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**Gulf of Mexico Fishing Gear and Their
Potential Impacts on Essential Fish Habitat**

by:

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INTRODUCTION

The 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act mandated that regional fishery management plans be amended to include the description and identification of essential fish habitat (EFH) for all managed species, including adverse impacts on such habitat caused by fishing. The requirement to evaluate fishing-related impacts on EFH developed into a profoundly difficult obstacle given the paucity of available information, specifically on the numerous types of gear utilized within the Gulf of Mexico. While there have been hundreds of studies published on gear impacts worldwide, the majority of these focus on mobile gear such as trawls. Currently, there are approximately 25 allowable gear types aside from trawls utilized within Federal waters of the Gulf of Mexico. Furthermore, as Gulf of Mexico EFH includes inshore and estuarine waters, there are several other gear types regulated by individual states that need to be evaluated. Due to the lack of specific information of fishery-related impacts, the Gulf of Mexico Fishery Management Council's Generic Amendment for Addressing Essential Fish Habitat Requirements was only partially approved by NOAA Fisheries. In an effort to correct these deficiencies, this evaluation attempts to review all utilized gear within the region and list the potential impacts a gear type may have on habitat, including literature citations of the pertinent studies that are available.

BACKGROUND

All fishing has an effect on the marine environment, and therefore the associated habitat. Impacts range from the extraction of a species which skews community composition and diversity to reduction of habitat complexity through direct physical impacts of fishing gear. Although predicting the *potential* impacts and the degree of severity for many gears is possible, the exact relationship that those impacts have on the associated community and productivity is not yet fully understood. While it is clear that fishing practices impact or alter EFH, the result of those impacts or the degree of habitat alteration that still allow for sustainable fishing is unknown (Dayton et al. 1995; Auster et al. 1996; Watling and Norse 1998). Furthermore, evaluating the cumulative effect of fishery-related impacts becomes even more difficult. Evaluation of fish stocks to determine habitat "health" or evaluating habitat impacts has its pitfalls; the (apparent) effects of fishing may be exacerbated by natural environmental conditions or camouflaged by good recruitment prior to the effects of habitat degradation being absorbed by a species. Therefore, it is prudent to take a precautionary approach to evaluating fishery-related impacts and implementing risk-averse and ecosystem-based management measures.

FISHERY-RELATED IMPACTS

The extent and severity of fishery-related impacts to habitat varies by gear type. Furthermore, an impact may vary in significance with the magnitude of application (i.e. cumulative impact); whereas the extent of an isolated habitat impact may be minimal to the associated marine community, the repetition of that impact may become very significant after a relatively short duration. Please refer to Table 1 for an analysis of various gear types and their potential impacts on EFH.

While individual gear types may have associated impacts unique to themselves, alteration of benthic habitat or reduction of habitat complexity resulting from gear impacts remain a constant with most. Direct consequences of habitat alteration include:

1. increased predation of juveniles due to lack of shelter; increased juvenile mortality due to disturbance of nursery beds (Gotceitas and Brown 1993; Gregory and Anderson 1997; Hsiao et al. 1987; Lindholm et al. 1998);
2. reduction in available forage:
 - a. loss of vertical and complex benthic habitat (truncated carrying capacity) for invertebrates and other prey species; and
 - b. compression of sediments that reduces the oxygenated layer of the benthos utilized by invertebrates and other prey species.
3. depressed recruitment due to habitat requirements during spawning;
4. lowered water quality attributed to the removal of filter-feeding organisms and sediment suspension (Churchill 1989, Gill et al. 1999, Jones 1992, Messieh et al. 1991, Pilskaln et al. 1998):
 - a. reduction in ambient light (photosynthesis implications);
 - b. smothering of benthos following sediment resettlement;
 - c. creation of anaerobic conditions near the seabed; and
 - d. reintroduction of interned toxins.
5. increased interspecies competition or species shift resulting from habitat alteration; lack of suitable habitat disturbs community structure and function (MacDonald et al. 1996).

GULF OF MEXICO HABITAT

In order to assess the range of impacts on EFH, this analysis evaluates four major habitat types: submerged aquatic vegetation (SAV), oyster reefs, soft bottoms, and complex benthic habitat (including artificial refugia). After each discussion, a list of gears is provided which is ordered based on the potential threat each gear poses towards the particular habitat type. These interpretive threat appraisals are based on scientific literature, photographic evidence, and anecdotal evidence. While there are numerous unique habitat types within the Gulf of Mexico, it would be impossible to evaluate impacts to each one. Therefore, utilizing four of the more representative habitat types allows for an insight to potential fishery-related impacts within the Gulf of Mexico.

SUBMERGED AQUATIC VEGETATION (SAV):

SAV beds are important natural resources which are essential for the development of numerous species of finfish and shellfish. Several species of seagrass are found in the Gulf of Mexico region including turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), star grass (*Halophila engelmannii*), paddle grass (*Halophila decipiens*), and widgeon grass (*Ruppia maritima*). SAV is comprised of rooted flowering plants that are historically found in estuaries and other subtidal areas to a depth of 20 meters or more (GMFMC 1998a); there are approximately 3,700,000 acres of SAV in the Gulf of Mexico (MMS 1983). Furthermore, the presence of SAV in an area is indicative of water quality conditions which are low in nutrient

enrichment and turbidity (Dennison et al. 1993).

Two categories of SAV impact can be established: damage to the exposed plant, including leaf-shearing and burial, and disturbance to the underground stem, or rhizome. Individual leaf-shearing events do not represent a significant threat to SAV health, however, fishing activities that repeatedly shear leaves could result in SAV loss. Furthermore, it should be noted that impacts range in severity depending on the species of SAV; impacts on species that depend largely on sexual reproduction (e.g., *Halophila decipiens*) may be extreme, as flower and seed removal may hamper SAV establishment. The use of mobile gear such as dredges and scrapes resuspend sediments that attenuates ambient light, negatively impacting the photosynthetic processes of submerged plants. Furthermore, there is a potential for smothering by sediments precipitating out of the water column if the load is great enough or the activity occurs frequently enough. For example, the growing tips of *Halophila* spp. are very close to the sediment and are extremely susceptible to burial. Disturbance to the rhizome generally presents a more serious threat to SAV survival than impacts to the exposed plant as SAV loss will occur. Dredging and raking for shellfish severely impacts SAV, removing the root structure of the organism and undermining the ability of SAV beds to stabilize sediments and remove nutrients. *Thalassia testudinum* has exhibited an extremely long recovery period from rhizome removal, taking more than 5 years to recolonize from prop scars (Zieman 1976). Recovery of *Halodule wrightii* did not begin for over two years after termination of two intense clam kicking applications (Peterson et al. 1987).

SAV GEAR THREATS

1. oyster dredge
2. rakes
3. oyster scrape
4. trawl
5. lobster/stone crab trap
6. haul seine

OYSTER REEFS:

The value of oysters as filter-feeding organisms has long been recognized, however, the habitat that oyster reefs provide to resident and transient species may not be fully appreciated. The increased surface area of an oyster reef allows for greater species diversity than level benthic areas due to expanded habitation opportunities (Watling and Norse 1998). Reef structure formed by oysters creates vast interstitial spaces for small invertebrates and juvenile fish, analogous to a tropical coral reef. Impacts to oyster reefs, especially fishing activities that target oysters, directly reduce EFH and hamper the natural water-cleansing ability of oysters (Coen 1995). Furthermore, fishing activities adjacent to oyster reefs can have a significant impact. Oyster dredging and the use of other mobile gear have the ability to suspend large quantities of sediment that can over-task the natural filtering ability of oysters; excess sedimentation can potentially stress or smother oysters, degrading EFH.

OYSTER REEF GEAR THREATS

1. oyster dredge
2. tongs
3. rakes
4. oyster scrape

SOFT BOTTOM (MUD/SAND/SILT):

Benthic areas comprised of sand are easily altered by natural environmental conditions such as currents and surge that constantly reshape surface features. Larger sized sediments (e.g., gravel, cobble, boulder) are more resilient to resuspension and are relatively static. In contrast, silt, mud, and clay are extremely susceptible to resuspension, and therefore usually accumulate in areas that are either infrequently impacted by natural events

or are frequently renourished with sediments (Watling and Norse 1998). Therefore, it might be concluded that fishing activities have a greater effect on mud bottoms than on sand. This has important implications on nutrient cycling in areas that are regularly trawled. Impacts include (PilskaIn et al. 1998):

1. burial of fresh organic matter and exposure of anaerobic sediments;
2. large nutrient delivery to the water column, possibly impacting primary production;
3. increase in nitrate flux out of the sediments; and
4. reduced denitrification (conversion of remineralized nitrogen into N₂ gas).

All of these may have desirable or undesirable ecosystem impacts. An increase in nitrate fluxes to the water column may alter primary production (phytoplankton), potentially benefitting fisheries or stimulating deleterious phytoplankton growth that result in harmful algal blooms (PilskaIn et al. 1998). While some fisheries (e.g., menhaden) may benefit, others may suffer (e.g., red snapper). If the impacts are regular enough, the benthic area might not be capable of providing adequate forage to dependent marine species. This lack of food might introduce additional stress to some species that may be currently overfished, prolonging the rebuilding of the stock.

Another physical impact primarily attributed to trawling is the compression and smoothing of soft bottom sediments. Towing speed, substrate type, and gear configuration are the primary factors that dictate sediment impacts. The footrope generally causes little physical substrate alteration aside from smoothing of bedforms and minor compression (Brylinsky et al. 1994, Kaiser and Spencer 1996). However, as trawlers repeatedly trawl the same general areas, these minor compressions can lead to sediment "packing" (Schwinghammer et al. 1996). Further compression can result from the dragging of a loaded net (cod end) along the bottom.

SOFT BOTTOM GEAR THREATS

1. trawl (cumulative impact)
2. oyster dredge

COMPLEX BENTHIC HABITAT:

The majority of hardbottom in the Gulf of Mexico consists of exposed limestone on which algae, coral, and sponge growth establish, and given time will accumulate; high vertical profile reef tracts, with a few notable exceptions, are not prevalent within the region. Nonetheless, many species important to commercial and recreational fisheries reside around banks, ledges, and small outcroppings colonized by sessile invertebrates such as hydroids, bryozoans, gorgonians, anthozoans, and algae that form complex benthic communities. Furthermore, many areas along the west coast of Florida are characterized by a thin sand veneer covering solid limestone. This layer of sand inhibits coral growth, but allows for sponge colonization; in some locales, sponges are quite abundant and provide the only substantial vertical habitat for many species. Hardbottom and "sponge gardens" are extremely vulnerable to damage from shrimp trawlers, and may be severely impacted in areas of local trawl activity (Image 2). Roller gear was found to damage 3.9% of the octocorals, 30.4% of the stony corals, and 31.7% of the sponges in a hardbottom community from a single tow (van Dolah et al. 1987). While trawlers may tend to stay away from large hardbottom communities due to potential damage to gear that may be incurred by outcroppings, habitat degradation may frequently occur in areas of sponge communities and random hardbottom areas.

Lines of fish and lobster traps present a potentially significant threat to complex benthic communities. Fishermen who do not buoy trap gear, recover long lines of traps by deploying a grapnel which is dragged in the vicinity of their gear. The line that is attached to the multiple traps has the potential to seriously impact sponges and corals if the line tension increases and sweeps the bottom for any considerable distance before ascending during recovery; the line can shear off portions of sponges (Image 3) or become entangled in coral causing considerable damage. The grapnel itself, which may be of considerable weight, has the potential to seriously damage corals

and sponges that it may impact. Furthermore, traps may become lodged within corals and damage complex benthic habitats during deployment (Image 1) or recovery if the gear is in close proximity to such habitats.

Similarly, bottom longlines can impact complex benthic habitats in the same manner as lines between fish and lobster traps; during recovery the line may sweep considerable distances before rising off the bottom, dislodging objects and impacting hard corals (NMFS 1998a). Large fish may move the groundline along the bottom or into the water column during their escape runs, potentially damaging sponges and corals.

Other gear such as hook and line and bandit gear may also pose a significant threat to complex benthic habitats, as they target species that associate with hardbottom habitat. A trawl may cause more damage with a singular event, however other gear types, utilized by numerous individuals in both the commercial and recreational sectors, are used regularly on hardbottom habitat and may present a considerable (cumulative impact) threat that needs to be quantified.

COMPLEX BENTHIC HABITAT GEAR THREATS

1. trawl
2. bottom longline
3. fish traps
4. lobster/stone crab traps
5. spearfishing/lobstering (includes spear, snare, bully net, hoop net, hand/dip net, hand harvest)
6. hook and line
7. gillnet
8. allowable chemical

CONCLUSIONS

All fishing practices impact the marine environment. However, the level of impact a specific habitat area can withstand and still support sustainable fisheries is not yet known. Fishery-related impacts vary significantly based on habitat type, gear type, duration of use, and recovery time. Within the Gulf of Mexico, there are several gear types and fishing activities that are compatible within the habitat areas they are employed, minimally impacting EFH. Conversely, there are several gear types that are not compatible with certain habitat types and these fishing activities should be reconsidered or investigated more thoroughly. Modifications to fishing gear and "gear zoning" would reduce the potential of adverse impacts on EFH and these should also be pursued. As evident in Table 1, there are many gear types where there is a complete unavailability of habitat impact studies. This glaring lack of information and understanding of marine habitat tolerances presents serious obstacles for responsible fisheries management and should be rectified.

ASSORTED GEAR AND EXAMPLES OF FISHERY-RELATED IMPACTS ON ESSENTIAL FISH HABITAT

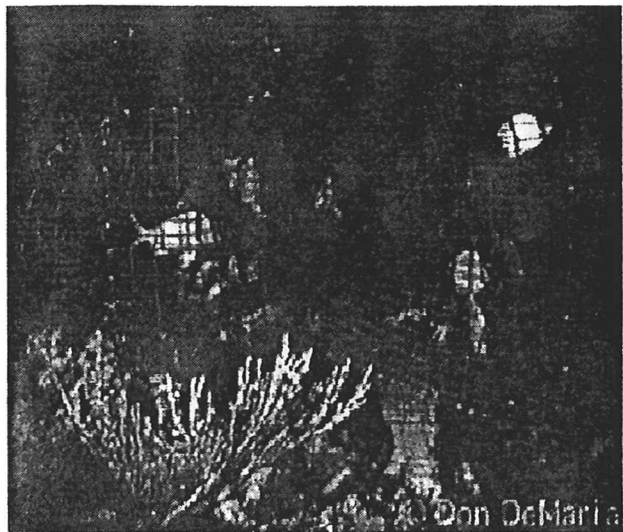


Image 1. Fish trap resting on a coral head (©Don DeMaria).

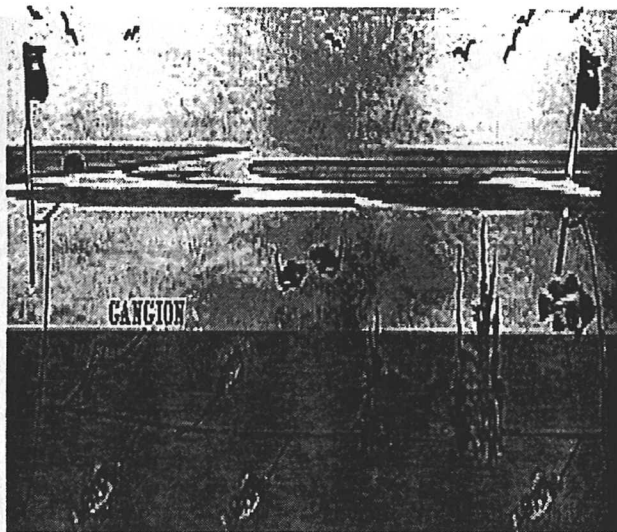


Image 2. Bottom longline (Robin Amaral*).

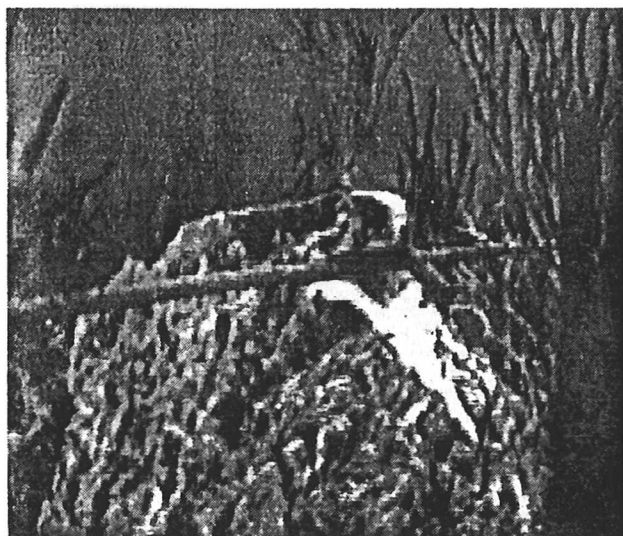


Image 3. Lobster trap line abrading sponge and coral habitat off eastern Florida (Bill Parks).

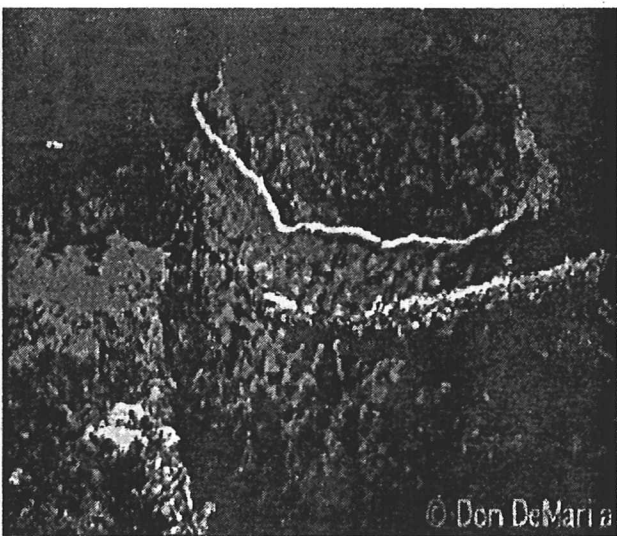


Image 4. Trap rope against a sponge (©Don DeMaria).



Image 5. Monofilament gillnet "ball" hung on shipwreck (Author).



Image 6. Monofilament line entangled in coral (Dr. Chris Koenig).

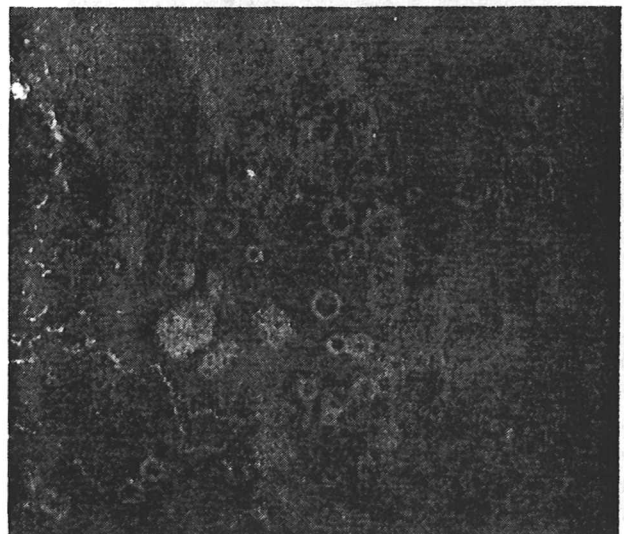


Image 7. Aerial photograph of clam dredge scars in Chincoteague Bay, Virginia (Moore and Orth 1997).

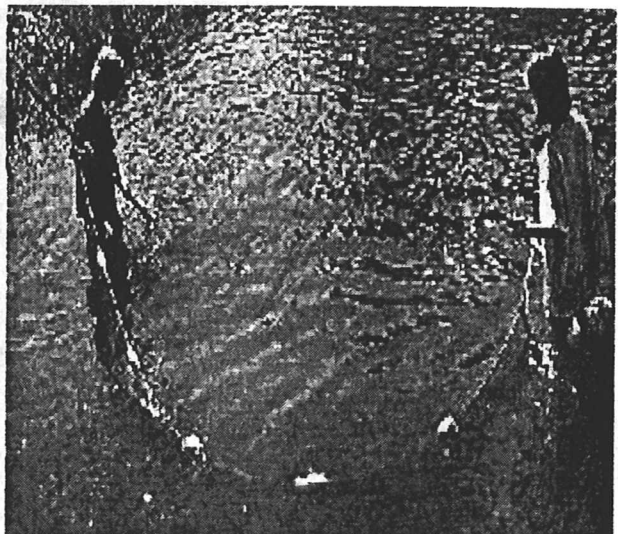


Image 8. Use of a beach/haul seine (Laren Leonard).

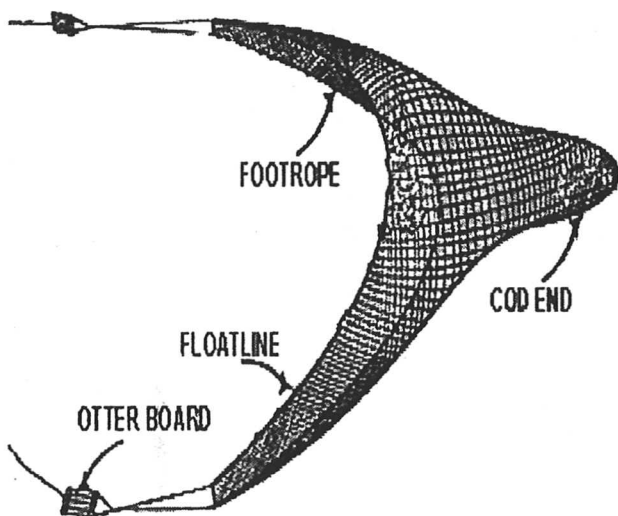


Image 9. Diagram of an otter trawl (Robin Amaral*).



Image 10. Trawl net hung on shipwreck (Author).



Image 11. Lobster trap sitting amongst coral habitat (Bill Parks).

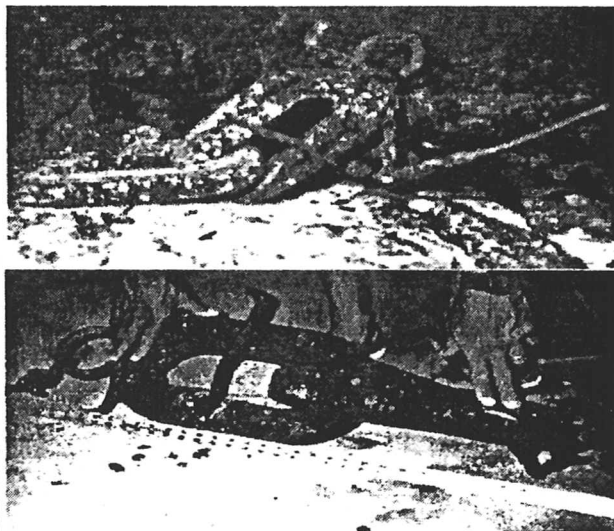


Image 12. Grapnel used to retrieve lobster traps off eastern Florida (Bill Parks).

- DIMENSIONS**
- (1) 117.5 cm (Y 6 1/2")
 - (2) 368.0 cm (12 2 1/2")
 - (3) 54.0 cm (2 1/4") Center of axle to bend
 - (4) 15.2 cm (6") Radius of side edge
 - (5) 100.0 cm (36 1/4") Bend to middle of support
 - (6) 42.0 cm (16 1/2")
 - (7) 1.2 cm (1/2") ID (inside diameter)
 - (8) 57.2 cm (22 1/2") Center of frame to rear edge
 - (9) 1.2 cm (1/2") ID
 - (10) 121.0 cm (48") Center of frame to middle of junction
 - (11) 1.9 cm (3/4") ID
 - (12) 82.1 cm (32 3/4") Center of frame to front edge
 - (13) 12.7 cm (5")
 - (14) 1.1 cm (7/16") Rod
 - (15) 2.5 cm (1") ID
 - (16) 1.1 cm (7/16") Rod
 - (17&18) See text

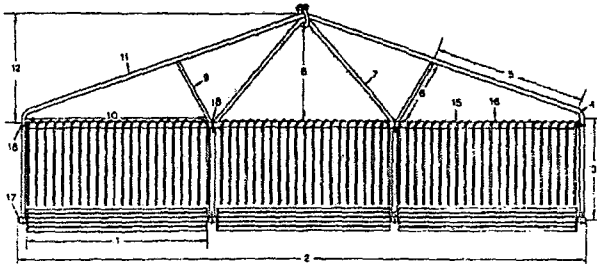
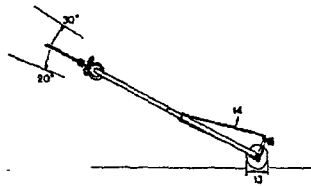


Image 13. Front and side view schematic of a roller frame trawl (Tabb and Kenny 1969).

Table 1. Analysis of regional fishing gear and associated potential impacts on essential fish habitat.

GEAR TYPE	HABITAT	POTENTIAL IMPACTS	REFERENCE
SCALLOP DREDGE	SUBMERGED AQUATIC VEGETATION	SIGNIFICANT IMPACT TO HABITAT. REDUCTION IN SAV COVERAGE AND LOSS OF RHIZOMES; SEDIMENT SUSPENSION; SMOTHERING OF SAV.	FONSECA ET AL. (1984)
SCALLOP DREDGE	SAND/SHELL	SIGNIFICANT IMPACT TO HABITAT. SMOOTHED BEDFORMS; REDUCTION OF EPIFAUNAL COVERAGE; SHELL AGGREGATE DISPERSAL.	AUSTER ET AL. (1996); CADDY (1973); COLLIE ET AL. (1996); THRUSH ET AL. (1995)
OYSTER DREDGE	SUBMERGED AQUATIC VEGETATION	MASSIVE IMPACT TO HABITAT. REDUCTION IN SAV COVERAGE AND LOSS OF RHIZOMES; EXTENDED RECOVERY TIME; SEDIMENT SUSPENSION; SMOTHERING OF SAV.	
OYSTER DREDGE	OYSTER REEFS	SIGNIFICANT-MASSIVE IMPACT TO HABITAT. REDUCTION IN VERTICAL OYSTER REEF HABITAT; REDUCTION IN FILTERING ABILITY OF OYSTER REEF (WATER QUALITY); SEDIMENT SUSPENSION.	
RAKE	SUBMERGED AQUATIC VEGETATION	SIGNIFICANT IMPACT TO HABITAT. REDUCTION IN SAV COVERAGE (55%-89%) AND LOSS OF RHIZOMES (37%-83%); SEDIMENT SUSPENSION; SMOTHERING OF SAV.	PETERSON ET AL. (1983); PETERSON ET AL. (1987)
RAKE	OYSTER REEFS	SIGNIFICANT-MASSIVE IMPACT TO HABITAT. REDUCTION IN VERTICAL OYSTER REEF HABITAT; REDUCTION IN FILTERING ABILITY OF OYSTER REEF (WATER QUALITY).	
OYSTER TONGS	OYSTER REEFS	MASSIVE IMPACT TO HABITAT. REDUCTION IN VERTICAL OYSTER REEF HABITAT; REDUCTION IN FILTERING ABILITY OF OYSTER REEF (WATER QUALITY).	
CLAM TONGS	ESTUARINE	SIGNIFICANT-MASSIVE IMPACT TO HABITAT. DEGRADATION OF SAV AND RHIZOME LOSS; REDUCTION IN VERTICAL OYSTER REEF HABITAT; REDUCTION IN FILTERING ABILITY OF OYSTER REEF (WATER QUALITY).	
TRAWL; ROLLER-RIGGED TRAWL	HARDBOTTOM (SPONGE/CORAL)	SIGNIFICANT-MASSIVE IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE/CORAL COVER 30-80%.	MOORE AND BULLIS, JR. (1960); SAINSBURY ET AL. (1997); TILMANT (1979); VAN DOLAH ET AL. (1987)
ROLLER FRAME BAIT SHRIMP TRAWL	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE/CORAL COVER.	BERKELEY ET AL. (1986); TABB AND KENNY (1969)
TRAWL; OTTER TRAWL	SUBMERGED AQUATIC VEGETATION	SIGNIFICANT IMPACT TO HABITAT. REDUCTION IN SAV COVERAGE AND LOSS OF RHIZOMES; SEDIMENT SUSPENSION; SMOTHERING OF SAV.	BERKELEY ET AL. (1986); GUILLEN ET AL. (1994)

Table 1. - (Continued.)

ROLLER FRAME BAIT SHRIMP TRAWL	SUBMERGED AQUATIC VEGETATION	MINIMAL IMPACT TO HABITAT. SAV DEGRADATION; SEDIMENT SUSPENSION.	MEYER ET AL. (1999); TABB AND KENNY (1969); WOODBURN ET AL. (1957)
TRAWL	ESTUARINE	IMPACT TO HABITAT. REDUCTION OF EPIFAUNAL COVERAGE; SMOOTHED BEDFORMS (SAND WAVES); SEDIMENT PENETRATION; COMPRESSION OF SEDIMENTS; SEDIMENT SUSPENSION (FINES).	VAN DOLAH ET AL. (1991)
TRAWL; OTTER TRAWL	SAND/MUD; SAND	IMPACT-SIGNIFICANT IMPACT TO HABITAT. REDUCTION OF EPIFAUNAL COVERAGE; SMOOTHED BEDFORMS (SAND WAVES); SEDIMENT PENETRATION; WATER QUALITY DEGRADATION RESULTING FROM BYCATCH DISPOSAL; COMPRESSION OF SEDIMENTS; SEDIMENT SUSPENSION (FINES); REDUCTION IN DEPTH OF OXYGENATED SEDIMENTS.	BRIDGER (1970, 1972); SAINSBURY ET AL. (1997); SCHWINGHAMER ET AL. (1998); THRUSH ET AL. (IN PRESS)
OTTER TRAWL; CHAIN SWEEP & ROLLER GEAR	SAND/SILT/MUD	IMPACT-SIGNIFICANT IMPACT TO HABITAT. TRAWL DOORS PRODUCE CONTINUOUS FURROWS; ROLLER GEAR PRODUCE DEPRESSIONS; CHAIN GEAR DAMAGE/LOSS OF EPIFAUNAL COVERAGE; WATER QUALITY DEGRADATION RESULTING FROM BYCATCH DISPOSAL; COMPRESSION OF SEDIMENTS; SEDIMENT SUSPENSION (FINES); REDUCTION IN DEPTH OF OXYGENATED SEDIMENTS.	SAINSBURY ET AL. (1997); SMITH ET AL. (1985)
TRAWL	MIDWATER	NEGLECTIBLE IMPACT TO HABITAT. DISPERSAL OF GELATINOUS ZOOPLANKTON (AGGREGATIONS).	AUSTER AND LANGTON (1999); AUSTER ET AL. (1992); BRODEUR (IN PRESS)
HOOK AND LINE; HANDLINE	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR; DAMAGE/LOSS OF SPONGE-CORAL COVER BY SINKERS AND FISHING WEIGHTS.	KOENIG (PERSONAL COMMUNICATION)
BANDIT GEAR	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR; DAMAGE/LOSS OF SPONGE-CORAL COVER BY SINKERS AND FISHING WEIGHTS.	
BUOY GEAR	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR; DAMAGE/LOSS OF SPONGE-CORAL COVER BY SINKERS AND FISHING WEIGHTS.	
TROLLING GEAR	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER BY PLANERS.	KOENIG (PERSONAL COMMUNICATION)
BOTTOM LONGLINE	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. ENTANGLEMENT AND DAMAGE TO SPONGE-CORAL COVER DURING RECOVERY OF GEAR; ENTANGLEMENT FROM DISPOSED/LOST GEAR.	SAFMC (1991)
BOTTOM LONGLINE	SAND/MUD	MINIMAL IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR.	NMFS (1998a); SAFMC (1991)

Table 1. – (Continued.)

PELAGIC & MIDWATER LONGLINE	HARDBOTTOM (SPONGE/CORAL)	MINIMAL IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR.	
TROT LINES	ESTUARINE	MINIMAL IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR.	
CAST NET	SUBMERGED AQUATIC VEGETATION	MINIMAL IMPACT TO HABITAT. ABRASION OF SAV.	DE SYLVA (1954)
HAUL SEINE	SUBMERGED AQUATIC VEGETATION	MINIMAL IMPACT TO HABITAT. SAV DEGRADATION; SEDIMENT SUSPENSION.	SADZINSKI ET AL. (1996)
HAUL SEINE	SUBMERGED AQUATIC VEGETATION	CUMULATIVE IMPACT TO HABITAT. SAV DEGRADATION FROM SEINING ACTIVITIES AT HAULOUT SITES; SEDIMENT SUSPENSION.	ORTH (PERSONAL COMMUNICATION)
HAND & BEACH SEINE	ESTUARINE/NEARSHORE	MINIMAL IMPACT TO HABITAT. SAV DEGRADATION.	
PUSH NET	SUBMERGED AQUATIC VEGETATION	MINIMAL IMPACT TO HABITAT. SAV DEGRADATION.	DE SYLVA (1954)
PURSE SEINE	ESTUARINE/NEARSHORE	NEGLIGIBLE IMPACT TO HABITAT. DISPERSAL OF GELATINOUS ZOOPLANKTON (AGGREGATIONS).	AUSTER AND LANGTON (1999); AUSTER ET AL. (1992); BRODEUR (IN PRESS)
GILLNET	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. ENTANGLEMENT AND DAMAGE TO SPONGE-CORAL COVER DURING RECOVERY OF GEAR; ENTANGLEMENT FROM DISPOSED/LOST GEAR.	BARNETTE (PERSONAL OBSERVATION); CARR (1988)
GILLNET	ESTUARINE	MINIMAL IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR.	DEMARIA (PERSONAL COMMUNICATION)
FYKE NET	ESTUARINE	NEGLIGIBLE IMPACT TO HABITAT. SAV DEGRADATION DURING HARVEST.	
TRAMMEL NET	ESTUARINE	NEGLIGIBLE IMPACT TO HABITAT. ENTANGLEMENT FROM DISPOSED/LOST GEAR.	
POUND NET	ESTUARINE	NEGLIGIBLE IMPACT TO HABITAT. SAV DEGRADATION DURING HARVEST.	
BUTTERFLY NET	ESTUARINE/NEARSHORE	NEGLIGIBLE IMPACT TO HABITAT.	
FISH TRAP	HARDBOTTOM (SPONGE/CORAL)	IMPACT-SIGNIFICANT IMPACT TO HABITAT. DAMAGE TO CORAL-SPONGE COVER DURING DEPLOYMENT AND RECOVERY. SIGNIFICANT DAMAGE DURING STORM EVENTS; DAMAGE/LOSS OF CORAL-SPONGE COVER DURING GRAPPLING FOR LINES OF TRAPS.	QUANDT (1999); SAFMC (1991)

Table 1. – (Continued.)

CRAB & LOBSTER TRAP	HARDBOTTOM (SPONGE/CORAL)	IMPACT-SIGNIFICANT IMPACT TO HABITAT. DAMAGE TO CORAL-SPONGE COVER DURING DEPLOYMENT AND RECOVERY. SIGNIFICANT DAMAGE DURING STORM EVENTS; DAMAGE/LOSS OF CORAL-SPONGE COVER DURING GRAPPLING FOR LINES OF TRAPS.	ENO ET AL (1996)
CRAB & LOBSTER TRAP	SUBMERGED AQUATIC VEGETATION	MINIMAL IMPACT TO HABITAT. DAMAGE TO SUBMERGED AQUATIC VEGETATION DURING DEPLOYMENT AND RECOVERY; STRESSING (SMOTHERING) OF SAV DURING SOAK TIME.	ENO ET AL (1996)
POWERHEAD	HARDBOTTOM (SPONGE/CORAL)	MINIMAL IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING FISH RECOVERY.	
POWERHEAD	OFFSHORE/PELAGIC	NO PERCEIVED DIRECT IMPACT TO HABITAT. PELAGIC FISHERIES.	
SPEAR	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING FISH RECOVERY.	GMFMC (1993)
HAND HARVEST (LOBSTER)	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING LOBSTER RECOVERY.	
SNARE	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING LOBSTER RECOVERY.	
SLURP GUNS	HARDBOTTOM (SPONGE/CORAL)	MINIMAL IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING TROPICAL SPECIES RECOVERY.	
BULLY NET	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING LOBSTER RECOVERY.	
HOOP NET	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING LOBSTER RECOVERY.	
HARPOON	OFFSHORE/PELAGIC	NO PERCEIVED DIRECT IMPACT TO HABITAT. PELAGIC/HMS FISHERIES.	
HAND/DIP NETS	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING TROPICAL SPECIES OR LOBSTER RECOVERY.	
ALLOWABLE CHEMICAL	HARDBOTTOM (SPONGE/CORAL)	MINIMAL IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING TROPICAL SPECIES RECOVERY. DEGRADATION OF CERTAIN SPECIES OF CORAL.	JAAP AND WHEATON (1975)
BARRIER NET	HARDBOTTOM (SPONGE/CORAL)	IMPACT TO HABITAT. DAMAGE/LOSS OF SPONGE-CORAL COVER DURING DEPLOYMENT AND RECOVERY; ENTANGLEMENT.	

DEFINITIONS

(¹Florida Fish and Wildlife Conservation Commission - Division of Marine Fisheries, ² Texas Parks and Wildlife, ³Louisiana Department of Wildlife and Fisheries, ⁴Code of Federal Regulations)

Allowable chemical: means a substance, generally used to immobilize marine life so that it can be captured alive, that, when introduced into the water, does not take Gulf and South Atlantic prohibited coral and is allowed by Florida for the harvest of tropical fish (e.g., quinaldine, quinaldine compounds, or similar substances).⁴

Artificial lure: any lure (including flies) with hook or hooks attached that is man-made and is used as a bait while fishing.²

Automatic reel: means a reel that remains attached to a vessel when in use from which a line and attached hook(s) are deployed. The line is payed out from and retrieved on the reel electrically or hydraulically.⁴

Bait: something used to lure any wildlife resource.²

Beach or haul seine: means a seine that is hauled or dragged over the bottom into shallow water or onto the beach, either by hand or with power winches.¹

Bully net: means a circular frame attached at right angles to the end of a pole and supporting a conical bag of webbing. The webbing is usually held up by means of a cord which is released when the net is dropped over a lobster.⁴

Buoy gear: means fishing gear consisting of a float and one or more weighted lines suspended therefrom, generally long enough to reach the bottom. A hook or hooks (usually 6 to 10) are on the lines at or near the end. The float and line(s) drift freely and are retrieved periodically to remove catch and rebait hooks.⁴

Butterfly net: a fixed, frame-mounted net, used to fish near-surface waters, which is suspended from the side or sides of a boat, pilings, floats, rafts or shore installation.³

Can: a metal container of not more than 55-gallon capacity which is set for the purpose of taking fish.³

Cast net: means a cone-shaped net thrown by hand and designed to spread out and capture fish as the weighted circumference sinks to the bottom and comes together when pulled by a line.¹

Crab dropnet: any device constructed with vegetable, synthetic, or metal fibers and without flues or throat, attached to a wire frame that forms a net basket and is used for the purpose of taking crabs. This device shall be operated solely by hand and fished in a stationary, passive manner.³

Crab trap: a cube-shaped device with entrance funnels and either a bait box or materials providing cover or shelter for peeler crabs, which is used for the sole purpose of taking crabs. This device shall be fished in a stationary, passive manner.³

Dip net: a net, usually a deep mesh bag of vegetable or synthetic materials, on a fixed frame attached to a handle and held and worked exclusively by hand and by no more than one individual. *see also Landing net.*³

Drift gillnet: means a gillnet, other than a long gillnet or a run-around gillnet, that is unattached to the ocean bottom, regardless of whether attached to a vessel.⁴

Entangling net: means a drift net, trammel net, stab net, or any other net which captures saltwater finfish, shellfish, or other marine animals by causing all or parts of heads, fins, legs, or other body parts to become entangled or ensnared in the meshes or in the pockets of the net. This term does not include a cast net.¹

Fish trap: (2) In the Gulf EEZ, a trap and its component parts (including the lines and buoys), regardless of the construction material, used for or capable of taking finfish, except a trap historically used in the directed fishery for crustaceans (that is, blue crab, stone crab, and spiny lobster).⁴

Fold-up trap: a device utilized to capture crabs which is baited and lowered to the bottom. When recovered, side panels fold up to capture crabs on the base panel.*

Fyke net: any cone-shaped net of vegetable or synthetic fibers having throats or flues which are stretched over a series of rings or hoops to support the webbing, with vertical panels of net wings set obliquely on one or both sides of the mouth of the cone-shaped net.³

Gaff: any hand held pole with a hook attached directly to the pole.²

Gig: any hand held shaft with single or multiple points, barbed or barbless.²

Gill net: means one or more walls of netting which captures fish by ensnaring or entangling them in the meshes of the net by the gills. This term does not include a cast net.¹

Handline: means a line with attached hook(s) that is tended directly by hand.⁴

Hook and line gear: means any handline, rod, reel, or any pole to which hook and line are attached, as well as any bob, float, weight, lure, plug, spoon, or standard bait attached thereto, with a total of ten or fewer hooks.¹

Hoop net: 1. a cone-shaped net of vegetable or synthetic materials having throats or flues and which are stretched over a series of rings or hoops to support the webbing.³ 2. A frame, circular or otherwise, supporting a shallow bag of webbing and suspended by a line and bridles. The net is baited and lowered to the ocean bottom, to be raised rapidly at a later time to prevent the escape of lobster.⁴

Landing or dip net: means a hand-held net consisting of a mesh bag suspended from a circular, oval, or rectangular rigid frame attached to a handle.¹

Lawful Archery Equipment: longbow, recurved bow, compound bow, and crossbow.

Lead or wing net: a panel of netting of any mesh size or length, with or without weights and floats, attached to one or both sides of the mouth of a cone-shaped net having flues or throats, and set so as to deflect or guide fish toward the mouth of the net.³

Long gillnet: means a gillnet that has a float line that is more than 1,000 yd (914 m) in length.⁴

Longline: means a line that is deployed horizontally to which gangions and hooks are attached. A longline may be a bottom longline, i.e., designed for use on the bottom, or a pelagic longline, i.e., designed for use off the bottom. The longline hauler may be manually, electrically, or hydraulically operated.⁴

Menhaden seine: a purse seine used to take menhaden and herring-like species.³

Mesh area (of a net): means the total area of netting with the meshes open to comprise the maximum square footage. The square footage shall be calculated using standard mathematical formulas for geometric shapes. The square footage of seines and other rectangular nets shall be calculated using the maximum length and maximum width of the netting.¹

Mesh size: the full measure of the mesh as found in use when measured as follows: Bar measure is the length of the full bar stretched from the near side of one knot to the far side of the other after being tarred, treated, or otherwise processed. Stretched measure is the full stretched distance from the near side of one knot to the far side of the opposite knot diagonally across the mesh. This measurement shall not be applicable to weaved or woven nets commonly used for menhaden fishing. In woven nets, stretched measure is the full stretched distance of the opening of the mesh; bar measure is one-half of stretched measure.³

Monofilament: a single untwisted synthetic filament.³

Mullet strike net: a gill net that is not more than 1,200 feet long and with a mesh size of not less than 3 ½ inches stretched that is not anchored or secured to the water bottom or shore and which is actively worked while being used.³

Multiple hook: means two or more fishhooks bound together to comprise a single unit or any hook with a single shank and eye and two or more pointed ends, used to impale fish.¹

Pompano strike net: a gill net that is not more than 2,400 feet long and with a mesh size of not less than 5 inches stretched that is not anchored or secured to the water bottom or shore and which is actively worked while being used.³

Powerhead: means any device employing an explosive charge or a release of compressed gas, usually attached to a speargun, spear, pole, or stick (known as a "bangstick"), which detonates upon contact.¹

Purse seine: any net or device commonly known as a purse seine and/or ring net that can be pursed or closed by means of a drawstring or other device that can be drawn to close the bottom of the net or the top of the net or both. Such nets are constructed of mesh of such size and design as not to be used primarily to entangle fish by the gills or other bony projection.³

Rebreather: means a closed circuit or semi-closed circuit underwater breathing apparatus that recycles and recirculates all or part of the gas mixture supplied for breathing. A rebreather is distinguished from other underwater breathing apparatuses by the inclusion of a scrubber (a component that removes carbon

dioxide from the breathing gas) and a counterlung (a waterproof bag that allows the diver's exhaled breath to be captured for scrubbing and recycling back to the diver for inhalation).¹

Rod and reel: means a rod and reel unit that is not attached to a vessel, or, if attached, is readily removable, from which a line and attached hook(s) are deployed. The line is payed out from and retrieved on the reel manually, electrically, or hydraulically.⁴

Run-around gillnet: means a gillnet, other than a long gillnet, that, when used, encloses an area of water.⁴

Sail Line: type of trotline with one end of the main line fixed on the shore, the other end of the main line attached to a wind-powered floating device or sail.²

Sea bass pot: means a trap has six rectangular sides and does not exceed 25 inches (63.5 cm) in height, width, or depth.⁴

Seine: means a small-meshed net suspended vertically in the water, with floats along the top margin and weights along the bottom margin, which encloses and concentrates fish, and does not entangle them in the meshes.¹ see also *Purse seine*.

Skimmer net: a net attached on two sides to a triangular frame and suspended from or attached to the sides of a boat, with one corner attached to the side of the boat and one corner resting on the waterbottom. A ski and one end of the lead line are attached to the corner of the frame that rests on the waterbottom and the other end of the lead line is attached to a weight which is suspended from the bow of the boat.³

Spear: any shaft with single or multiple points, barbed or barbless, which may be propelled by any means, but does not include arrows.²

Speargun: any hand operated device designed and used for propelling a spear, but does not include the crossbow.²

Stab or sink net: means a gill or trammel net, that sinks to the bottom when placed, set, or fished in water deeper than its hanging depth.¹

Strike net: any gill net, trammel net or seine not anchored or secured to the water bottom or shore and which is actively worked while being used.³

Test trawl: a trawl which is not more than 16 feet along the corkline or 20 feet along the leadline or headrope.³

Trammel net: means a net constructed of two or more walls of netting hung from the same cork and lead lines, with one wall having a larger mesh than the other(s), which traps a fish in a pocket of netting when the fish pushes the smaller mesh wall through a mesh in the larger mesh wall.¹

Trawl: any net, generally funnel-shaped, pulled through the water or along the bottom with otter boards to spread the mouth open while being fished. The term "trawl" also means and includes plumb staff beam trawls that do not exceed 16 feet, and that do not use otter boards but are held open laterally by a horizontal beam and vertically by two vertical beams (plumb staffs), and that are used while the vessel is under way.³

Trawl (Individual Bait-Shrimp Trawl): a bag-shaped net which is dragged along the bottom or through the water to catch aquatic life.²

Trotline: a non-metallic main fishing line with more than five hooks attached and with each end attached to a fixture.²

Umbrella net: a non-metallic mesh net that is suspended horizontally in the water by multiple lines attached to a rigid frame.²

Underwater breathing apparatus: means any apparatus, whether self-contained or connected to a distant source of air or other gas, whereby a person wholly or partially submerged in water is able to obtain or reuse air or any other gas or gasses for breathing without returning to the surface of the water.¹

Wing (with reference to a seine): means a panel of netting on one or both ends of the seine, which panel has a larger mesh than the main body of the seine and is used to guide fish into the main body of the seine.¹

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APPENDIX A: FISHING GEAR PERMITTED WITHIN THE GULF OF MEXICO REGION

(NOTE: GEAR TYPES VARY; CONSTRUCTION REQUIREMENTS AND SPECIFICATIONS, AS WELL AS RESTRICTED AREAS, ARE MANAGED BY INDIVIDUAL STATES)

FISHING GEAR PERMITTED WITHIN STATE TERRITORIAL WATERS:

FLORIDA:

Bandit gear, Barrier net, Beach/haul seine, Bully net, Cast net, Dip/landing net, Drop net, Fold-up trap, Gaff, Gig, Hand harvest (includes feet), Hand net, Hook and line (includes rod and reel), Hoop net, Lance, Lawful archery equipment, Oyster dredge, Purse seine, Push net, Push scrape, Quinaldine, Rakes, Slurp gun, Spear, Speargun, Tongs (clam), Tongs (oyster), Trap (black sea bass), Trap (blue crab), Trap (lobster), Trap (peeler crab), Trap (pinfish), Trap (shrimp), Trap (stone crab), Trawl (bait shrimp), Trawl (beam/frame), Trawl (jellyfish), Trawl (otter), Trawl (roller), Trawl (baitfish), Trawl (seahorse), Trotline.

ALABAMA:

Bandit gear, Beach/haul seine, Cast net, Dip/landing net, Drop net, Gaff, Gig, Gillnet, Hand harvest, Hook and line (includes rod and reel), Hoop net, Lance, Lawful archery equipment, Oyster dredge, Purse seine, Push net, Skimmer net, Spear, Speargun, Tongs (clam), Tongs (oyster), Trammel net, Trap (blue crab), Trap (minnow), Trawl (bait), Trawl (frame/beam), Trawl (otter), Trawl (roller), Trawl (skimmer), Trotline.

MISSISSIPPI:

Bandit gear, Beach seine, Cast net, Dip/landing net, Drop net, Gaff, Gig, Gillnet, Hand harvest, Haul seine, Hook and line (includes rod and reel, handline, and throwline), Hoop net, Lance, Lawful archery equipment, Oyster dredge, Purse seine, Push net, Spear, Speargun, Tongs (clam), Tongs (oyster), Trammel net, Trap (blue crab), Trap (eel), Trap (fish), Trap (minnow), Trawl (bait/recreational), Trawl (otter), Trawl (skimmer), Trotline.

LOUISIANA:

Barbless spear (i.e., gig), Beach seine, Bow and arrow, Butterfly net, Cans (pipes, drums, tires, buckets), Cast net, Dip/landing net, Drop net, Experimental gear, Gaff, Hand harvest, Hook and line (includes handline, bushline, rod and reel, and yo-yos or trigger devices), Hoop net, Lawful archery equipment, Mullet strike net, Oyster dredge, Oyster scrape, Pompano strike net, Purse seine, Spear, Speargun, Tongs (oyster), Trap (blue crab), Trap/pot (eel), Trap (minnow), Trap (slat), Trawl (bait/recreational), Trawl (otter), Trawl (skimmer), Trotline.

TEXAS:

Cast net, Crab line, Dip net, Gaff, Gig, Hand harvest, Lawful archery equipment, Minnow seine, Oyster dredge, Pole and line (includes rod and reel), Purse seine, Sail line, Sand pumps, Spear, Speargun, Tongs (oyster), Trap (crab), Trap (perch), Trawl (beam), Trawl (individual bait shrimp), Trawl (otter), Trotline, Umbrella net.

FISHING GEAR PERMITTED WITHIN FEDERAL WATERS:

Allowable chemical, Bandit gear, Barrier net, Bully net, Butterfly net, Cast net, Dip net, Dredge, Gillnet, Hand harvest, Handline, Harpoon, Hook and line, Hoop net, Longline, Pot, Powerhead, Purse seine, Rod and reel, Seine, Snare, Skimmer, Slurp gun, Spear, Trap, Trawl.

APPENDIX B: GULF OF MEXICO FISHERIES (NMFS 1996; NMFS 1998b, 1998c)

FISHERY	LANDINGS (mt)	PRINCIPAL GEARS
Coastal Migratory Pelagics (dolphin, king mackerel, Spanish mackerel, cobia)	7,900	gillnet, hook and line, trolling gear
Reef Fish (snapper, grouper, porgy, etc.)	23,000	trap, hook and line, longline, spear, trammel net
Drum and Croaker (Atlantic croaker, red drum, black drum, kingfish, seatrout)	13,300	hook and line, gillnet, trammel net, pound net, purse seine, (long)haul seine
Menhaden	560,000	purse seine
Invertebrates (shrimp, spiny lobster, stone crab)	99,000	trawl, trap