
Southeast and Caribbean Invertebrate Fisheries



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Unit 11

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INTRODUCTION

Important recreational and commercial marine invertebrates in the southeastern United States include shrimp, spiny lobster, stone crab, and conch. Some fisheries, as for coral, are almost nonexistent. Others, like the Penaeid¹ shrimp fishery, are both extensive and extremely valuable. The Southeast Region's shrimp fisheries are one of the most valuable U.S. fisheries, based on ex-vessel revenue. Other fisheries, such as those for spiny lobster and stone crab, have only moderate value on a national basis but are important locally or regionally. Because of the diversity in species, fisheries, geographic locations, yields, values, and other factors, each species

¹Family of prawns.

group in the marine invertebrates unit must be examined separately for proper perspective.

SPECIES AND STATUS

Shrimp Species

Penaeid shrimp have been fished commercially since the late 1800's. The first fishery used long seines in shallow waters, until the otter trawl (introduced in 1915) extended shrimping to deeper waters. At first, most vessels towed one large trawl, sometimes 120 feet wide at the mouth. Soon, a single-trawl arrangement on both sides of the vessel (with each trawl about 40–75 feet wide at the mouth) was found more effective. Some shrimpers began using a twin-trawl system that tows four

Photo above:
Caribbean spiny lobster,
Florida Keys.

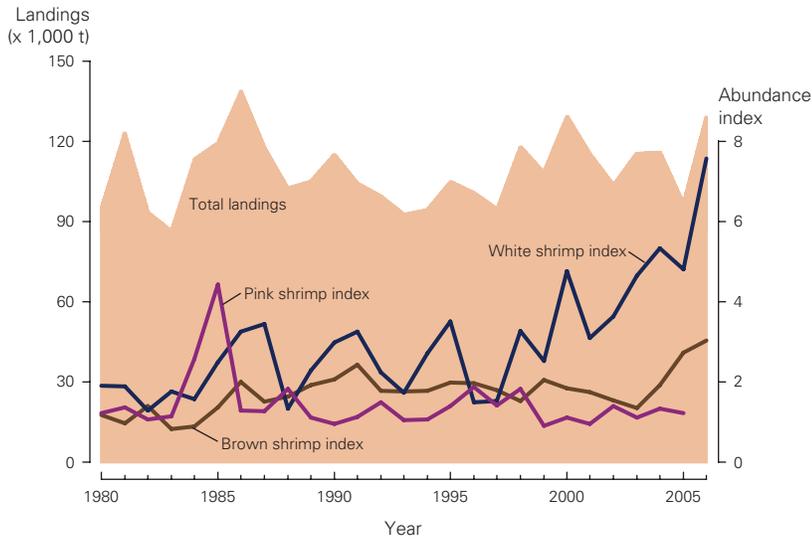


Figure 11-1
Shrimp landings in metric tons (t) and abundance index from the U.S. Gulf of Mexico, 1980–2006. The abundance index is calculated by dividing the current level of reproductive shrimp by the overfishing level.

trawls, each about 40 feet wide at the mouth. The twin-trawl system is now a very common gear on commercial offshore shrimpers.

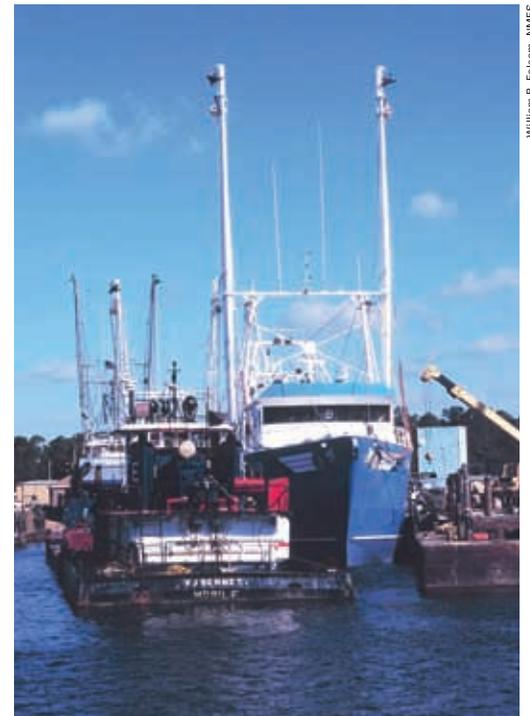
Brown, white, and pink shrimp account for over 99% of the total Gulf of Mexico shrimp catch. In 2006 alone, these three important species produced 128,644 metric tons (t) valued at \$388,278,286 in ex-vessel revenue (Figure 11-1). They are typically found in all U.S. Gulf waters shallower than 120 m. Most of the offshore brown shrimp catch is taken at 40–80 m depths; white shrimp are caught in 20 m or less; and pink shrimp in 40–60 m. Brown shrimp are most abundant off the Texas–Louisiana coast, whereas the greatest concentration of pink shrimp is off southwestern Florida. Current, recent, and maximum sustainable yields for these species are given in Table 11-1.

Brown and white shrimp catches in the Gulf increased significantly from the late 1950’s to around 1990, but catch levels during most of the 1990’s were below these maximum values. However, catch levels in 2000 were extremely good for both species, with near-record levels reported. Catches in 2001–04 were again below these record catch levels, but still well above average for both species. Catch levels in 2006 were excellent for both species, with white shrimp reaching an all-time high at approximately 59,500 t. Pink shrimp catches remained stable until about 1985 and then declined to an all time low in 1990. During the mid 1990’s, catches increased above average levels, but have again shown a moderate declining trend in

recent years (Hart and Nance, 2007). The number of young shrimp of each species entering the fisheries has generally reflected the level of catch. All commercial shrimps are harvested at maximum levels. Until very recently the fishery was believed to have more boats and gear than needed (i.e. reducing fishing effort would not significantly reduce the shrimp catch; Nance, 2007a). Reducing bycatch of the shrimp industry, however, would help protect finfish resources.

Recruitment overfishing has not been evident in the Gulf of Mexico for any shrimp stocks (Klima et al., 1990; Nance, 1993, 2007b). The number of young brown shrimp produced per parent increased significantly until about 1991 and has remained near or slightly below that level during most years. White and pink shrimp have not shown any general trend. Although pink shrimp stocks rebounded from the low values experienced in the early 1990’s, they have started to decline again in recent years. The brown shrimp increase appears related to marsh habitat alterations. Coastal sinking and a sea-level rise in the northwestern Gulf of Mexico inundates intertidal marshes longer, allowing shrimp to feed for longer periods within the marsh area. Both factors have also expanded estuarine areas, created more marsh edges, and pro-

Photo on right:
Shrimp boats, Bayou la Batre, Alabama.



William B. Folsom, NMFS

SOUTHEAST AND CARIBBEAN INVERTEBRATE FISHERIES

Species/stock	Recent average yield (RAY) ¹	Current yield (CY)	Sustainable yield (MSY)	Stock level relative to B_{MSY}	Harvest rate	Stock status
Brown shrimp ²						
Gulf of Mexico	53,557	Unknown	57,809	Near	Not overfishing	Not overfished
South Atlantic	2,160	Unknown	3,341	Near	Not overfishing	Not overfished
Pink shrimp ²						
Gulf of Mexico	6,563	Unknown	7,392	Near	Not overfishing	Not overfished
South Atlantic	551	Unknown	786	Near	Not overfishing	Overfished
Rock shrimp						
Gulf of Mexico	715	Unknown	1,070	Unknown	Undefined	Undefined
South Atlantic	1,474	Unknown	1,561	Unknown	Not overfishing	Not overfished
Royal red shrimp	227	Unknown	305	Unknown	Not overfishing	Unknown
Seabob shrimp	1,149	Unknown	2,927	Unknown	Undefined	Undefined
White shrimp ²						
Gulf of Mexico	51,995	Unknown	42,614	Near	Not overfishing	Not overfished
South Atlantic	5,995	Unknown	6,290	Near	Not overfishing	Not overfished
Coral ³	0	0	Unknown	Unknown		
Queen conch ⁴	110	Unknown	Unknown	Below	Overfishing	Overfished
Caribbean spiny lobster						
Caribbean	123	Unknown	Unknown	Unknown	Unknown	Unknown
Southeast United States ⁵	1,988	Unknown	2,742	Near	Not overfishing	Unknown
Golden deepsea crab	177	Unknown	Unknown	Unknown	Unknown	Unknown
Stone crab ⁶	1,177	Unknown	1,465	Near	Not overfishing	Undefined
Total	127,961	Unknown	128,712			

Table 11-1

Productivity in metric tons (t) and status of Southeast and Caribbean invertebrate fisheries resources.

¹2004–06 average.

²MSY for brown, pink, and white shrimp is based upon last observed 10-year average annual yield (1997–2006).

³Coral harvest prohibited except for a small take allowed for use in aquarium and pharmaceutical industries. Harvest rate and stock status are not available for this stock.

⁴Landings from Puerto Rico and the U.S. Virgin Islands. Fishing for this species is prohibited in Florida.

⁵Yields based on commercial catches; recreational catch is unknown but may be significant.

⁶Yields are in tons of claws; declawed crabs are released and regenerate new claws.

vided more protection from predators. As a result, the nursery function of those marshes has been greatly magnified, and brown shrimp production has expanded. However, continued subsidence will lead to marsh deterioration and an ultimate loss of supporting wetlands, and current high fishery yields may not be indefinitely sustainable. Parent stock indices for the three major Gulf species are shown in Figure 11-1.

Regulations in the Gulf of Mexico Shrimp Fishery Management Plan (FMP) restrict shrimp-ing by closing two shrimp-ing grounds. There is a seasonal closure of fishing grounds off Texas for brown shrimp and a closure off Florida for pink shrimp. Size limits also exist for white shrimp caught in Federal waters and landed in Louisiana. These regulations strive to improve the monetary value of the shrimp fishery (Hart and Nance, 2007; Nance, 2008).

The shrimp fishery in the South Atlantic is much smaller than the Gulf of Mexico fishery. White shrimp landings are about 12% of the Gulf yield, while brown and pink shrimp are around 4% and 8% of the Gulf yield, respectively (Table 11-1). In the South Atlantic, white shrimp stocks are centered off the Georgia and South Carolina coasts and brown shrimp are centered off the North and South Carolina coasts. The Atlantic fishery is currently managed under a Federal FMP implemented in November 1993. The FMP provides for compatible state and Federal closures if needed to protect overwintering shrimp stocks. Subsequent amendments added rock shrimp and royal red shrimp to the management unit of the FMP, and defined overfishing definitions for all species.

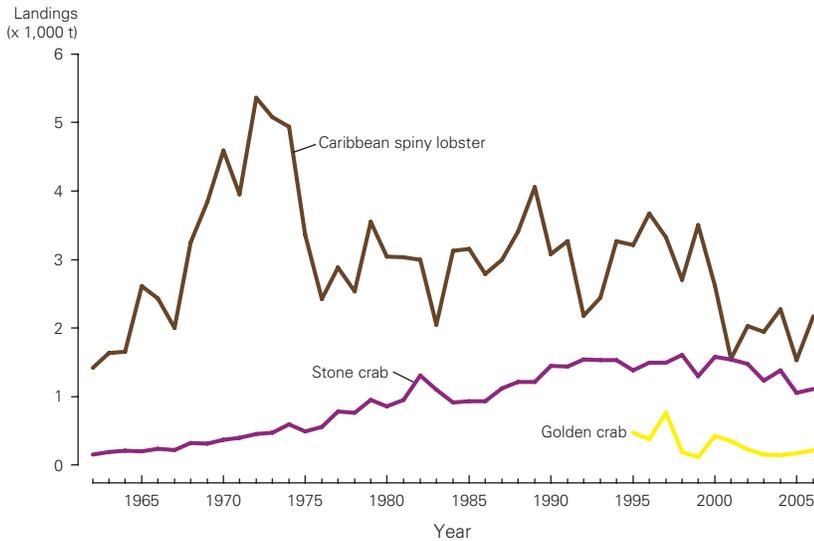


Figure 11-2
Landings in metric tons (t) of stone crab (claw weight), golden crab, and Caribbean spiny lobster, 1962–2006.

Caribbean Spiny Lobster

Annual landings of Caribbean spiny lobster in Florida historically have fluctuated, but remained fairly stable since 1980 with an average catch of about 2,790 t (Figure 11-2). Recent high landings were experienced in 1996 when the 3,568 t catch was worth approximately \$30 million ex-vessel. The fishery is considered overcapitalized, and a trap reduction program was instituted in 1993. This program, not to exceed 10% per year, is oriented toward maintaining or maximizing the sustainable Caribbean spiny lobster harvest from the fishery. The program has successfully reduced the number of traps from 900,000 in 1992 to slightly fewer than 500,000 in 2005 (SEDAR, 2005). A continuing problem in the commercial fishery is the use of live undersized lobsters as attractants in lobster traps. Due to a high mortality rate for these live bait animals, about 30–50% of the potential yield is lost. The recreational fishery for Caribbean spiny lobster in the southeastern U.S. is not well quantified in terms of effort and landings; however, it is a popular recreational species, and the recreational catch may be significant.

Caribbean spiny lobster along the southeastern coast of the United States are managed under a joint FMP coordinated with regulations by the State of Florida. Current regulations specify a 3-inch minimum carapace length, a closed season from 1 April to 5 August to protect spawning adults,

mandatory release of egg-bearing females, closure of some nursery areas, recreational bag limits, a 2-day sport season, and a trap reduction program which began in 1993 (Harper and Muller, 2001).

The fishery for Caribbean spiny lobster in the U.S. Caribbean is much smaller than the Florida fishery (Table 11-1). Annual Caribbean spiny lobster landings for Puerto Rico have averaged 104 t since 1990, varying from 68 t in 1993 to a high of 149 t in 1999. U.S. Virgin Islands landings for 1980–2006 were fairly stable, averaging 28 t. In the U.S. Caribbean, Caribbean spiny lobster are caught primarily by fish traps, lobster traps, and divers. The Caribbean Fishery Management Council’s Spiny Lobster FMP includes the Federal waters of Puerto Rico and the U.S. Virgin Islands. The Federal plan is based on a 3.5-inch minimum carapace length and protection of egg-bearing female lobsters (Bolden, 2001).

Caribbean spiny lobster larvae may drift at sea for up to 9 months, and thus identification of their source or parent stock is almost impossible. The origin of Caribbean spiny lobster stocks in U.S. waters, including the Florida stock, remains unknown. To improve management, there is a practical need to increase knowledge of lobster origin and subsequent movements into fisheries.

Conch

The conch fishery targets the queen conch but also takes other species. Most conchs are taken by divers, and the resource can be easily depleted. Conchs are currently protected in state and Federal waters off Florida, but a fishery still exists in some areas of the U.S. Caribbean. An FMP was implemented in 1996 for the Federal waters off Puerto Rico and the U.S. Virgin Islands by the Caribbean Fishery Management Council.

Corals

Corals are managed as two groups, hard² and soft³. Because they are generally slow growing and



Florida Keys Nat. Marine Sanctuary

Close-up of a sea fan (left) and brain coral (right). Corals provide important habitat for many species of fish.

²Coral colonies are cemented together by the calcium carbonate secreted by individual coral polyps. The calcium carbonate skeletons form reefs.

³Corals that do not produce substantial calcium carbonate skeletons and do not build reefs.

provide critical habitat for many fishes, hard corals are protected except for very small collections taken by permit for research and educational purposes. Regulations are based on the fact that the value of coral as natural habitat is far more important than their commercial use. Soft corals include gorgonians and sea fans. Some gorgonians are taken (about 50,000 colonies annually) for the aquarium and pharmaceutical trade. Growth potential for most species is considered limited. Sea fans are completely protected except for research and educational use by permit.

Stone Crab

Stone crabs are caught mainly off southern Florida, though some are landed farther north along Florida's west coast. The Gulf of Mexico Stone Crab FMP, approved in September 1979, generally extended Florida's regulations into the U.S. Exclusive Economic Zone (EEZ). These regulations are based on a minimum claw size of 2.75 inches, biodegradable trap panels, protection of egg-bearing females, and closed seasons. Minimum size regulations assure that crabs have reproduced at least once before being caught.

Annual catches of stone crab (claw weight) averaged 1,419 t on the Gulf of Mexico and Atlantic coasts 1990–2006, with a record 1,604 t landed during 1998 (Figure 11-2). Recent annual ex-vessel revenue averaged \$24,400,000. The number of stone crab traps fished seasonally increased from 295,000 in 1979–80 to a record 1,568,000 during 2001–02 (Muller et al., 2006). While total landings have increased since 1980, it is clear that these landings are the result of increased fishing effort (number of traps fished), especially during the early months of the stone crab season.

Golden Deepsea Crab

The deepwater commercial fishery for golden deepsea crab was established in the mid 1990's following the prohibition of fish traps in the snapper-grouper fishery of the U.S. South Atlantic Ocean. The Golden Crab FMP was developed cooperatively with fishermen and included measures to protect the stock. These measures included a limited entry program that prohibited large vessels entering the

fishery from outside the area, and established fishing zones and other protective measures for the crabs. Annual catches have averaged 300 t from 1995 through 2006, with a record 759 t landed in 1997 (Figure 11-2).

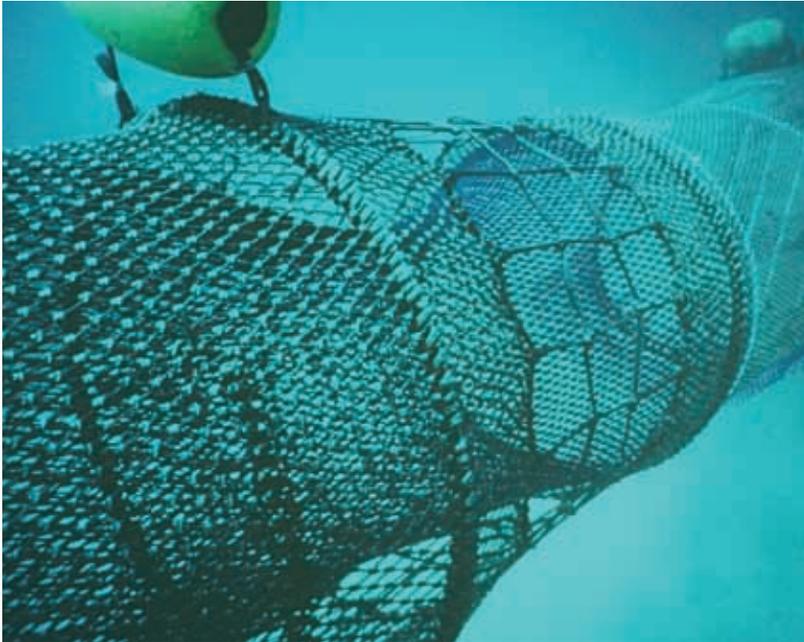
ISSUES

Habitat Concerns

Habitat concerns impact many of the southeast and Caribbean invertebrate fishery resources. Estuarine and marsh loss removes critical habitat used by young shrimp (Zimmerman et al., 2000; Minello et al., 2003). Additional studies are needed to further assess the impacts of human-induced changes in habitat availability, environmental conditions, predator abundance, and pollution in nursery areas. Caribbean spiny lobsters in Florida depend on reef habitat and shallow-water algal flats for feeding and reproduction, but these habitat requirements may conflict with expanding coastal development. The productivity of stone crabs in Florida Bay is related to water quality and flow through the Everglades. Specific water requirements need to be identified and maintained through comprehensive Everglades



Conch in a healthy sea grass bed, Florida Keys National Marine Sanctuary.



NOAA

A shrimp trawl outfitted with a combination bycatch reduction/turtle excluder device deployed in the water. Fish escape by swimming forward and out of the large holes in the net, while shrimp are retained by being swept into the bag at the end of the net. The oval metal ring and bars (right side of photo) deflect turtles, and force any turtle that has become stuck in the net toward a trap door that will open, allowing the turtle to swim free.

water management. A unified program to integrate and study the combined effects of environmental alterations, fishing technology improvements, regulations, habitat restoration, and economic factors on shrimp, lobster, and crab production is needed, particularly in the reef habitats of south Florida. Steps also need to be taken to mitigate or restore lost estuarine habitats.

Transboundary Stocks and Fishery Management Jurisdiction

Spiny lobster stocks in Florida could be of Caribbean origin, being swept into the region by currents of the Gulf Stream. Another hypothesis is that they could comprise a number of different spawning stocks. The actual sources of all Florida and Caribbean lobster stocks (both U.S. and foreign) need to be identified and international management established to prevent overharvesting.

Bycatch and Multispecies Interactions

Shrimp fisheries use small-mesh trawl nets and can catch nontarget species, including commercially fished species such as red snappers, croakers, and seatrouts, and also protected resources such as sea turtles. Juvenile finfish are a major component of

the bycatch and this may be a major source of mortality for them. Some fish caught by shrimpers are currently at low stock levels (see Unit 8, Atlantic, Gulf of Mexico, and Caribbean Reef Fisheries and Unit 9, Southeast Drum and Croaker Fisheries); this bycatch may prevent or slow recovery if not mitigated. All sea turtle species are listed as endangered or threatened under the Endangered Species Act, and shrimp vessels have been required to use turtle excluder devices in their nets since 1988 to avoid capturing sea turtles.

Other Management Concerns

In Florida, increasing numbers of recreational Caribbean spiny lobster fishermen have been a cause of concern for fishery managers and have sparked conflicts between the commercial and recreational sectors. Also, a recently discovered, highly lethal virus infecting juvenile spiny lobster has the potential to negatively impact recruitment of this important fishery species.

Until very recently, the shrimp fisheries were overcapitalized, with more fishing effort being expended than was needed to sustainably harvest the resource (Nance et al., 2006). This trend in fishing effort may have been modified by the lower-than-average ex-vessel prices for shrimp and higher-than-average fuel prices over the past few years. Additionally, the harvesting of small shrimp is sacrificing yield and value of the catch by cutting short future population growth (Caillouet et al., 2008).

Progress

The National Marine Fisheries Service and the fishing industry are working together to continue development of bycatch-reduction gear to address the problems of finfish bycatch in shrimp fisheries of the Gulf of Mexico and South Atlantic. A gear conflict between stone crab trappers and shrimp trawlers off southwestern Florida has mostly been resolved in the 200-mile EEZ with a line separating the fishing areas and seasonal area closures. This approach requires continued monitoring to gauge its success and prevent renewal of conflicts.

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