

FINAL REPORT

Sea Turtle Abundance and Relocation Trawling

**Brownsville, Texas
Brazos Santiago Pass
Galveston District**



Dates:

06 Dec 02-19 Dec 02

Submitted by:

**Tara Fitzpatrick
REMSA, Inc.
Marine Endangered Species Observer
Biologist/Project Manager
08 January 03**

ABSTRACT

A twenty-four-hour-per-day sea turtle relocation project was conducted onboard the fishing vessel Miss Anna during the dredging project in Brazos Santiago Pass near Brownsville, Texas from December 06, 2002 through December 19, 2002. Species targeted included loggerhead (*Caretta caretta*), kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*) sea turtles. A total of six sea turtles were caught, tagged, and safely released approximately 5 miles off the coast of Texas.

INTRODUCTION

The sea turtle relocation project was initiated as a safety precaution by the US Army Corps of Engineers (COE), Galveston District, after other projects (Brownsville and Port Mansfield) within their district neared or exceeded the National Marine Fisheries Service (NMFS) incidental take limit of green sea turtles. Consultation between the NMFS Protected Resources Division (PRD) and COE Galveston regarding dredging the Brownsville Channel began on December 06, 2002 in which the Galveston District requested that NMFS modify the Regional Biological Opinion (RBO) to require and authorize sea turtle abundance and relocation trawling during hopper dredging operations in the COE's Galveston District. The consultation referred to is No. 1/SER/2002/00600 and a copy is appended to this report (Appendix 1).

SCOPE OF WORK

The sea turtle abundance and relocation trawling project in Brownsville, Texas was contracted by Weeks Marine, Inc. The party agreeing to provide relocation trawling services (*Remsa, Inc.*) was to be responsible for providing the trawler, nets, equipment, and the necessary trained personnel. Pre-dredge trawling was to be conducted 24 hours per day for a period of five (5) days before dredging operations were to begin. Methods and equipment were standardized as much as possible including data sheets, nets, trawling speed and direction to tide, length of segment, length of tow, and numbers of tows per segment. Trawling was conducted with repetitive 35-40 minute (total time) tows in the channel. Data sheets were provided by the COE. Positions at the beginning and end of each tow were determined from GPS positioning equipment. Tow speed was taken at the approximate mid point of each tow. The trawler was fitted with two 60 foot trawling nets constructed from 8 inch mesh (stretch) as specified by the COE turtle trawling net specification (Appendix 2).

All turtles that were caught were identified, measured, tagged, and released approximately four miles off the Texas coast (away from the dredging project).

Turtles were tagged with Inconel tags previously obtained from the University of Florida's Archie Carr Center for Sea Turtle Research in each of the front flippers according to National Marine Fisheries Service protocol. Aseptic conditions were maintained for tag attachment and preparation. Data on turtles was logged on standard data sheets provided by the COE. Photographs were taken of each turtle and attached to this report.

Water temperature measurements were taken at the surface twice daily. Weather conditions were recorded including air temperature, wind velocity and direction, and sea state-wave height. High and low tides that include each tow time were recorded in military time.

RESULTS

Sea turtle abundance and relocation trawling began on 06 December 02 with five days of "pre-dredge" trawling for twenty four hours per day. Two turtles were caught during the five days of pre-dredge trawling. On 13 December 02 the hopper dredge *BE Lindholm* began dredging Brazos Santiago Pass and trawling was continued twenty-four hours per day for the duration of the project which concluded on 19 December 02. Trawling was conducted for a total of thirteen days with a total of 297 tows of 40 minutes or less. A total of six sea turtles were captured, tagged, and released safely away from the project area (Appendix 3).

Trawling reports were completed for each tow which included: begin tow and end tow times, depth, speed mid tow, latitude and longitude, station/buoys, water temperature, wave height, air temperature, wind speed, by-catch, number of turtles, and comments were recorded. Copies of these reports were turned in to the COE Galveston district on a daily basis. Copies of these reports will not be duplicated for this report because of the sheer volume but copies are available upon request.

The mean sea temperature during this period averaged 17°C degrees with a fluctuation of +/- 2°C. The by-catch on this project was not significant but certain sea turtle prey species such as jelly fish and squid were fairly abundant. A large number of bottlenose dolphins (*Tursiops truncatus*) were present in the project area during the entire project.

DISCUSSION-RECOMMENDATIONS

Damaged and destroyed nets became a serious issue on this trawling project. "Bogging down" is a common occurrence in channels that are being dredged. The dragheads of hopper dredges often make deep "grooves" in the channel which can wreak havoc on trawl nets. If the nets have to be replaced or repaired a minimum of one hour of trawling is lost due to net maintenance. Therefore, it is a threat to the dredging company for an incidental sea turtle take.

A total of six endangered/threatened sea turtles were caught, examined, tagged, and released safely approximately 5 miles off the coast of Texas. An adult Kemp's ridley was captured in the wing of the net. Unfortunately, it was caught just as the nets were being brought up and escaped before we were able to tag and relocate it.

On 15 December 02, (load #26) the trawl supervisor was informed that the dredge had taken a green turtle (*Chelonia mydas*). Shortly after the first incident, observers onboard the dredge reported finding green turtle bone fragments and tissue (fresh) in the screening system. This finding was the remaining parts from the previous incidents. The turtle from load #26 was examined onboard the dredge, it showed that the same viscera found in load #29 was missing.

On 18 December 02, a meeting took place aboard the dredge *B.E. Lindholm* while it was temporarily shut down due to weather. The ACOE and two certified NMFS biologist discussed sea turtle behavior and migration patterns during the meeting to revise dredging and trawling activity for the area (written report-Appendix 4). On 19 December 02, (load #59) the third turtle incident was reported (*Chelonia mydas*). This resulted in project termination on 19 December 02.

If you would like more information on any aspect of this report, feel free to contact me directly at (757) 723-2930.

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APPENDIX 1
MODIFICATION OF REGIONAL BIOLOGICAL OPINION
GALVESTON DISTRICT COE

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

F/SER3:EGH

Mr. Robert Hauch
Galveston District
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Dear Mr. Hauch:

This responds to your June 12, 2002, faxed letter and telephone request to Mr. Eric Hawk of my Protected Resources Division (PRD) staff to reinstate emergency consultation, pursuant to section 7 of the Endangered Species Act (ESA), on the National Marine Fisheries Service's (NMFS) September 22, 1995, Regional Biological Opinion (RBO) to the U.S. Army Corps of Engineers' (COE) Galveston and New Orleans Districts. You have requested that NMFS modify the RBO to require and authorize sea turtle abundance assessment and relocation trawling during hopper dredging operations in the COE's Galveston District, until NMFS Southeast Region issues the Gulf of Mexico hopper dredging RBO (currently in preparation) which will supersede the 1995 RBO. The requirement to conduct relocation/abundance trawling (terms and conditions are non-discretionary on the part of the action agency) serves as the permitting authority to conduct the trawling, eliminating the need for additional permits under ESA section 10. We have assigned No. I/SER/2002/00600 to this consultation; please refer to it in future correspondence on this subject.

Background:

On September 22, 1995, NMFS Office of Protected Resources issued a RBO prepared by SERO PRD authorizing the incidental take of sea turtles pursuant to COE hopper dredging of navigation channels in the New Orleans and Galveston Districts. The RBO is currently being updated by PRD to include hopper dredging operations in the Gulf of Mexico by the COE's Mobile and Jacksonville Districts, and issuance is planned for early August. The draft RBO includes terms and conditions in the Incidental Take Statement requiring the use of abundance and relocation trawlers under conditions of high documented sea turtle abundance and other environmental conditions. At the time the 1995 RBO was written, PRD included language in the Conservation Recommendations recommending relocation trawling under certain conditions:

"Relocation trawling has shown limited success in east coast channels at temporarily reducing the abundance of sea turtles during periods in which dredging is required. Relocation trawling in advance of an operating dredge in Texas and Louisiana channels

should be considered if takes are documented early in a project that requires use of a hopper dredge during a period in which large numbers of sea turtles may occur."

Subsequent to issuance of the RBO, the NMFS Section 7 Consultation Manual was revised in 1998 to indicate that activities authorized by the terms and conditions of the Incidental Take Statement of a biological opinion do not require additional section 10 permitting. Conservation recommendations, however, are not part of the Incidental Take Statement, are discretionary on the part of the action agency, and therefore may not serve as the permitting authority, as had been our original intention.

Proposed Action:

The COE Galveston District has requested (in telephone conversations between COE and PRD staff) that the RBO be amended on an emergency basis to authorize relocation and abundance trawling of sea turtles planned for July 2002 at Sabine Pass and Freeport Entrance Channel, Texas, be authorized by the RBO, without the need (at least temporarily) for COE contract personnel aboard relocation/assessment trawlers to obtain section 10 research permits to conduct the activity. Currently, there are no contractors with section 10 research permits to conduct relocation trawling at Sabine Pass and Freeport Channels.

NMFS has strongly recommended to the Galveston District that relocation/assessment trawling be conducted prior to and concomitant to dredging operations at these two sites (E. Hawk, May 2, 2002, e-mail comm. to R. Hauch). Green turtles are known to be abundant there; dredging will take place when water temperatures are warm—virtually assuring turtle presence in this area. Turtles have been historically taken during hopper dredging at these sites. The COE agrees that hopper dredging is necessary; however, it may be forced to dredge without the benefit of relocation trawlers since no contractors currently hold current section 10 research permits authorizing said activity.

The Galveston District needs to maintenance dredge Sabine Pass and Freeport Channel, from July-October 2002, to remove 2.1 and 2.4 million cubic yards of material, respectively. The District wishes to conduct relocation trawling to minimize and potentially avoid green sea turtle takes but because of unavoidable delays in the issuance of the section 10 permits by NMFS there are no permitted contractors available. This situation will force the COE to conduct hopper dredging without relocation trawling—to the unnecessary detriment of green sea turtle populations in the Gulf of Mexico. Based on past takes at Sabine Pass and Freeport Channel during cooler winter months when sea turtle abundance is lowest and the apparent unusual abundance of green turtles this year along the Texas coast, we anticipate that summer 2002 dredging at these sites will result in takes of loggerhead sea turtles and green turtles.

Effects Analysis: Anticipated Take by Relocation/Assessment Trawlers

Shrimp trawlers have been successfully used by the COE's Atlantic and Gulf of Mexico Districts to "sweep" the area in the path of an oncoming hopper dredge with a modified shrimp trawl net to remove turtles from the dredge's path and reduce the possibility of hopper dredge-endangered species interactions. Turtles captured by the trawlers have been safely released well away from the hopper dredge site. Relocation trawling has been successful at temporarily reducing the

abundance of sea turtles in Atlantic coast and Florida west coast channels and nearshore sand mining areas (e.g., Thimble Shoals Channel, Virginia Beach, Virginia; Bogue Banks, North Carolina; Kings Bay, Georgia; Canaveral Entrance Channel, Florida; Tampa Bay, Florida; St. Petersburg Harbor, Florida) during periods in which hopper dredging was imminent or ongoing.

NMFS expects that relocation/assessment trawling in Galveston District navigation channels may take an unquantifiable number of live loggerhead, green, hawksbill, and Kemp's ridley sea turtles, and Gulf sturgeon. Relocation trawling may occur under certain circumstances prior to dredging. This trawling will result in sea turtle and Gulf sturgeon takes, but these takes are not expected to be lethal due to the short duration of the tow times (15 to 30 minutes per tow). While relocating sea turtles and Gulf sturgeon may stress the animals, the level of stress should be minimized by proper, expedited handling. Additionally, capturing a live turtle or sturgeon in a relatively slowly advancing shrimp trawl net is less harmful to the animal than being entrained in a dredge draghead and pumped into a screening box. Thus, an unquantifiable number of live loggerhead, Kemp's ridley, green, and hawksbill sea turtles, and Gulf sturgeon, are anticipated to be taken during any relocation/assessment trawling deemed necessary by NMFS or the COE during hopper dredging of Sabine Pass and Freeport navigation channels.

In summary, NMFS believes that relocation trawling may effect, but is not likely to adversely effect listed species under NMFS purview and hereby modifies the 1995 RBO to include relocation/assessment trawling as a term and condition of the ITS.

Amendment No. 1:

The Amendment described below is modeled after terms and conditions found in the draft RBO currently under preparation. The 1995 RBO is amended (Amendment No. 1) as follows:

- A. Conservation Recommendation No. 2 of the 1995 RBO is eliminated.
- B. The following term and condition (No. 10) is added to the Incidental Take Statement of 1995 RBO, as follows:
 10. Relocation Trawling and Relative Abundance Trawling: Relocation trawling and relative abundance trawling in association with hopper dredging projects in COE Galveston District's navigation channels, conducted by NMFS-approved endangered species observers, should be considered if: takes are documented early in the project during a period in which large numbers of sea turtles may occur; 2 or more turtles are taken in a 24-hour period; 4 or more turtles are taken in a project; seawater temperatures are unseasonably warm; large amounts of sea turtle prey species are being collected in the inflow screens; the take level for a particular species at a particular hopper dredging project is so high that the District is on verge of terminating the project and/or reaching its District species quota for that species; dredging is necessary outside the December 1-March 31 window or unseasonably warm temperatures exist during the window; evidence exists indicating that protected species presence may be high; a combination of these factors exists.

Lethal or injurious takes which result from relocation/assessment trawling (including capturing, handling, weighing, measuring, tagging, and releasing) in the Galveston District are limited to 1 (one) sea turtle and 1 (one) Gulf sturgeon per fiscal year and are subtracted from (counted against) the authorized, anticipated take levels discussed previously for hopper dredging; e.g., a Kemp's ridley injury or lethal take during a Galveston District's relocation/assessment trawling effort shall be counted as a documented take against the District's fiscal year anticipated take level or "quota." NMFS shall be immediately notified of any injuries sustained by protected species during relocation/assessment trawling.

The Galveston District shall each provide NMFS Southeast Regional Office with project completion reports detailing any relocation trawling and relative abundance trawling efforts and results at Sabine Pass and Freeport Channel.

This Opinion authorizes the unlimited non-lethal, non-injurious take of sea turtles and Gulf sturgeon in association with all relocation trawling and relative abundance trawling deemed necessary by the COE to temporarily reduce the abundance or assess the abundance of these species during and in the days preceding a hopper dredging project to reduce the possibility of lethal hopper dredge interactions, subject to the following conditions:

- A. Trawl tow-time durations shall be not longer than 30 minutes (doors in - doors out); 15-30 minutes is recommended.
- B. Turtles and sturgeon captured pursuant to relocation trawling or relative abundance trawling shall be handled in a manner designed to ensure their safety and comfort.
- C. Captured turtles shall be kept moist and whenever possible shaded until they are released.
- D. Turtles shall not be kept longer than 12 hours prior to release and shall be released as far away as practicable from the dredge site (if it can be done safely, turtles may be transferred onto another vessel for transport to the relocation site to enable the relocation trawler or relative abundance trawler to keep sweeping the dredge site); sturgeon shall be released as soon as possible after measuring, away from the dredge site or in already dredged areas.
- E. All turtles and sturgeon shall be measured prior to release (for turtles, standard carapace measurements including body depth; for sturgeon, fork length and total length), and weighed when it is possible to do so safely.
- F. Any endangered species injured or killed during or as a consequence of relocation trawling or relative abundance trawling shall count toward the appropriate COE District's incidental take quota.

G. All sea turtles captured by relocation trawling or relative abundance trawling shall be flipper-tagged prior to release with Inconel tags which must be previously obtained from the University of Florida's Archie Carr Center for Sea Turtle Research. This Opinion serves as the permitting authority for any NMFS-approved endangered species observer aboard a relocation trawler or relative abundance trawler to flipper-tag captured sea turtles with external tags (e.g., Inconel tags). Columbus crabs or other organisms living on external sea turtle surfaces may be sampled and removed under this authority.

H. All other tagging, external or internal sampling procedures (e.g., PIT tagging, blood letting, skin tag sampling, laparoscopies, gastric lavages, mounting satellite or radio transmitters, genetics sampling, etc.) for sea turtles or sturgeon are prohibited unless the observer holds a valid sea turtle or sturgeon research permit, pursuant to section 10 of the ESA, from the NMFS Office of Protected Resources, Permits Division, authorizing him or her to conduct the research, either as the permit holder, or as designated agent of the permit holder.

Conclusion:

NMFS PRD has determined that Amendment No. 1 to the 1995 RBO will not adversely affect listed species under NMFS purview. This concludes consultation responsibilities under section 7 of the ESA. Consultation should be reinitiated if there is a take, new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified or critical habitat designated that may be affected by the identified activity.

If you have any questions about this consultation, please contact Eric Hawk at the letterhead phone number, or by e-mail at eric.hawk@noaa.gov.

Sincerely,

Joseph E. Powers, Ph.D.
Acting Regional Administrator

cc: F/PR1, F/PR3

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APPENDIX 2
TRAWLING SCOPE OF WORK

Trawling Scope of Work

INTRODUCTION

The following scope of work is for assessment of the relative abundance of sea turtles in entrance channels which are being maintained by hopper dredges. Sea turtles will be captured by trawling. The trawling survey will provide information on the times of occurrence and general location of turtles in these channels. Species, size, sex, and general condition will be recorded for captured turtles. The approach used for this survey standardizes the distance trawled (2 km, 1.08 nm) and flow direction (with the tidal flow).

OBJECTIVES

To determine relative abundance of sea turtles in the entrance channel 2 to 7 days prior to dredging.

TRAWLING SPECIFICATIONS:

Trawling will be conducted to capture turtles to determine relative abundance in the channel. Survey methods and equipment will be standardized as much as possible including data sheets, nets, trawling speed and direction to tide, length of segment, length of tow, and numbers of tows per segment. Trawling will be conducted with repetitive 15-30 minute (total time) tows in the channel. Data sheets will be provided by CE. Nets to be used will be the standard CE turtle nets used on previous surveys (Appendix A.). Trawling speed will be at a constant rate and consistent for each tow (approximately 2.5-3.0 knots). Trawling will be conducted with the tidal flow. A minimum of 6 tows per segment, 2 each in the green, red, and center portion of the channel. The channel will be divided into segments 3 km in length which will be set for all surveys in that channel. The segments will include the areas of the channel which will be dredged and a "buffer" segment in the channel on each side of the dredged segments. Each 3 km segment will be trawled for a distance of 2 km. Tow times will be adjusted from 15 to 30 minutes to achieve the 2 km tow length. Surveys will be conducted according to a randomized design consistent with NMFS survey protocol as much as possible.

Positions at the beginning and end of each tow will be determined from GPS positioning equipment. Tow speed will be taken at the approximate mid point of each tow.

NET SPECIFICATIONS:

The trawler will be fitted with two 60 foot trawling nets constructed from 8 inch mesh (stretch) as specified in the attached description. The nets will be fitted with mud rollers and floats as specified.

TURTLE HANDLING AND MEASUREMENTS

All turtles that are caught will be identified, measured, tagged and released back into the channel at the approximate point of capture. They will be released into the channels in the location where they are captured to determine their recapture rate. Turtles will be returned to the water as soon as possible after capture. Measurements will be taken according to the protocol detailed in Pritchard et al. 1983. At a minimum, straight line length, straight line width, tail length, and weight will be taken. Turtles will be tagged with NMFS #681 Inconel tags in each of the front flippers according to National Marine Fisheries protocol. Trovan Passive Integrated Transponder (PIT) tags will be injected subcutaneously in the wrist area of the turtles right front flipper. Aseptic conditions will be maintained for tag attachment and tags. Data on turtles will be entered in a standard data sheet in a format provided by the Corps of Engineers (Appendix B.). Photographs will be taken of each turtle captured. Included in the photograph will be a 4 x 6 card with the tag numbers, date, and location written in large black letters. Additional photographs will be taken of methods, injured turtles, unusual bycatch, or other items of technical interest. A copy of the photos will be provided to the Corps of Engineers.

WATER QUALITY AND PHYSICAL MEASUREMENTS

Water temperature measurements will be taken at surface, mid depth, and bottom each slack tide during the sample period for a minimum of one measurement at the beginning and one at the end of the sample period (each month). Weather conditions will be recorded including air temperature, wind velocity and direction, sea

state-wave height, and precipitation. This information can be obtained from the local weather service. High and low tides that include each low time will be recorded in military time.

SAMPLE PERIODS

Trawl surveys will be conducted in the channel two to seven days prior to initiation of dredging.

PERMITS

Permits for handling threatened and endangered species and for collecting other organisms will be obtained from the appropriate agencies.

APPENDIX B: TURTLE TRAWL NETS SPECIFICATIONS

Back

DESIGN: 4 seam, 4 legged, 2 bridal trawl net

WEBBING: 4 inch bar, 8 inch stretch top - 36 gauge twisted nylon dipped side - 36 gauge twisted nylon dipped bottom - 84 gauge braided nylon dipped

NET LENGTH: 60 ft from cork line to cod end

BODY TAPER: 2 to 1

WING END HEIGHT: 6 ft

CENTER HEIGHT: Dependent on depth of trawl 14 to 18 ft

COD END: Length 50 meshes x 4" = 16.7 ft Webbing 2 inch bar, 4 inch stretch, 84 gauge braid nylon dipped, 80 meshes around, 40 rigged meshes with 1/4 x 2 inch choker rings, 1 each \leftarrow x 4 inch at end cod end cover - none chaffing gear - none

HEAD ROPE: 60 ft \leftarrow inch combination rope (braid nylon with stainless cable center)

FOOT ROPE: 65 ft \leftarrow inch combination rope

LEG LINE: top - 6 ft, bottom 6 - ft

FLOATS: size - tuna floats (football style), diameter - 7 inch length - 9 inch, number - 12 each, spacing - center on top net 2 inches apart

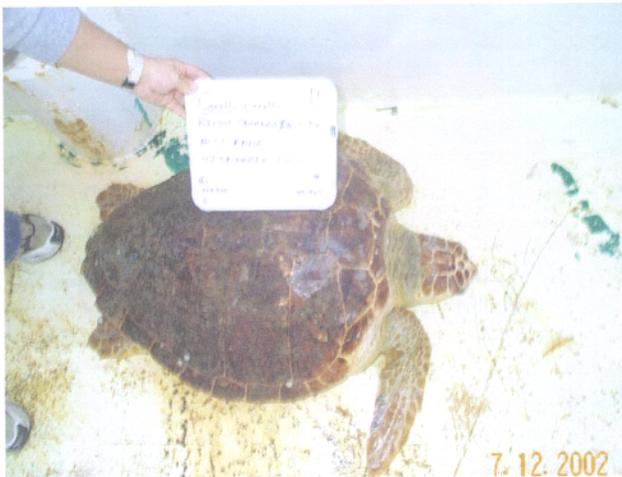
MUD ROLLERS: size 5 inch diameter 5.5 inch length, number - 22 each, spacing - 3 ft attached with 3/8 inch polypropylene rope (replaced with snap on rollers when broken)

TICKLER CHAINS: NONE (discontinued- but previously used 1/4 inch x 74 ft galvanized chain)

WEIGHT: 20 ft of 1/4 inch galvanized chain on each wing, 40 ft per net looped and tied

DOOR SIZE: 7 ft x 40 inches (or 8 ft x 40 inches), Shoe - 1 inch x 6 inch, bridles - 3/8 inch high test chain

APPENDIX 3
SEA TURTLE TAGGING REPORTS



Caretta caretta
 Take #1
 07 Dec 02
 SCL-69.8 SCW-55.6
 Lt Flipper: XXZ984 Rt Flipper: XXZ985



Chelonia mydas
 Take #2
 08 Dec 02
 SCL-45.5 SCW-37.7
 Lt Flipper: XXXZ986 Rt Flipper: XXZ987



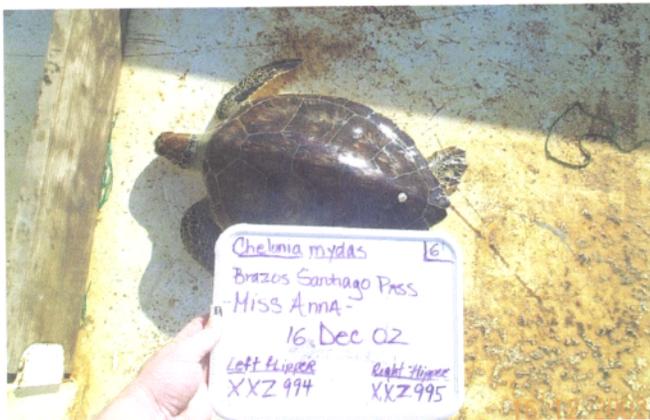
Chelonia mydas
 Take #3
 12 Dec 02
 SCL- 46 SCW- 36.3
 Lt Flipper: XXZ989 Rt Flipper: XXZ988



Chelonia mydas
Take # 4
14 Dec 02
SCL- 58.2 SCW- 45.3
Lt Flipper: XXZ990 Rt Flipper: XXZ991



Chelonia mydas
Take #5
15 Dec 02
SCL- 33.6 SCW- 26
Lt Flipper: XXZ992 Rt Flipper: XXZ993



Chelonia mydas
Take #6
16 Dec 02
SCL- 51.3 SCW- 40.2
Lt Flipper: XXZ994 Rt Flipper: XXZ995

APPENDIX 4
DISCUSSION AND RECOMMENDATION ON THE IMPACT OF SEA TURTLES
DUE TO HOPPER DREDGE ACTIVITIES ON THE TEXAS COAST

On December 15, 2002 a green sea turtle (*Chelonia mydas*) was incidentally taken by a hopper dredge project in Brazos Santiago Pass near Brownsville, Texas. The Army Corp of Engineers (ACOE) and National Marine Fisheries Service (NMFS) were immediately notified about the sea turtle incident. A few days after the incident, a meeting took place aboard the dredge *B.E. Lindholm* while it was temporarily shut down due to weather. The ACOE and two certified NMFS biologist discussed sea turtle behavior and migration patterns during the meeting to plan a more aggressive form of action during hopper dredge activity. On December 18, 2002 shortly after the ACOE meeting the dredge *B.E. Lindholm* resumed to dredging, this resulted in their second green sea turtle incident. The ACOE consulted with NMFS which resulted in the termination of the project, fearing that more turtles would be taken by the dredge. The yearly limit for the Galveston district is 5 green sea turtles. Since the project resulted in 2 of the 5 takes it was terminated so it would not impact further dredge projects in the site.

I had the opportunity to speak with Dr. Donna Shaver and Jeff George who both specialize in sea turtle behavior and migration patterns along the Texas coast. Their primary conclusion for dredging along the Texas coast is to start the projects as soon as possible. It is found that the ideal time to dredge is during the winter months due to low water temperature.

The South Texas coast presents some unique challenges because there is a year round sea turtle presence. The following is a written report put together for a more aggressive prevention plan in order to reduce further sea turtle incidents. First is the timing for water temperature; if above 55 degrees Fahrenheit, sea turtles are more likely present. Second, dealing with procedures of relocation trawling, taking into consideration weather, swell compensators, and the use of two trawlers. Last, examining historical sea turtle incidents on the Texas coast.

Timing dredging projects around water temperature is crucial. There is a species gradient along Texas coast waterways, where Kemp's ridleys dominate the northern Texas coast and green turtles dominate on the southern coast. Satellite tracking studies, sonic tracking studies, netting studies, and stranding work indicate that the Kemp's ridleys (the top of the endangered list) may move out of the upper Texas coast passes and bays as water temperature decreases. Green turtles (follow the ridleys on the endangered list) may also move out of the passes and bays when the temperature decreases. The population in the southern most areas of the state are more stable due to relatively warm water year round. Starting in mid-March the risk of turtle capture will increase, especially in south Texas where the temperatures remain warmer. Here is a list of some possible dredging areas off the coast of Texas:

- Sabine Pass - mostly Kemp's ridley turtles (with a few greens and a few loggerheads, possibly an occasional hawksbill). Captures of turtles were almost exclusively during the late-spring, summer, and early-fall.
- Galveston - species composition likely similar to Sabine Pass
- Houston - species composition likely similar to Sabine Pass
- Freeport - species composition likely similar to Sabine Pass

- Port Aransas - mixture of green turtles, Kemp's ridley, hawksbill, and loggerhead
- Corpus Christi - species composition similar to Port Aransas
- Port Mansfield - mostly green turtles (with a few hawksbills and loggerheads, possibly an occasional Kemp's ridley). January was the only month where no turtles were captured. April through December (peaking in September and October) is the period where sea turtles are most abundant. However, strandings in inshore areas of south Texas follow almost the opposite trend. The numbers are greatest during December, January, and February. Strandings are highly dominated by cold stunning, which validate that turtles can be present during these months in some years.

Another issue that needs to be addressed is relocation trawling procedures. Weather, swell compensators, and utilizing two trawlers are all key areas to look at to avoid shut down situations. Weather is the number one factor to cause sea turtle incidents by the dredge. The Army Corps of Engineers (ACOE) needs to formulate an outlined procedure for bad weather conditions. The swell compensators play an important role when harsh weather conditions set in. In the ACOE contract for dredging, there should be rules to follow when the swell compensators fail to keep the dragheads on the sea floor due to rough seas. For example, Dredge B.E. Lindholm of Weeks Marines has a swell compensator that allows dragheads to remain on the bottom if swells up to 8 feet. Dredging contracts should state that operations should be shut down temporarily until further notice of clear weather. If the swells rise above 8 feet, the dragtender will have trouble keeping the dragheads on the bottom. This may be one cause of turtle incidents by the dredge because the dragheads are now able to suck up anything in the water column. Another way to prevent turtle incidents is to trawl 6 hours prior to dredging after bad weather has struck. The trawler can cover all the surface area of the dig site (same as pre-trawling) before the dredging operation begins, this will clear the area of all turtles. Utilizing 2 trawlers is very effective and ACOE and the dredge company should consider this for future projects. In areas where there is an abundance of turtles, especially Texas, using two trawlers would be the best solution while dredging in order to cover as much bottom as possible.

Another suggestion that would be an excellent guide for future projects would be to examine the historical sea turtle incidents with hopper dredges. Once that information is analyzed, a better conclusion to where and when dredging projects can start with the least chance for incidents can be made. These are some views and ideas that our MESO office has come up with. We strongly recommend that the ACOE takes this report in consideration to prevent sea turtle incidents with hopper dredge activity. We know that dredging entrance channels is imperative, if all ends meet with everyone working together, the outcome will be rewarding.