Moderate Decomposition	47.1%	44.7%	63.0%	57.9%
Advanced Decomposition	23.5%	13.2%	15.4%	16.5%
Mummified/Skeletal	9.8%	2.6%	2.9%	4.0%
Dead-Condition Unknown	5.9%	7.9%	4.3%	5.1%

Bottlenose dolphins are the most common coastal marine mammal species in the United States and live close to shore. The pattern of initial observation condition code shifts dramatically when bottlenose dolphins are excluded; this pattern is driven largely by the offshore habitat range of many of the other species (Figure 9a, b). When a cetacean dies in the offshore waters, it is much less likely that the carcass will make it to shore to be found and reported. More likely, however, sick or injured offshore species come in closer to shore, away from their natural habitat prior to stranding, resulting in a higher proportion of live strandings for non-bottlenose species. These patterns are not specific to the Gulf of Mexico and are consistent throughout the Southeast Region of the United States (National Marine Fisheries Service, 2020). When examining only non-bottlenose dolphin strandings, the proportion of live strandings is 40% compared to only 4% for bottlenose strandings, and comprises the largest proportion of initial observation code (Figure 9a). Figure 9a includes eight strandings recorded as Dead-Condition Unknown that were not examined by the stranding network and therefore species is unknown. Mass strandings and UMEs often exhibit different patterns as well. When examining the initial observation code for only bottlenose dolphins associated with the SWFL UME, the proportion of live animals drops to only 2% while the proportion of moderate decomposition strandings increases to 75% from 66% for all bottlenose dolphins (Figure 9b, c).

Of the 297 strandings entered into GulfMAP by GEBF grant recipients from 2018, 15 were initially recorded as dead-condition unknown. Five of these animals were ultimately recovered: three animals in a state of advanced decomposition received limited necropsies and two animals with moderate decomposition, one of which received a complete necropsy and the other of which was severely shark scavenged and therefore was not necropsied. The 10 remaining strandings were not recovered or necropsied, though two were identified as bottlenose dolphins through photographs (Appendix Table A10). Twelve animals were recorded as mummified or skeletal remains and also did not receive a necropsy (Appendix Table A10).

Finally, 28 animals were alive when first observed (Appendix Table A2). Twelve of these animals either died or were euthanized during response, all of which were necropsied, with only one being a limited necropsy (Figure 10, Appendix Table A10). Of the remaining 16 animals, four were transferred to a rehabilitation facility, three were disentangled, and the remainder were either not seen again or were released by the public. One of the rehabilitated animals was released, one died, and two were transferred to permanent care facilities.

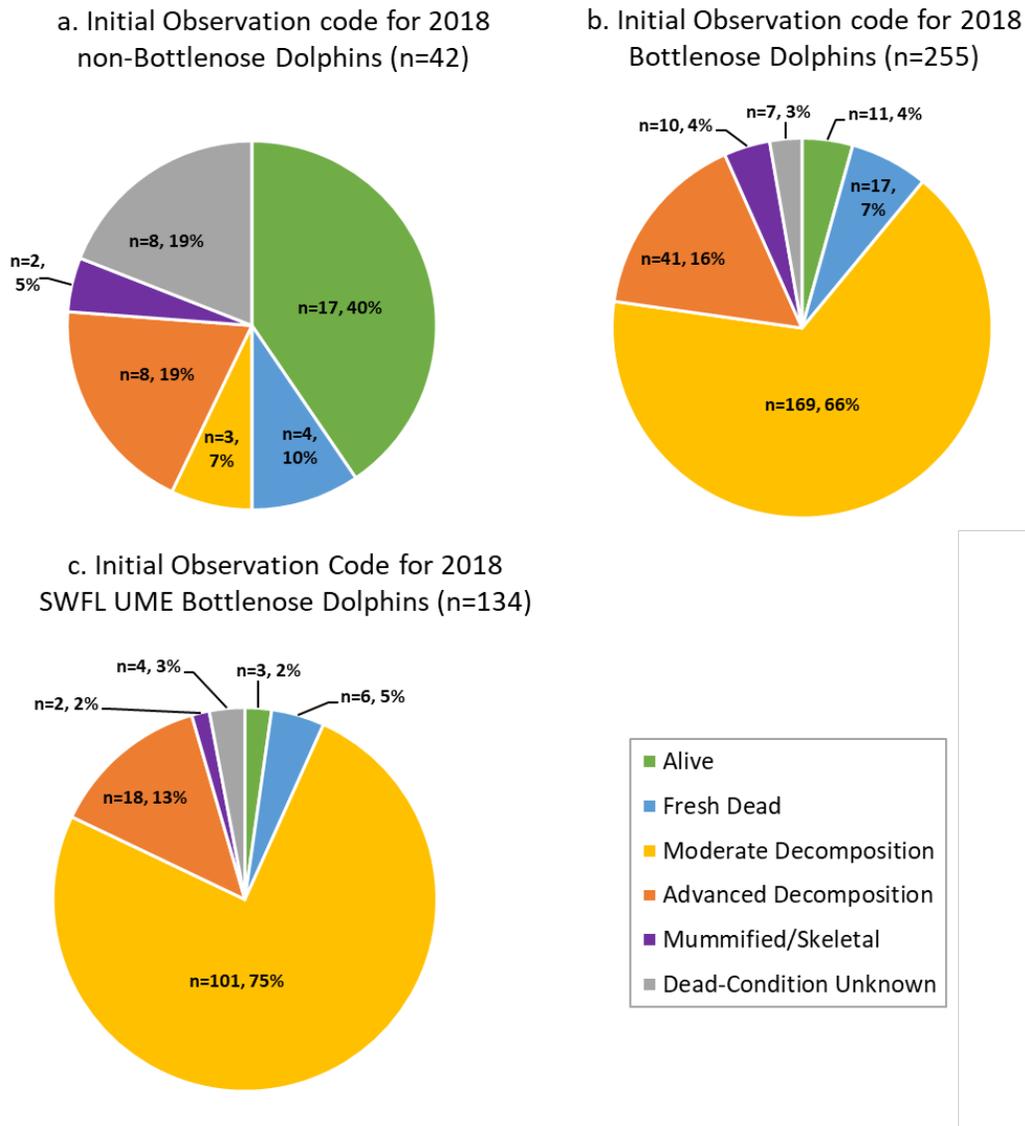


Figure 9. Count and frequency of Initial Observation condition code for strandings entered into GulfMAP in 2018 by GEBF grant recipients for: a. all non-bottlenose dolphin species including eight animals recorded as Dead-Condition Unknown who were not recovered and therefore species is unknown, b. all bottlenose dolphins, and c. bottlenose dolphins associated with the SWFL UME. Note: Animals initially recorded as Dead-Condition Unknown in b. and c. were later confirmed to be bottlenose dolphins and are not included in a.

Mass strandings and UMEs can often overwhelm the stranding network, and strandings in remote areas can receive limited response because getting supplies and heavy equipment to the area may not be possible. However, the proportion of fresh dead or moderately decomposed strandings from the SWFL UME that received complete necropsies was higher (66% and 47% respectively, Figure 11a) than that of all cetaceans (52% and 40% respectively, Figure 10) or that of non-UME bottlenose dolphins (63% and 30% respectively, Figure 11b) entered in GulfMAP for 2018 (Appendix Tables A10 – A12). This higher rate of necropsy is likely due to the increased support of and cooperation among stranding network agencies as a result of the UME investigation.

The Florida Fish and Wildlife Conservation Commission, Southwest Field Laboratory (FWC-SW) had the highest number of stranding in 2018 (n=88 animals, Appendix Table A13), most of which were attributed to the SWFL UME. While FWC-SW led the response to these strandings, several other agencies both assisted FWC-SW with response to these animals and continued responding in their normal coverage area. Data of each agency’s response by condition code, sampling, and level of necropsy are presented in Appendix Table A13.

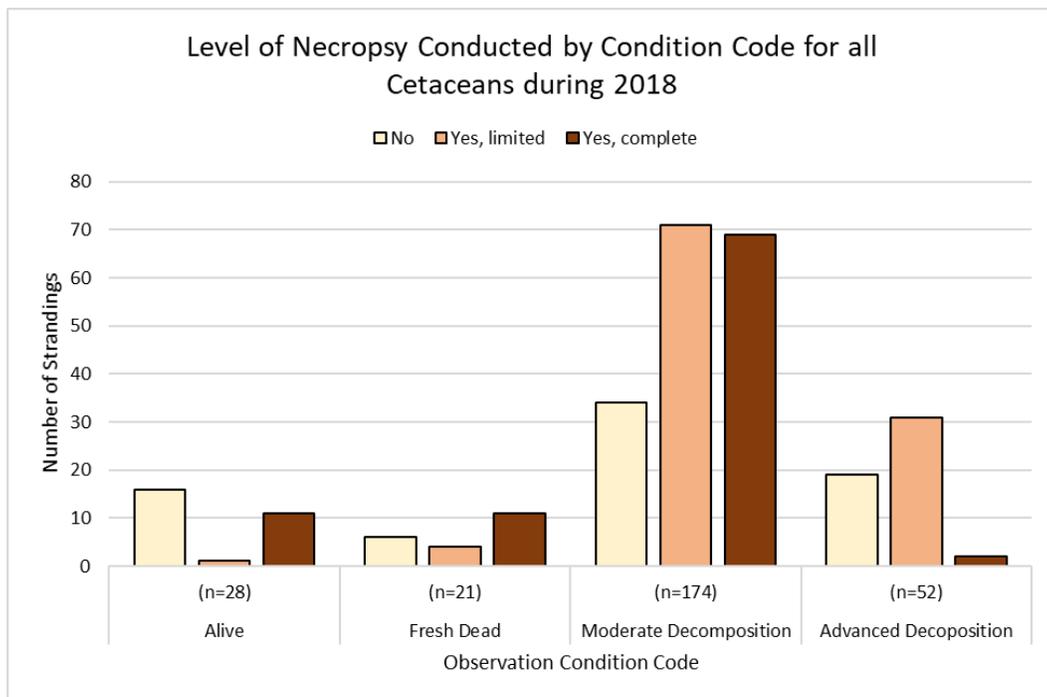


Figure 10. 2018 cetacean strandings entered into GulfMAP by GEBF grant by initial observation condition code and level of necropsy. The examination condition was used for five animals that were necropsied but had an initial observation code of unknown. Complete necropsies consist of a detailed exam with documentation of internal lesions, broken bones, and examination of the entire GI tract. Limited necropsies are exams in which some but not all of the organs or systems are examined. The number of strandings for each condition code are given in parentheses below each bar. The 22 animals recorded as mummified/skeletal or dead-condition unknown that were not necropsied are not shown.

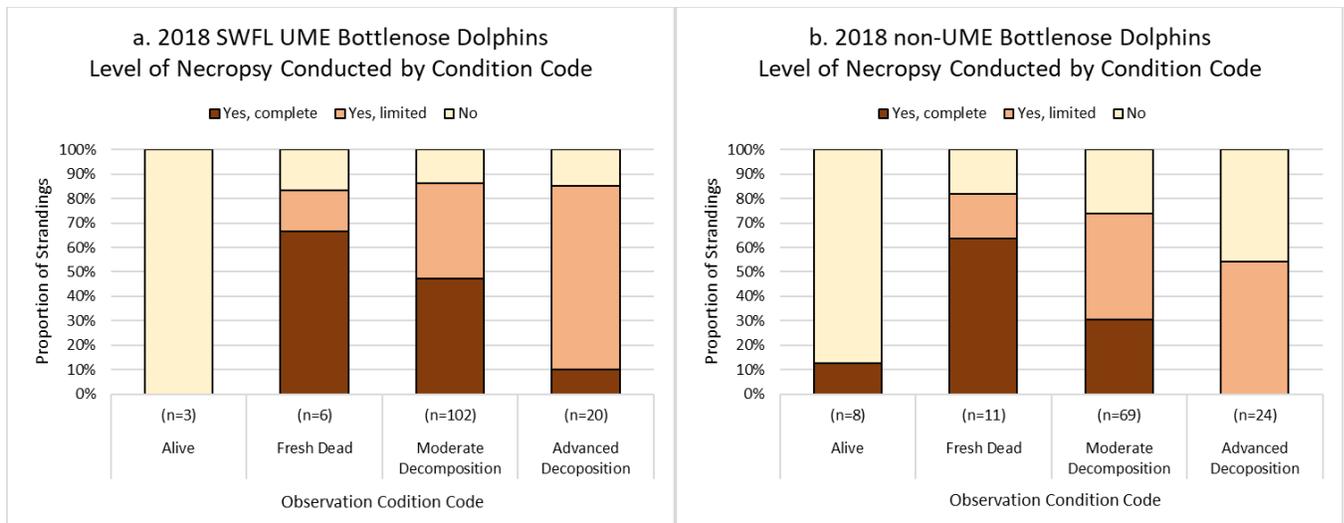


Figure 11. a. 2018 bottlenose dolphin strandings from the SWFL UME by initial observation condition code and level of necropsy. The examination condition was used for three animals that were necropsied but had an initial observation code of unknown. b. 2018 bottlenose dolphin strandings that were not considered part of the SWFL UME by initial observation condition code and level of necropsy. The examination condition was used for two animals that were necropsied but had an initial observation code of unknown. Necropsy definitions as in Figure 10. The number of strandings for each condition code are given in parentheses below each bar.

Sample Collection

One of NFWF’s goals was to increase the baseline data collected from stranded cetaceans in the Gulf of Mexico. One way to accomplish this is through consistent sampling of strandings. Sample and sample tracking information is now available in GulfMAP. A total of 4,264 samples collected during 2018 have been entered into GulfMAP. FL Gulf had the highest number of samples entered (n = 2,917) followed by AL (n = 1,266) and MS (n = 81), which is partly a reflection of the number of strandings occurring in each state (Table 2). The majority of samples were collected for histology followed by biotoxin testing (Table 2). Histology has the largest number of samples collected largely due to the fact that each major organ and any lesions are collected from the same animal (Table 2). The majority of biotoxin samples were collected from strandings in Florida largely due to the SWFL UME investigation.

Higher priority is placed on sampling live and fresh dead carcasses for histology, biotoxins, and viral/bacterial pathogens, which can help with determination of cause of death. Consistent life history analysis (including genetics, age analysis, and stable isotopes) is important to collect across all condition codes. The majority of samples entered in GulfMAP were collected from moderately decomposed cetaceans, which is the most frequent condition code of strandings in 2018 (172 out of 297, 58%). Live and fresh dead strandings were less common but still had a high number of samples collected (Table 3).

The majority of strandings attributed to the SWFL UME were found in stages of moderate or advanced decomposition (Table 4). The majority of fresh dead, moderate decomposition, and advanced decomposition dolphins from the SWFL UME received some level of necropsy (Table 4). The one fresh dead animal that was not necropsied was reported floating and despite search efforts was never recovered. A summary of the total number of samples collected from the SWFL UME strandings is given in Table 5. Samples are separated by sample purpose the majority of which were histology and biotoxin samples, important indicators for the SWFL UME.

Table 2. Total number of samples collected from cetaceans in 2018 and entered into GulfMAP by GEBF grant recipients by sample purpose and state.

Sample Purpose	Mississippi	Alabama	FL Gulf	Total
Age Determination	4	15	126	145
Archive	-	181	174	355
Biotoxin	13	183	706	902
Blood Chemistry/Hematology	-	2	12	14
Contaminant	-	4	4	8
Contaminant Other Samples	-	2	-	2
Contaminant Trace Elements Samples	-	-	-	-
Cytology Samples	-	4	14	18
Diagnostic Imaging Samples	-	-	-	-
Educational Museum Display Samples	-	2	1	3
Endocrinology Samples	-	-	-	-
Genetics Samples	9	41	192	242
Histopathology Samples	-	537	1091	1628
Microbiology Samples	-	-	13	13
Other Samples	33	93	120	246
Parasitology Samples	3	21	-	24
Pathogen Bacterial Samples	-	32	51	83
Pathogen Fungal Samples	-	1	-	1
Pathogen Parasite Samples	-	-	1	1
Pathogen Viral Samples	8	34	137	179
Reproductive Analysis Samples	-	-	6	6
Serology Bacterial Samples	-	-	-	-
Serology Viral Samples	1	-	10	11
Stable Isotope Analysis Samples	10	107	232	349
Stomach Content Analysis Samples	-	3	27	30
Urinalysis Samples	-	4	-	4
Total Samples	81	1266	2917	4264
Number of strandings with samples entered	11	27	154	192

Table 3. Total number of samples collected and entered from all stranded cetaceans entered in GulfMAP by GEBF grant recipients for 2018 by sample collection purpose and animal condition code at initial observation. Life history is the combination of samples collected for genetics, stable isotopes, stomach analysis, age determination, and reproduction. Sample purpose Other includes all other categories that were not as common and samples for archive.

Initial Observation Condition Code	Sample Purpose							Total Strandings
	Histology	Biotoxin	Viral	Bacterial	Blood Chemistry/ Hematology	Life History	Other	
Alive	277	61	23	29	13	42	101	28
Fresh Dead	333	102	27	11	-	75	89	21
Moderate Decomposition	1017	682	129	43	1	571	447	172
Advanced Decomposition	1	49	-	-	-	71	37	49
Mummified/Skeletal	-	-	-	-	-	3	5	12
Dead-Condition Unknown	-	8	-	-	-	10	7	15
Total	1628	902	179	83	14	772	686	297

Table 4. Summary of bottlenose dolphin strandings from the SWFL UME from July to December 2018 by initial observation condition code, samples entered, and level of necropsy. Samples were collected from necropsied and non-necropsied dolphins. Samples from non-necropsied carcasses are often limited to skin, blubber, and teeth. Complete necropsies consist of a detailed exam with documentation of internal lesions, broken bones, and examination of the entire gastrointestinal tract. Limited necropsies are exams in which some but not all of the organs or systems are examined. The ability to conduct complete necropsies is limited as decomposition advances.

Initial Observation Condition Code	Strandings with Samples Entered	No Necropsy	Limited Necropsy	Complete Necropsy	Total Strandings
Alive	-	3	-	-	3
Fresh Dead	4	1	1	4	6
Moderate Decomposition	87	13	40	48	101
Advanced Decomposition	15	3	13	2	18
Mummified/Skeletal	-	2	-	-	2
Dead-Condition Unknown	2	2	2	-	4
Total	108	24	56	54	134

Table 5. Summary of samples entered into GulfMAP from SWFL UME strandings from July to December 2018. Total number of samples entered are broken down by month of stranding and sample purpose. The Other samples category is a combination of samples collected for life history, archive, etc. Note that multiple samples may be collected from the same stranded animal for each sample purpose.

Month	Biotoxin samples	Histology samples	Virology samples	Bacterial samples	Genetic samples	Other samples	Total samples	Strandings with Samples Entered
July	27	68	8	4	9	41	157	7
August	245	220	18	13	64	158	718	35
September	74	113	14	9	24	79	313	15
October	5	-	-	-	1	3	9	1
November	208	171	56	3	51	209	698	41
December	49	79	13	4	9	58	212	9
Total Samples	608	651	109	33	158	548	2107	108

Louisiana Strandings

Stranding network members from the state of Louisiana entered stranding data from 2018 into GulfMAP on a voluntary basis and as such only entered four of the 39 strandings that occurred. Two animals were bottlenose dolphins, one male advanced decomposition, and one mummified with sex unknown. The other two animals entered in GulfMAP stranded alive, one a male pygmy sperm whale and the other a female rough-toothed dolphin. The mummified bottlenose dolphin was examined with two life history samples collected, while both the pygmy sperm whale and rough-toothed dolphin received complete necropsies, resulting in entry of 111 samples into GulfMAP. Of the four strandings, the rough-toothed dolphin was determined to be HI Yes when fishing line was found in the stomach, the two bottlenose dolphins were HI CBD, and the pygmy sperm whale was HI No.

Discussion – data impacts and future research topics

Throughout 2018, stranding agencies collaborated on sample analysis and stranding responses, the majority of which occurred during the SWFL UME, live animal strandings, and human interaction cases. Other collaborations included strandings in the central Florida region where multiple agencies worked together on the same necropsy, or one agency transferred a carcass to another facility to be necropsied. A meeting among Florida network members took place in December 2018, where summaries of various events, network status, and introductions to new members were discussed.

General findings of HI (Yes, No, CBD) remained consistent across the two years of data entered in GulfMAP even though types of HI Yes varied and a new type of interaction was

incorporated. In addition, Alabama seems to continue to have a higher proportion of strandings with evidence of human interaction than FL Gulf. Though sample sizes are small when HI Yes animals are separated by state, sex, or life stage in this report, as the database grows to include more years of data, consistent and statistically significant patterns may emerge.

In 2018, sample collection data from all agencies were entered in GulfMAP. Due to consistent baseline sampling that was made possible by NFWF grants, many of the initial strandings in the SWFL UME had biotoxin samples collected and available for early analysis. This is an improvement over previous UME events where resources and sample collection protocols were not able to be distributed until after the UME was declared. In addition, the existence of the GulfMAP database could expedite the entry of sample collection data making them available faster during the UME investigation, however, not all agencies were using this functionality due to time constraints and other factors. We are working with the network to address this during future events.

Nearly half of strandings in 2017 were attributed to mass stranding events while in 2018 nearly half of strandings were attributed to the SWFL UME. Findings such as these could be fruitful for future research as well as have potential management implications. While logistical constraints will always be an issue in mass strandings and UMEs, increased coordination and dissemination of resources to the stranding network in the Gulf of Mexico will help increase the proportion of mass stranded and UME individuals examined and necropsied over time leading to enhanced health data to help guide management.

The data within GulfMAP establishes a baseline that can be used to compare the stranding network response, data quality, and trends in stranding data throughout the course of the project. These data will provide a key mechanism to monitor marine mammal health, population recovery, and the effectiveness of management actions to reduce anthropogenic or natural threats. The consistency of this dataset has improved, as each stranding network agency has used the same collection guidelines and the same QA/QC protocols were applied for auditing. This project increased coordination among stranding network agencies and coordination between NOAA and the network.

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Unusual Mortality Event (UME) website:

<https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-unusual-mortality-events>

Appendix

Table A1. All cetacean strandings entered in GulfMAP for 2018 by species' common and stranding month (including Louisiana). Scientific names are given in parenthesis.

Common Name	J	F	M	A	M	J	J	A	S	O	N	D	Total strandings by Species
Dolphin, Atlantic spotted (<i>Stenella frontalis</i>)	1	-	-	-	-	-	-	-	-	-	-	-	1
Dolphin, common bottlenose (<i>Tursiops truncatus</i>)	7	32	15	21	6	10	11	45	19	8	61	22	257
Dolphin, pantropical spotted (<i>Stenella attenuata</i>)	-	-	-	-	-	-	-	-	-	1	-	-	1
Dolphin, rough-toothed (<i>Steno bredanensis</i>)	-	-	1	-	-	-	-	-	-	1	-	-	2
Whale, dwarf sperm (<i>Kogia sima</i>)	1	-	-	-	-	-	-	1	-	-	-	-	2
Whale, Gervais' beaked (<i>Mesoplodon europaeus</i>)	-	-	-	-	1	-	-	-	-	-	-	-	1
Whale, melon-headed (<i>Peponocephala electra</i>)	-	-	-	-	-	-	1	1	1	-	-	-	3
Whale, pilot, short-finned (<i>Globicephala macrorhynchus</i>)	-	-	-	-	-	-	-	-	-	3	-	-	3
Whale, pygmy killer (<i>Feresa attenuata</i>)	-	-	-	-	-	-	1	2	-	-	-	-	3
Whale, pygmy sperm (<i>Kogia breviceps</i>)	-	-	-	-	-	1	-	-	-	-	2	-	3
Whale, sei (<i>Balaenoptera borealis</i>)	-	-	1	-	-	-	-	-	-	-	-	-	1
Dolphin, unidentified stenelline	-	1	-	-	-	-	-	-	-	-	-	-	1
Dolphin, unidentified	-	-	4	2	-	-	-	2	3	1	2	1	15
Cetacean, unidentified	-	1	-	1	-	-	3	1	-	2	-	-	8
Monthly Total	9	34	21	24	7	11	16	52	23	16	65	23	301

Table A2. Cetacean strandings entered in GulfMAP for 2018 by species' common name and Initial Observation Condition code as entered by GEBF grant recipients.

Common Name	Alive	Fresh Dead	Moderate Decomposition	Advanced Decomposition	Mummified/Skeletal	Dead-Condition Unknown	Total Strandings by Species
Dolphin, Atlantic spotted	-	-	1	-	-	-	1
Dolphin, bottlenose	11	17	169	41	10	7	255
Dolphin, pantropical spotted	1	-	-	-	-	-	1
Dolphin, rough-toothed	1	-	-	-	-	-	1
Whale, dwarf sperm	2	-	-	-	-	-	2
Whale, Gervais' beaked	1	-	-	-	-	-	1
Whale, melon-headed	3	-	-	-	-	-	3
Whale, pilot, short-finned	2	-	-	1	-	-	3
Whale, pygmy killer	3	-	-	-	-	-	3
Whale, pygmy sperm	2	-	-	-	-	-	2
Whale, sei	-	1	-	-	-	-	1
Dolphin, unidentified stenelline	-	-	-	1	-	-	1
Dolphin, unidentified	-	2	2	4	1	6	15
Cetacean, unidentified	2	1	-	2	1	2	8
Condition Code Total	28	21	172	49	12	15	297

Table A3. 2018 cetacean strandings by species' common name and sex as entered by GEBF grant recipients. Unknown signifies the sex could not be determined or was not assessed.

Common Name	Female	Male	Unknown	Total strandings by Species
Dolphin, Atlantic spotted	-	1	-	1
Dolphin, bottlenose	76	116	63	255
Dolphin, pantropical spotted	1	-	-	1
Dolphin, rough-toothed	1	-	-	1
Whale, dwarf sperm	1	1	-	2
Whale, Gervais' beaked	-	1	-	1
Whale, melon-headed	-	3	-	3
Whale, pilot, short-finned	1	-	2	3
Whale, pygmy killer	3	-	-	3
Whale, pygmy sperm	-	2	-	2
Whale, sei	-	-	1	1
Dolphin, unidentified stenelline	-	1	-	1
Dolphin, unidentified	-	2	13	15
Cetacean, unidentified	-	1	7	8
Total by Sex	83	128	86	297

Table A4. 2018 cetacean strandings by sex and how sex was determined as entered by GEBF grant recipients. Unknown signifies the sex could not be determined or was not assessed.

Sex	Method of Sex Determination					Total strandings by Sex
	Genetic Testing	Internal Gross Examination	External Morphology (in-person)	External Morphology (remote)	Not Recorded	
Female	1	63	17	2	-	83
Male	-	92	28	6	2	128
Unknown	-	-	-	-	-	86
Method Total	1	155	45	8	2	297

Table A5. 2018 cetacean strandings by species' common name and life stage as entered by GEBF grant recipients. Unknown signifies the life stage could not be determined or was not assessed.

Common Name	Life Stage				Total strandings by Species
	Sexually Immature	Sexually Mature	Unknown	Not Recorded	
Dolphin, Atlantic spotted	-	-	1	-	1
Dolphin, bottlenose	78	43	58	76	255
Dolphin, pantropical spotted	-	-	-	1	1
Dolphin, rough-toothed	1	-	-	-	1
Whale, dwarf sperm	1	-	1	-	2
Whale, Gervais' beaked	-	-	-	1	1
Whale, melon-headed	-	2	1	-	3
Whale, pilot, short-finned	-	-	3	-	3
Whale, pygmy killer	1	2	-	-	3
Whale, pygmy sperm	-	1	1	-	2
Whale, sei	-	-	1	-	1
Dolphin, unidentified stenelline	-	-	1	-	1
Dolphin, unidentified	1	-	5	9	15
Cetacean, unidentified	-	1	2	5	8
Total per Life Stage	82	49	74	92	297

Table A6. 2018 cetacean strandings by life stage and how life stage was determined as entered by GEBF grant recipients. Unknown signifies the life stage could not be determined or was not assessed.

Life Stage	Method of Life Stage Determination				Total strandings by Life Stage
	Known Age	Internal Gross Examination	External Morphology (in-person)	External Morphology (remote)	
Sexually Immature	3	52	26	1	82
Sexually Mature	3	37	9	-	49
Unknown	-	-	-	-	74
Not Recorded	-	-	-	-	92
Method Total	6	89	35	1	297

Table A7. Cetacean strandings entered by GEBF grant recipients in 2018 by species and human interaction (HI) determination. Yes = evidence of HI was present, No = the animal was examined for evidence of HI and no evidence was found, CBD = HI could not be determined or could not be assessed. The table also lists the types of HI that were observed. HI Other includes ingestion of marine debris, mutilation, and markings indicative of rope entanglements.

Common Name	Human Interaction			Human Interaction Type							Total strandings by Species
	CBD	No	Yes	Boat Collision	Boat Collision and Other	Fishery Interaction	Fishery Interaction and Other	Public Release	HI Other	Shot	
Dolphin, Atlantic spotted	1	-	-	-	-	-	-	-	-	-	1
Dolphin, bottlenose	225	4	26	1	1	13	2	2	6	1	255
Dolphin, pantropical spotted	-	1	-	-	-	-	-	-	-	-	1
Dolphin, rough-toothed	-	-	1	-	-	1	-	-	-	-	1
Whale, dwarf sperm	2	-	-	-	-	-	-	-	-	-	2
Whale, Gervais' beaked	-	-	1	-	-	-	-	1	-	-	1
Whale, melon-headed	1	1	1	-	-	-	-	1	-	-	3
Whale, pilot, short-finned	2	-	1	-	-	-	-	1	-	-	3
Whale, pygmy killer	2	1	-	-	-	-	-	-	-	-	3
Whale, pygmy sperm	2	-	-	-	-	-	-	-	-	-	2
Whale, sei	-	-	1	-	-	-	-	-	1	-	1
Dolphin, unidentified stenelline	1	-	-	-	-	-	-	-	-	-	1
Dolphin, unidentified	15	-	-	-	-	-	-	-	-	-	15
Cetacean, unidentified	6	-	2	-	-	-	-	2	-	-	8
Total by HI	257	7	33	1	1	14	2	7	7	1	297

Table A8. Cetacean strandings entered by GEBF grant recipients that were necropsied in 2018 by species and human interaction (HI) determination. Human Interaction definitions and Types as in Table A7.

Common Name	Human Interaction			Human Interaction Type							Total strandings by Species
	CBD	No	Yes	Boat Collision	Boat Collision and Other	Fishery Interaction	Fishery Interaction and Other	Public Release	HI Type Other	Shot	
Dolphin, Atlantic spotted	1	-	-	-	-	-	-	-	-	-	1
Dolphin, bottlenose	161	3	20	1	1	9	2	-	6	1	184
Dolphin, pantropical spotted	-	1	-	-	-	-	-	-	-	-	1
Whale, dwarf sperm	2	-	-	-	-	-	-	-	-	-	2
Whale, melon-headed	-	1	1	-	-	-	-	1	-	-	2
Whale, pilot, short-finned	1	-	-	-	-	-	-	-	-	-	1
Whale, pygmy killer	2	1	-	-	-	-	-	-	-	-	3
Whale, pygmy sperm	2	-	-	-	-	-	-	-	-	-	2
Whale, sei	-	-	1	-	-	-	-	-	1	-	1
Dolphin, unidentified	2	-	-	-	-	-	-	-	-	-	2
Cetacean, unidentified	1	-	-	-	-	-	-	-	-	-	1
Total by HI	172	6	22	1	1	9	2	1	7	1	200

Table A9. Bottlenose dolphin strandings entered by GEBF grant recipients that were necropsied with evidence of human interaction by type and stranding state. Human Interaction definitions and Types as in Table A7.

State	Human Interaction			Human Interaction Type						Total strandings by State
	CBD	No	Yes	Boat Collision	Boat Collision and Other	Fishery Interaction	Fishery Interaction and Other	HI Type Other	Shot	
Mississippi	28	-	4	1	-	1	-	1	1	32
Alabama	14	-	5	-	-	4	-	1	-	19
FL Gulf	119	3	11	-	1	4	2	4	-	133
Total by HI	161	3	20	1	1	9	2	6	1	184

Table A10. 2018 cetacean strandings by initial observation condition code and level of necropsy entered by GEBF grant recipients. The examination condition was used for five animals that were necropsied but had an initial observation code of unknown. Complete necropsies consist of a detailed exam with documentation of internal lesions, broken bones, and examination of the entire GI tract. Limited necropsies are exams in which some but not all of the organs or systems are examined.

Initial Observation Condition Code	No Necropsy	Limited Necropsy	Complete Necropsy	Total strandings by Condition Code
Alive	16	1	11	28
Fresh Dead	6	4	11	21
Moderate Decomposition	34	71	69	174
Advanced Decomposition	19	31	2	52
Mummified/Skeletal	12	-	-	12
Dead-Condition Unknown	10	-	-	10
Necropsy Total	97	107	93	297

Table A11. 2018 SWFL UME bottlenose dolphin strandings by initial observation condition code and level of necropsy. The examination condition was used for three animals. Necropsy definitions as in Table A10.

Initial Observation Condition Code	No Necropsy	Limited Necropsy	Complete Necropsy	Total strandings by Condition Code
Alive	3	-	-	3
Fresh Dead	1	1	4	6
Moderate Decomposition	14	40	48	102
Advanced Decomposition	3	15	2	20
Mummified/Skeletal	2	-	-	2
Dead-Condition Unknown	1	-	-	1
Necropsy Total	24	56	54	134

Table A12. All 2018 bottlenose dolphin strandings not associated with the SWFL UME by initial observation condition code and level of necropsy as entered by GEBF grant recipients. The examination condition was used for two animals. Necropsy definitions as in Table A10.

Initial Observation Condition Code	No Necropsy	Limited Necropsy	Complete Necropsy	Total strandings by Condition Code
Alive	7	-	1	8
Fresh Dead	2	2	7	11
Moderate Decomposition	18	30	21	69
Advanced Decomposition	11	13	-	24
Mummified/Skeletal	8	-	-	8
Dead-Condition Unknown	1	-	-	1
Necropsy Total	47	45	29	121

Table A13. All 2018 cetacean strandings entered by GEBF grant recipients by stranding network agency, initial observation condition code, and level of necropsy conducted. The Strandings w/Samples Entered is the number of strandings with samples entered into GulfMAP from both necropsied and non-necropsied cetaceans. Animals who were not examined are counted in the No Necropsy column. Necropsy definitions as in Table A9. Each of the five * represents one animal who is counted in the table based on its examination condition code but whose initial observation code was Dead-Condition Unknown.

Stranding Network Agency	Initial Observation Condition Code	No Necropsy	Limited Necropsy	Complete Necropsy	Strandings w/Samples Entered	Total Strandings
Institute for Marine Mammal Studies	Alive	2	-	1	-	3
	Fresh Dead	2	-	3	2	5
	Moderate Decomposition	6	17	2*	3	24
	Advanced Decomposition	2	11*	-	3	12
	Mummified/Skeletal	5	-	-	2	5
	Dead-Condition Unknown	1	-	-	1	3
	Total	18	28	6	11	52
Dauphin Island Sea Lab	Alive	2	-	2	2	4
	Fresh Dead	3	2	2	5	7
	Moderate Decomposition	3	2	13	16	18
	Advanced Decomposition	4	1	-	4	5
	Mummified/Skeletal	1	-	-	1	1
	Dead-Condition Unknown	3	-	-	-	3
	Total	16	5	17	28	38
Gulf World Marine Park/Gulf World Marine Institute	Alive	2	1	1	2	4
	Fresh Dead	-	-	-	-	-
	Moderate Decomposition	8	2	3	12	13
	Advanced Decomposition	6	-	-	6	6
	Mummified/Skeletal	2	-	-	2	2
	Dead-Condition Unknown	-	-	-	-	-
	Total	18	3	4	22	25
Clearwater Marine Aquarium	Alive	4	-	2	2	6
	Fresh Dead	-	-	-	-	-
	Moderate Decomposition	1	-	4	4	5
	Advanced Decomposition	1	1	-	1	2
	Mummified/Skeletal	1	-	-	-	1
	Dead-Condition Unknown	3	-	-	-	3
	Total	10	1	6	7	17

Table A13 continued.

Stranding Network Agency	Initial Observation Condition Code	No Necropsy	Limited Necropsy	Complete Necropsy	Strandings w/Samples Entered	Total Strandings
FWCC, Marine Mammal Pathobiology Laboratory	Alive	3	-	3	2	6
	Fresh Dead	-	1	2	1	3
	Moderate Decomposition	2	14	5	14	21
	Advanced Decomposition	1	6**	-	3	5
	Mummified/Skeletal	-	-	-	-	-
	Dead-Condition Unknown	1	-	-	2	3
	Total	7	21	10	22	38
Mote Marine Laboratory	Alive	-	-	1	1	1
	Fresh Dead	-	-	3	3	3
	Moderate Decomposition	-	16	-	16	16
	Advanced Decomposition	-	10	-	9	10
	Mummified/Skeletal	-	-	-	-	-
	Dead-Condition Unknown	-	-	-	-	-
	Total	0	26	4	29	30
FWCC, Southwest Field Laboratory	Alive	1	-	-	1	1
	Fresh Dead	1	-	-	-	1
	Moderate Decomposition	14*	20	42	61	75
	Advanced Decomposition	2	2	2	4	6
	Mummified/Skeletal	3	-	-	1	3
	Dead-Condition Unknown	1	-	-	-	2
	Total	22	22	44	67	88
Dolphins Plus Marine Mammal Responders	Alive	2	-	1	2	3
	Fresh Dead	-	1	1	2	2
	Moderate Decomposition	-	-	-	-	-
	Advanced Decomposition	3	-	-	2	3
	Mummified/Skeletal	-	-	-	-	-
	Dead-Condition Unknown	1	-	-	-	1
	Total	6	1	2	6	9
	Grand Total	97	107	93	192	297