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Synopsis of Puerto Rican Commercial Fisheries

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EXECUTIVE SUMMARY

This report offers a synopsis of the main commercial fisheries around the Commonwealth of Puerto Rico. Commercial fisheries are an important source of income, sustenance, and employment to many coastal communities in the U.S. Caribbean. The synopsis provides a brief description of the species' geographic distribution, habitat preferences, landings and revenue patterns, main gears used, main regulations, and biological condition. The goal of this manuscript is to provide an accessible document for disseminating the salient features of commercially valuable fisheries and draw attention to those fisheries that face management challenges. This report also complements the findings of the 2008 census of active commercial fishermen (Matos-Caraballo and Agar, 2011).

ACKNOWLEDGMENTS

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Introduction

Commercial fisheries are an important source of income, sustenance, and employment to many coastal communities in the Commonwealth of Puerto Rico. Managing these resources is complex because of the high diversity of species landed, the multitude of fishing gears used, and the complex life histories of many of these species. Many reef fish are vulnerable to over-exploitation because they are sedentary, long-lived, slow growing, late maturing, and have predictable, highly aggregated spawning events (Sadovy and Eklund, 1999). The purpose of this report is to provide an accessible document that disseminates the salient features of commercially valuable fisheries. This report offers a brief description of the species' geographic distribution, habitat preferences, landings patterns, economic significance, main gears used, and main regulations.

The report highlights the interplay between geography, fishing gears and species targeted. For example, the northern coast of Puerto Rico has a narrow insular shelf and an exposed coast which offer little protection against heavy swells and rough seas. This encourages the use of hook and line and, to a lesser extent, net gears, and discourages the use of traps and scuba. Fishermen in this region favor reef fish species such as yellowtail snapper, triggerfish, and parrotfish; deep-water snappers such as silk and queen snappers; and pelagic species such as dolphin-fish, king mackerel, and little tunny. In contrast, the southwest coast has a relatively shallow and extended shelf, favoring the use of bottom lines, scuba, and, to a lesser extent,

troll lines and fish pots. This larger shelf allows fishermen to target a richer mix of species, including queen conch, spiny lobster, reef fish (e.g., yellowtail, lane and mutton snappers), deep-water snapper (e.g., silk and queen snappers) and pelagic species (e.g., dolphinfish, skipjack, blackfin and yellowfin tunas, and king mackerel).

Finally, this description touches on the biological condition of the stocks. It details whether various commercially valuable species are overfished and are undergoing overfishing to draw attention to the current progress and future challenges managing these resources. The information presented in this report is intended to complement the findings of the 2008 census of active commercial fishermen (Matos-Caraballo and Agar, 2011).

Data and Methods

Puerto Rico trip ticket data from 1983 to 2008 were obtained from the Department of Natural and Environmental Resources (DNER). Trip ticket records contain information on landings, dockside prices, gears used, effort, and landing sites. Trip ticket reports do not contain information on fishing areas.

This report presents historical information on landings and revenues and offers maps depicting the geographic distribution of recent landings. Commonwealth level reported landings and gross revenue estimates were adjusted for mis-reporting and under-reporting using correction factors developed by Turner and Cummings (Cummings, *personal communication*). The maps show the percentage distribution of species landings by municipality. The percentages do not reflect the area where the fish were caught since this information is not available from the ticket reports.

To help contextualize landing patterns, shapefiles containing information on habitat types (e.g., reefs, mangroves and sea grasses), bathymetry and landings were added to the various maps. Information on the biological condition of the stocks was obtained from the National Marine Fisheries Service (NMFS, 2011a).

Results

In 2008, the Puerto Rican small-scale commercial fleet landed about two million pounds of finfish and shellfish valued at 6 million dollars. The latest census of commercial fishermen reported that there were 868 'active' fishermen in 2008 down from 1,758 in 1996. However, key informants have suggested that the actual number of total fishermen (which includes full-time, part-time, seasonal, and "recreational/not licensed") probably lies between 1,500 and 2,000 participants since many of the active fishermen in the census did not hold a valid license and many seasonal fishermen were likely not included in the census.

This analysis revealed that fishermen use a variety of gears including hook and line, scuba, nets and traps to catch a diverse number of finfish and shellfish species, including Caribbean spiny lobster, queen conch, reef-fishes (snappers and groupers), and pelagic species (mackerels, dolphinfish and wahoo). Hook and line was found to be dominant gear, followed by diving gears (scuba and skin diving), traps and nets.

When we examined the interplay between geography and landings, we found that the west coast, which spreads from the municipalities of Cabo Rojo to Aguadilla, was the most productive region in terms of commercial landings . Hook and line gears were the dominant fishing gears in 2008. Queen snapper, Caribbean spiny lobster, and silk snappers were the main species caught in this western area. The second and third most productive regions were the south and east coasts. The south

coast stretches from the municipalities of Patillas to Lajas had scuba diving as the most important fishing gear. Caribbean spiny lobster, lane and yellowtail snappers were the species most often landed in the south coast. The east coast which runs from the municipalities of Fajardo to Maunabo had scuba diving and fish pots as the main gears in this region. Queen conch, yellowtail snapper, and Caribbean spiny lobster were the main species caught in this region. The north region, which extends from the municipalities of Isabela to Luquillo, was the least productive region of the island because of its narrow shelf and exposed coast (Figure 1). Yellowtail and silk snappers and herrings were the main species caught in this region. Hook and line gears were the main gears used in this region.

The remainder of this section provides a brief description of the species' geographic distribution, habitat preferences, landings patterns, economic significance, main gears used, and main regulations. The report summarizes the main features of commercially valuable species, starting with shellfishes like spiny lobster and queen conch, followed by reef fish species such as snappers and groupers, and finishes discussing the pelagic species.

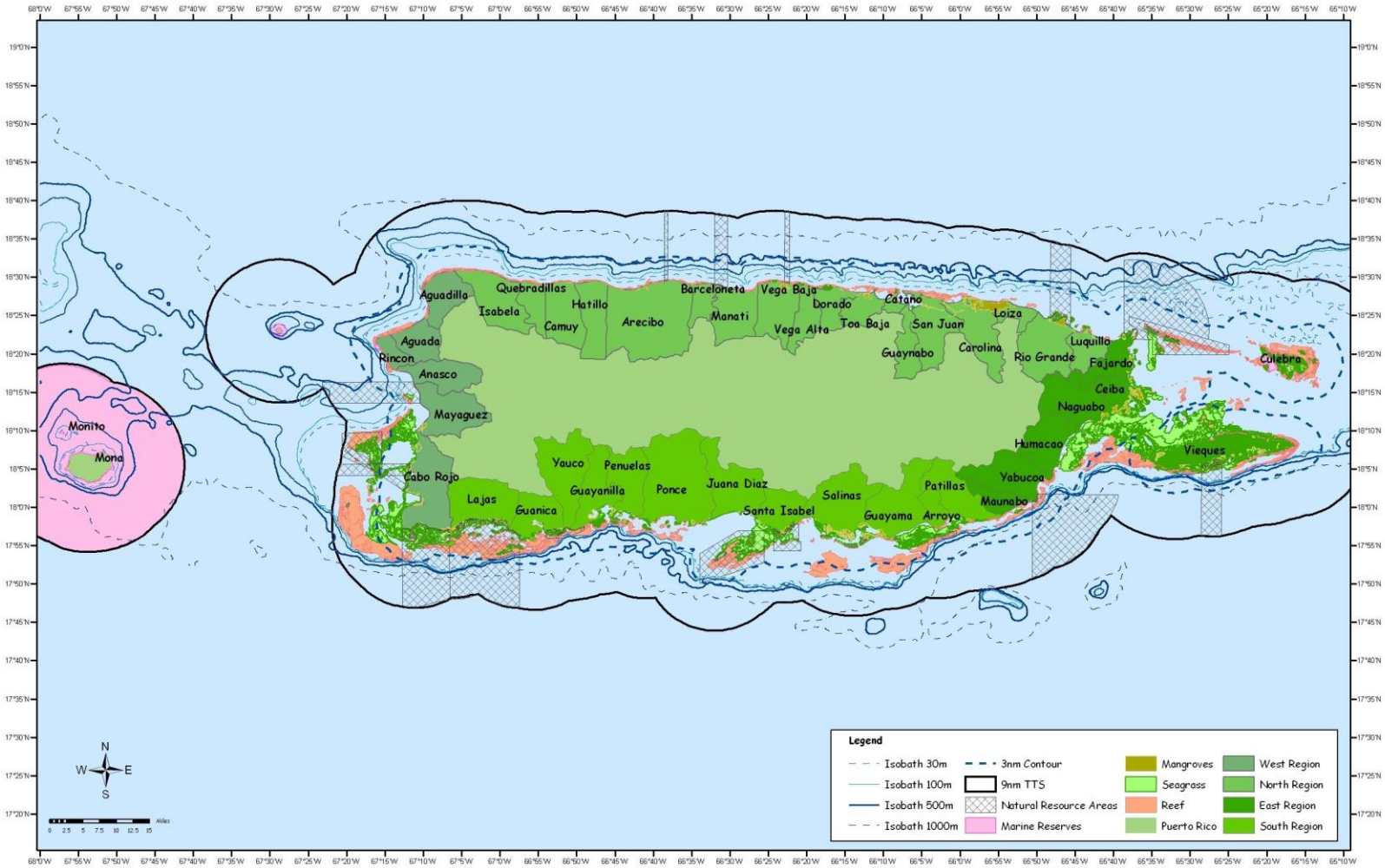

Figure 1: Coastal municipalities and hydrographic features of Puerto Rico

Name: Caribbean spiny lobster *(Panulirus argus)*

Distribution: Caribbean spiny lobsters are found in the Western Central and South Atlantic Ocean, Caribbean Sea and the Gulf of Mexico (CFMC, 2004).

Habitat: Spiny lobsters undergo several life stages before reaching maturity. As planktonic phyllosomes, they are found in pelagic waters and drift with the currents towards the edge of the continental shelf where they molt. Then, as postlarval pueruli, they settle in clumps of red macro-algae, seagrass meadows and mangrove prop roots. Once as juveniles they seek out crevice shelters such as rocks, holes and ledges, and undercut coral heads (CFMC, 2004). After a year of benthic existence, juveniles become sub-adults, occurring in mangrove, seagrass, reef, and hard bottom habitats. Adults tend to enter social living arrangements aggregating in enclosed dens and shelter environments, including holes and rocky outcrops (Saul, 2004).

Revenues and Landings

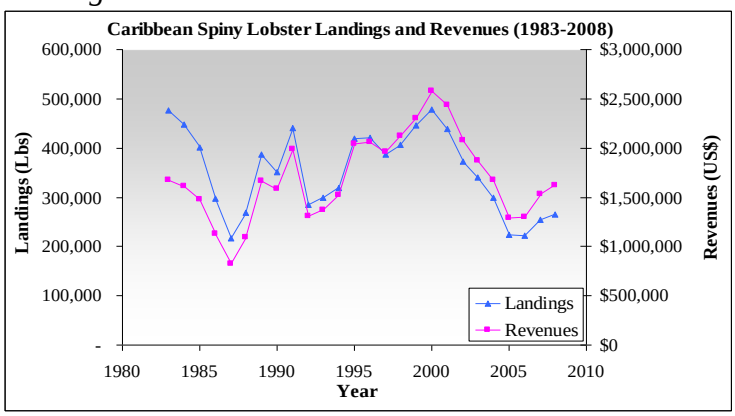

Figure 2: Caribbean spiny lobster landings and revenues (1983-2008).

The lobster fishery is the most valuable commercial fishery in Puerto Rico yielding 265,518 lbs. valued at US$ 1,617,250 in 2008 (Figure 2). The majority of the landings take place along the west coast, particularly in the municipality of Cabo Rojo (Figure 3).

Main Gears: Scuba is leading fishing gear, followed by fish and lobster traps.

Main Regulations: Minimum carapace length (3.5 inches); use of spears, hooks, piercing devices, explosives and poison is banned; in the EEZ the use of gillnets and trammel nets in the EEZ is banned and lobsters must be landed with the head and carapace intact.

Status: Unknown.

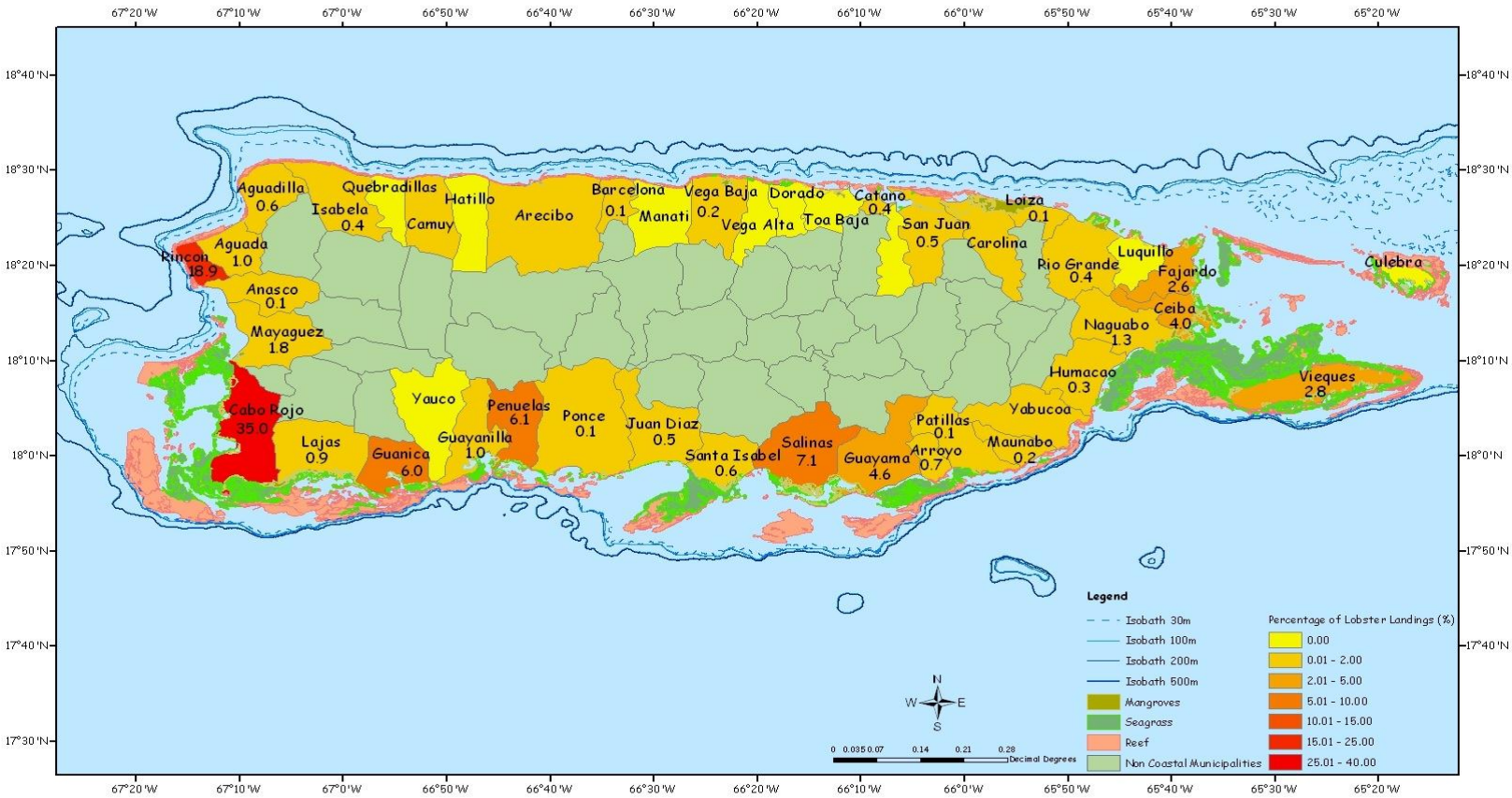

Figure 3: Distribution of Caribbean spiny lobster landings (2008)

Name: Queen Conch (*Strombus gigas*)

Distribution: Queen conch occurs in semi-tropical and tropical waters of the Atlantic Ocean and Caribbean Sea, ranging from Florida and Bermuda to northern South America (Rhines, 2000).

Habitat Description: Conch are found in shallow, clear water of oceanic or near-oceanic salinities at depths generally less than 75m. Their distribution is restricted to this depth range because of the narrow seagrass and algae cover at those depths (SEDAR, 2007).

Revenues and Landings:

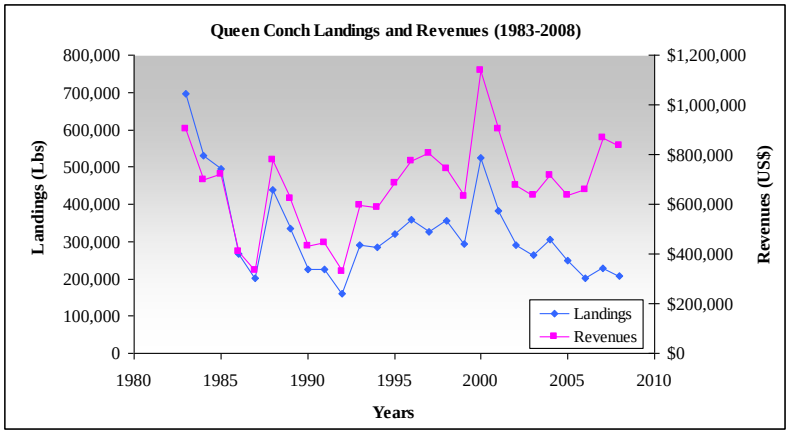

Figure 4: Queen conch landings and revenues (1983-2008).

The queen conch fishery is the second most important commercial fishery in Puerto Rico, yielding 208,676 lbs. and US$ 836,347 in 2008 (Figure 4). The fishery is most prominent along the east and west coasts. In 2008 most of the landings and revenues came from the west coast (62%), followed by the east coast (20%) and the south coast (17%). The highest landings and revenues came from the municipality of Cabo Rojo in the west coast (Figure 5).

Main Gears: Scuba.

Main Regulations: Minimum shell length (9 inches or less than 3/8 inch lip thickness measured at the thickest point of the lip); Hookah gear prohibited; seasonal closures in Commonwealth waters; year-round prohibition in federal waters; mandatory landings of shells; trip limits (450 conch per boat) in Commonwealth waters.

State: Overfished, undergoing overfishing.

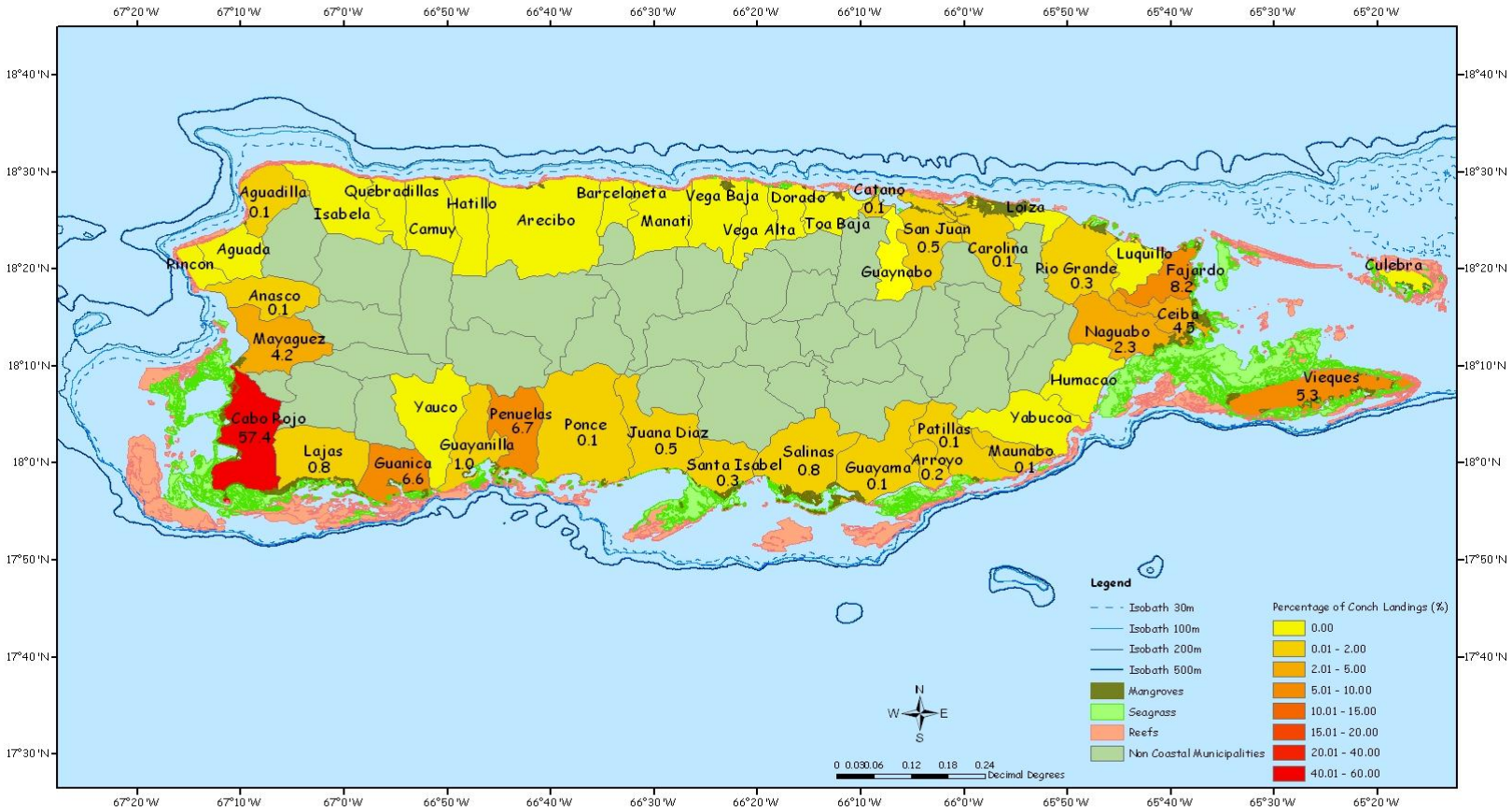

Figure 5: Distribution of Queen conch landings (2008)

Name: Silk Snapper (*Lutjanus vivanus*)

Distribution: Silk snappers inhabit the western Atlantic, with the northernmost limit in Bermuda and North Carolina (USA) and the southernmost limit in central Brazil (Allen, 1985).

Habitat Description: Silk snappers are commonly found near the edge of the continental and insular shelves (CFMC, 2004). They occur at depths of 90 to 140m, though some have been found in depths of up to about 300m.

Revenues and Landings:

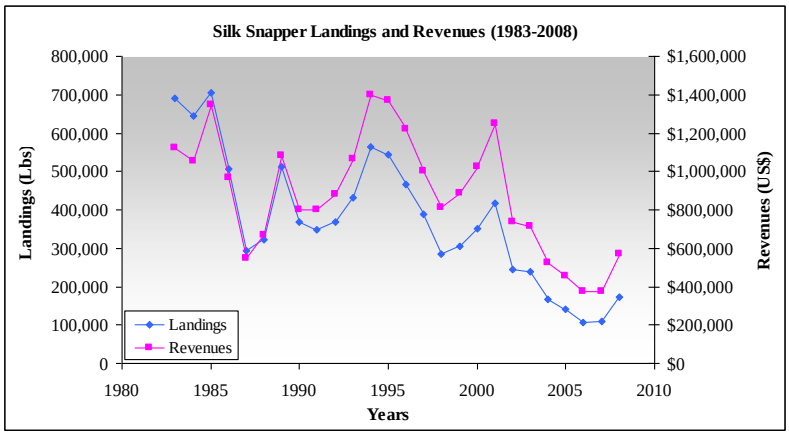

Figure 6: Silk snapper landings and revenues (1983-2008).

Landings and revenues totaled about 172,591 lbs. and US$ 572,458 in 2008 (Figure 6). Most of the landings came from the west coast (84%). The north (9.2%) and south (3.8%) coasts made relatively small contributions to overall landings. In 2008, the highest landings for silk snapper occurred in the municipality of Rincón (39.4%), followed by Cabo Rojo (24.1%) (Figure 7).

Main Gears: Bottom lines, scuba, and fish pots.

Main Regulations: Seasonal closures in federal and Commonwealth waters, incidental catch quota, and size limits (16 inches of fork length).

State: Approaching overfished, undergoing overfishing.

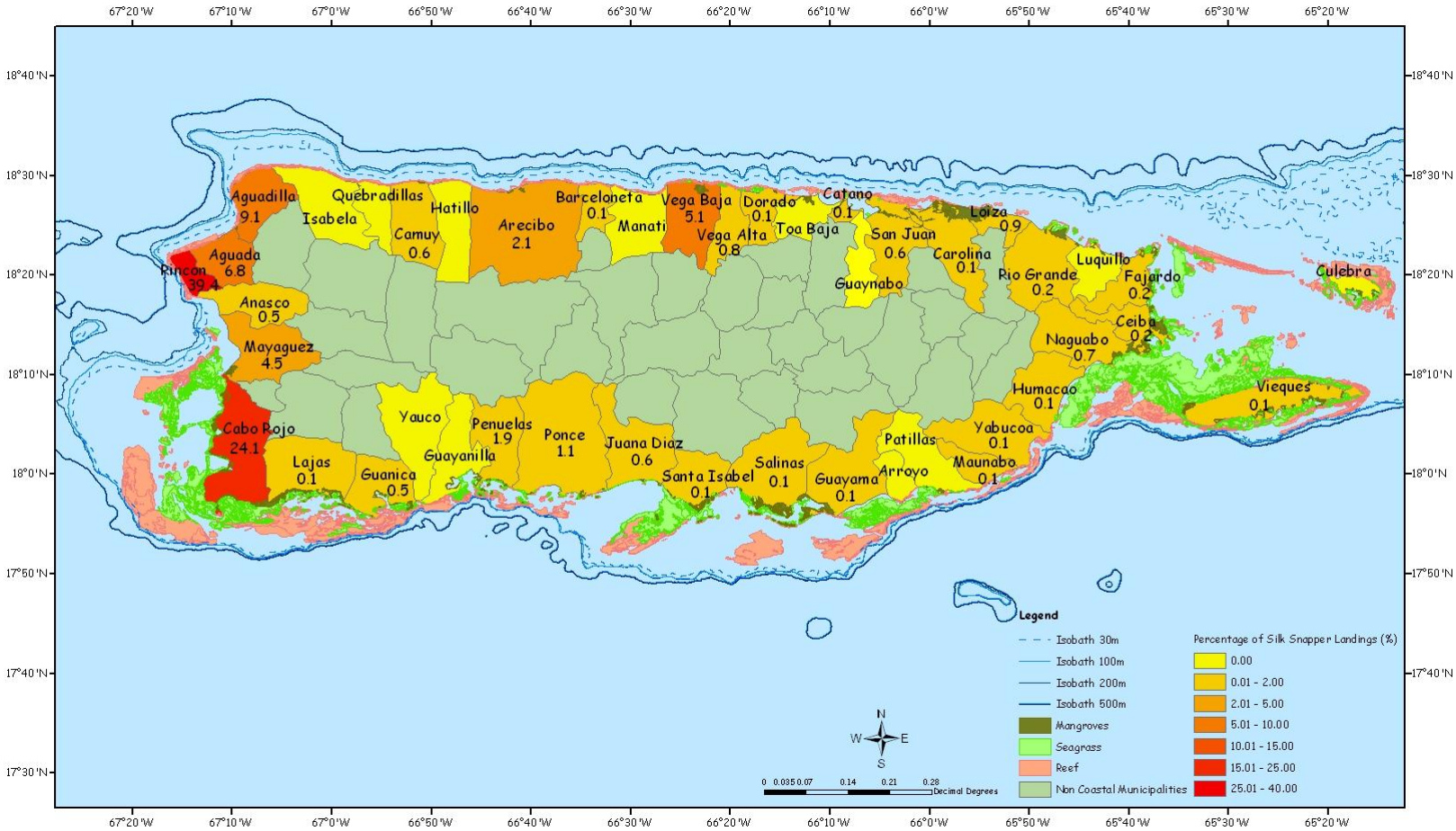

Figure 7: Distribution of Silk snapper landings (2008)

Name: Blackfin Snapper (*Lutjanus buccanella*)

Distribution: Blackfin snappers occur in the western Atlantic, as far north as North Carolina and Bermuda, and as far south as Trinidad and Tobago and the northern parts of Brazil, including the Gulf of Mexico and Caribbean Sea (Allen, 1985).

Habitat Description: Blackfin snappers are a demersal species and can be found at depths between 20 and 200m Adults live offshore near the continental shelf over sandy or rocky bottom. Juveniles live in shallow waters (from 35 to 50m) and typically inhabit rocky outcroppings (CFMC, 2004).

Revenues and Landings:

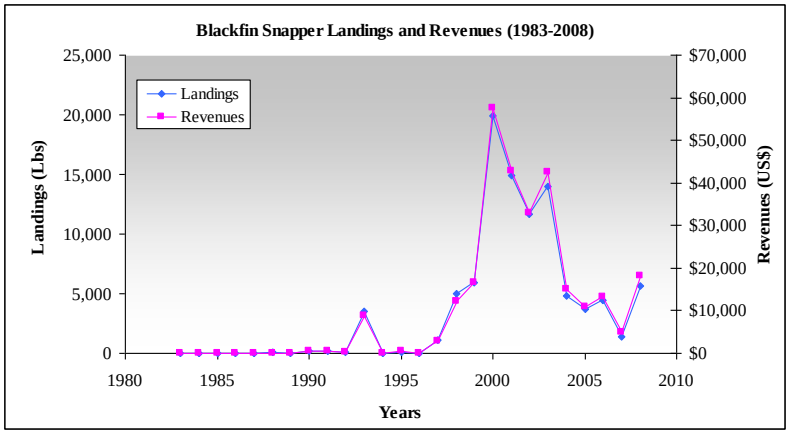

Figure 8: Blackfin snapper landings and revenues (1983-2008).

In 2008, landings and revenues totaled 5,655 lbs. and US$ 18,231, respectively (Figure 8). The majority of the landings came from the west coast (68.7%), followed by the south coast (28.6%) and north coast (7.8%). The municipalities of Rincón (50.3%), Guánica (15.8%) and Aguadilla (12.2%) accounted for most of the landings (Figure 9).

Main Gears: Bottom lines and fish pots.

Main Regulations: Seasonal closures in federal and Commonwealth waters, incidental catch quota, and size limits (12 inches of fork length).

State: Approaching overfished, undergoing overfishing.

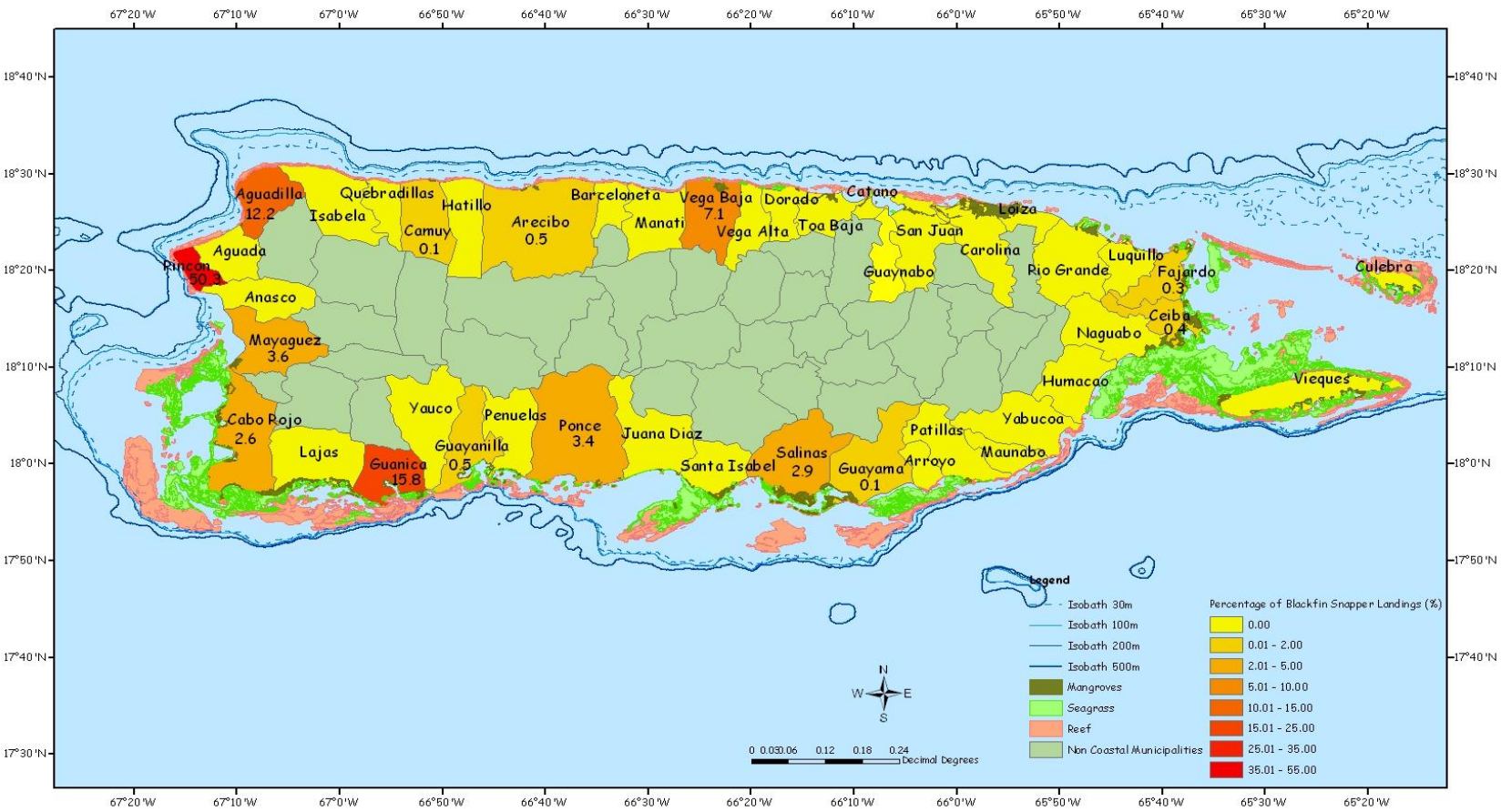

Figure 9: Distribution of Blackfin snapper landings (2008)

Name: Vermilion Snapper *(Rhomboplites aurorubens)*

Distribution: Vermilion snappers are found in the western Atlantic, as far north as North Carolina and Bermuda, and as far south as Brazil, including Gulf of Mexico and Caribbean Sea (Allen, 1985).

Habitat Description: Vermilion snapper is a demersal species that can be found over rock, gravel, or sandy bottoms, typically at depths between 75 and 110m. In Puerto Rico, they have been reported at depths of 300m (CFMC, 2004).

Revenues and Landings:

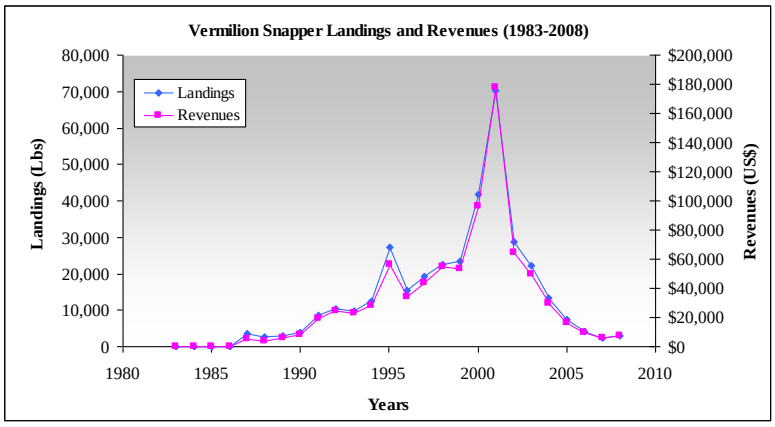

Figure 10: Vermilion snapper landings and revenues (1983-2008).

In 2008, landings and revenues totaled about 2,877 lbs. (Figure 10) and US$ 7,625. The majority of the landings came from the north coast (37%), followed by the east coast (32.9%) and the west coast (22.6%). The municipalities of Rincón (50.3%), Guánica (15.8%) and Aguadilla (12.2%) were the most productive in terms of landings (Figure 11).

Main Gears: Bottom lines and fish pots.

Main Regulations: Seasonal closure in federal waters.

State: Approaching overfished, undergoing overfishing.

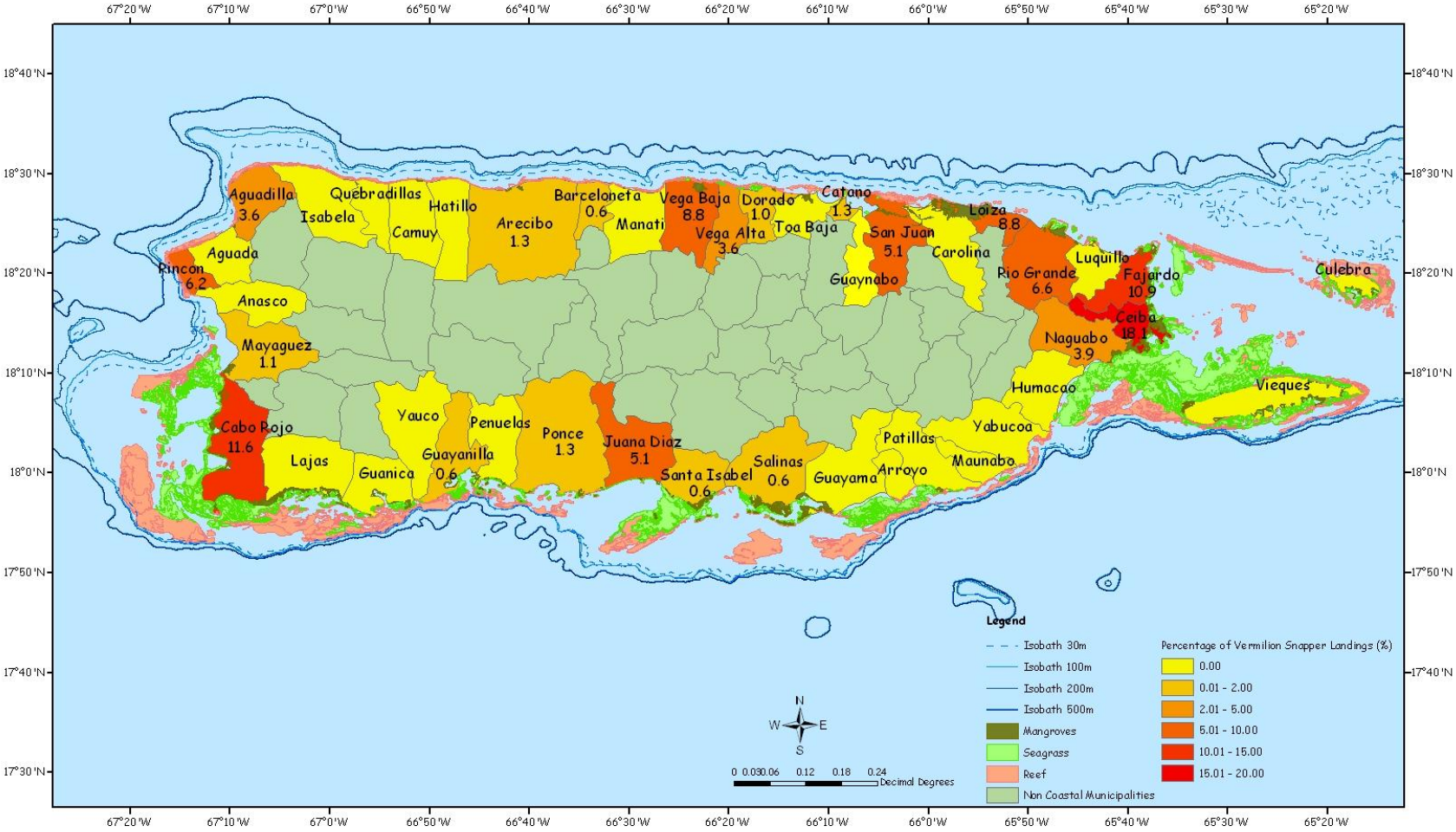

Figure 11: Distribution of Vermilion snapper landings (2008)

Name: Queen Snapper (*Etelis oculatus*)

Distribution: Queen snappers occur in the western Atlantic, as far north as North Carolina and Bermuda, and as far south as central Brazil, including Gulf of Mexico and Caribbean Sea (Allen, 1985).

Habitat Description: Queen snappers are bathydemersal species that move from offshore waters to deep-water reefs and rocky ledges as they grow and mature. They are commonly found in areas characterized by rocky bottoms and are abundant near oceanic islands at depths from 100 to 450m (Cummings, 2003).

Revenues and Landings:

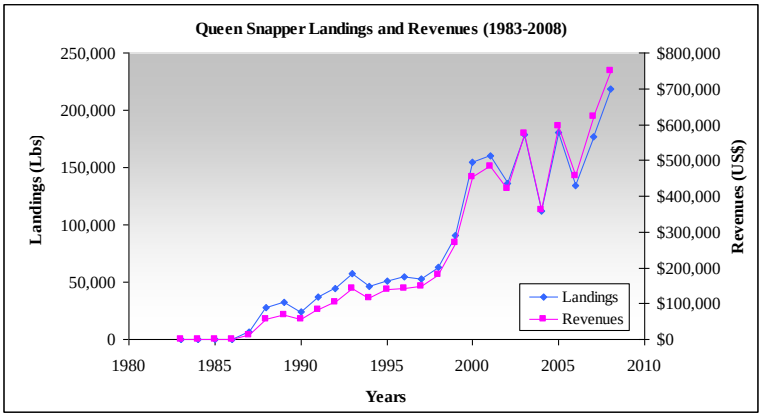

Figure 12: Queen snapper landings and revenues (1983-2008).

Landings and revenues for queen snapper totaled about 218,290 lbs. and US$ 748,517 in 2008 (Figure 12). The majority of the landings came from the west coast (96.5%), followed by the north coast (1.9%) and east coast (0.9%). The landings of queen snapper were the highest of all reported species from the west coast in 2008. The municipality of Rincón accounted for almost 83% of the landings (Figure 13).

Main Gears: Bottom lines and scuba.

Main Regulations: Not regulated in Puerto Rico.

State: Unknown.

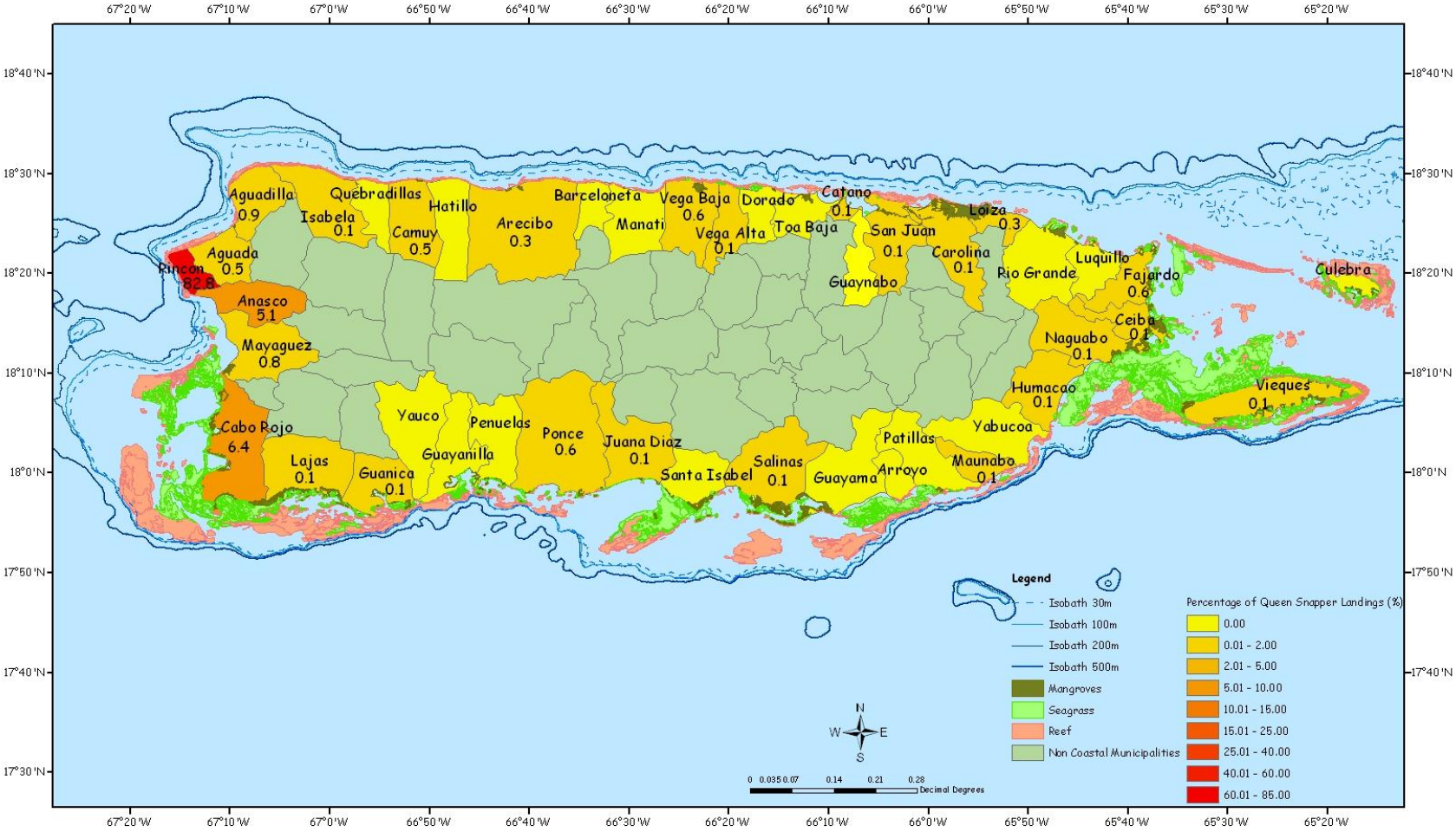

Figure 13: Distribution of Queen snapper landings (2008)

Name: Lane Snapper (*Lutjanus synagris*)

Distribution: Lane snappers occur in western Atlantic, as far north as North Carolina and Bermuda, extending south to southern Brazil, inclusive of the Gulf of Mexico and Caribbean Sea. It is most common around the Antilles, on the Campeche Bank, off Panama and the northern coast of South America (Allen, 1985).

Habitat Description: Lane snappers can be found in different types of bottom but they are usually found in coral reefs and on vegetated sandy areas at depths of 10 to 400m (Allen, 1985).

Revenues and Landings:

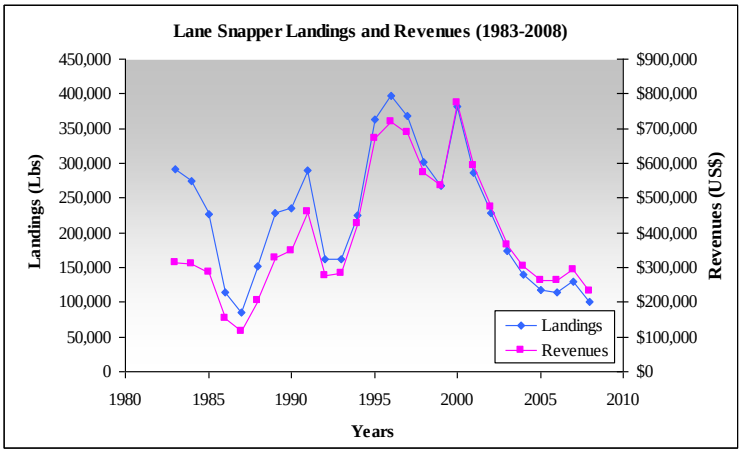

Figure 14: Lane snapper landings and revenues (1983-2008).

In 2008, Puerto Rican landings and revenues of lane snapper were around 100,739 lbs. and US$ 230,466, respectively (Figure 14). The majority of the landings came from the south coast (53.9%), followed by the west coast (35.5%) and east coast (8.5%). Cabo Rojo, Salinas, Ponce and Peñuelas were the most productive municipalities (Figure 15).

Main Gears: Bottom line and fish pots.

Main Regulations: Seasonal closures in federal and Commonwealth waters.

State: Unknown.

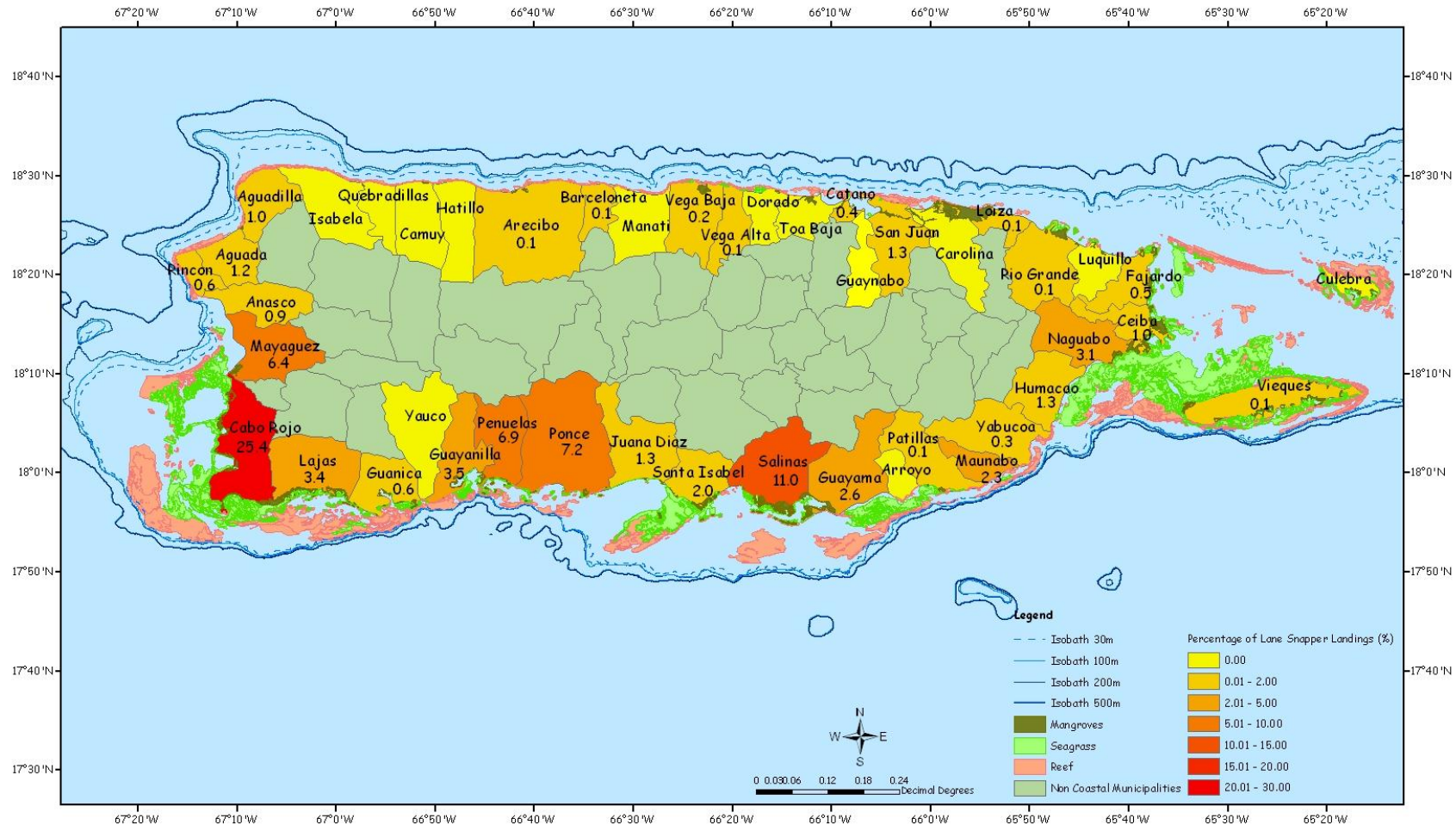

Figure 15: Distribution of Lane snappers landings (2008)

Name: Dog Snapper (*Lutjanus jocu*)

Distribution: Dog snappers occur in the western and eastern Atlantic, as far north as Massachusetts, and as far south as northern Brazil, inclusive of the Gulf of Mexico and Caribbean Sea (Allen, 1985).

Habitat Description: Adult dog snappers are commonly found around coral reefs and rocky bottoms, at depths of 5 to 30m, while the young dog snappers occur in estuaries and have been known to occasionally swim into rivers. Dog snappers are one of the only *lutjanids* that can be found in freshwaters (CFMC, 2004).

Revenues and Landings:

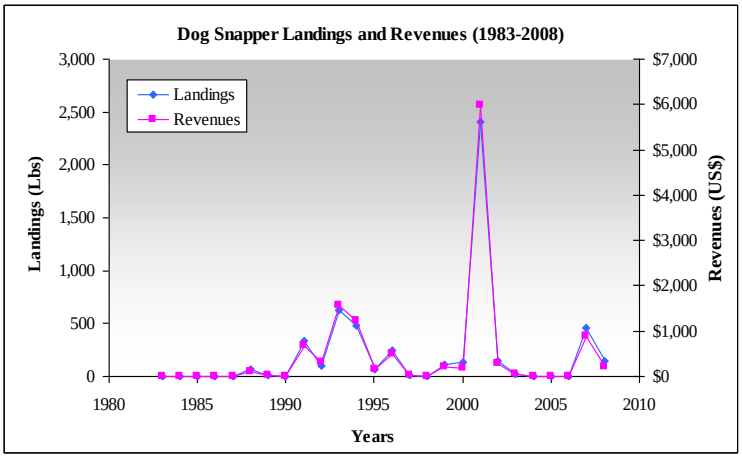

Figure 16: Dog snapper landings and revenues (1983-2008).

In 2008, the landings of dog snapper were about 142 lbs. valued at US$ 212 (Figure 16). From 1989 to 2008 the landings varied from different municipalities and coasts. However, all of the 2008 production was landed in the municipality of Mayaguez (Figure 17).

Main Gears: Bottom line

Main Regulations: Not regulated in Puerto Rico.

State: Unknown.

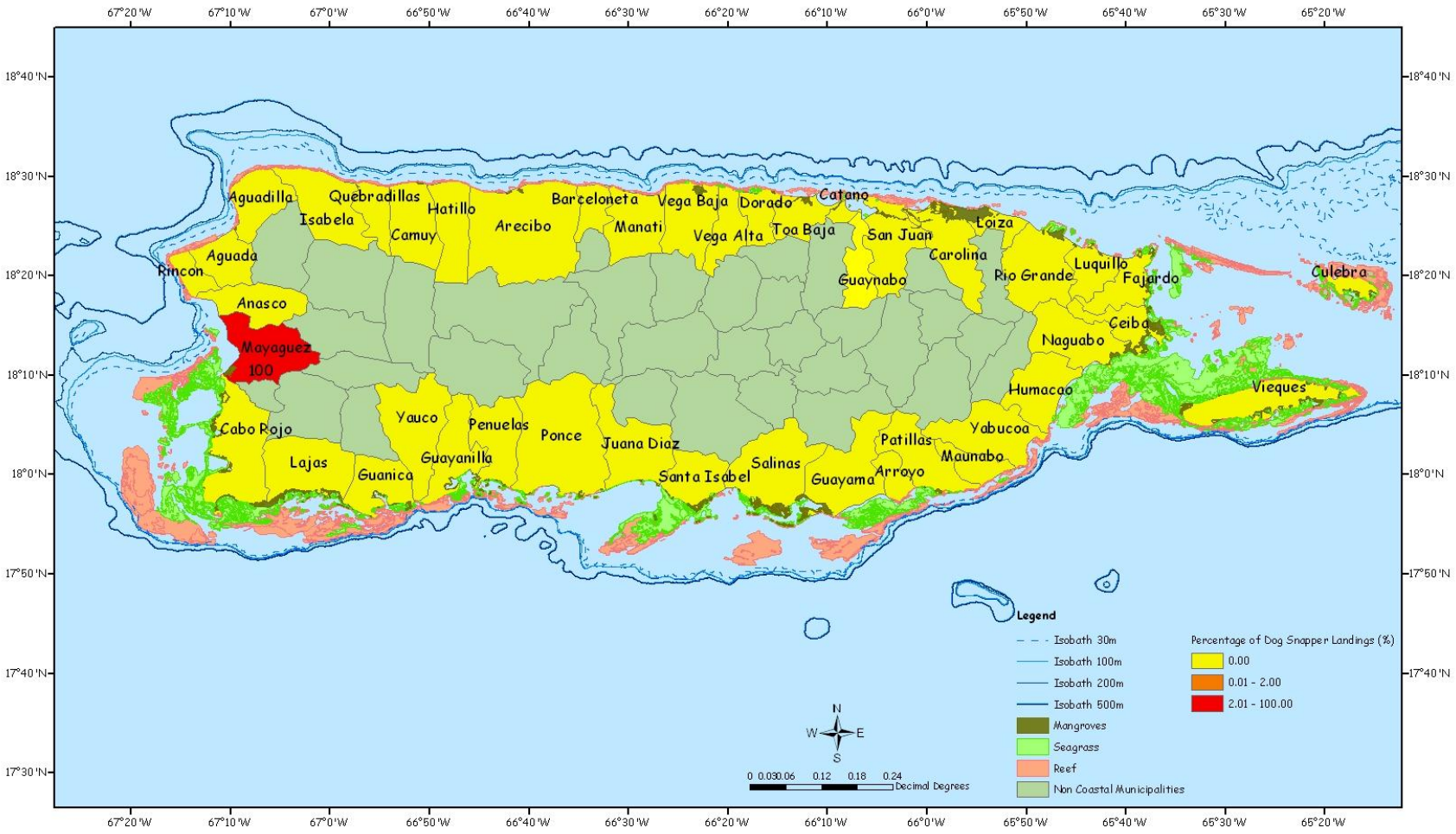

Figure 17: Distribution of Dog snapper landings (2008)

Name: Mutton Snapper (*Lutjanus analis*)

Distribution: Mutton snappers occur in the western Atlantic, as far north as Massachusetts, and as far south as southeastern Brazil, including Gulf of Mexico and Caribbean Sea. It is most common around the Antilles, the Bahamas, and off southern Florida (Allen, 1985).

Habitat Description: Mutton snapper is commonly found at depths from 25 to 95m. Juveniles generally live close to the shore, in seagrass beds, mangrove creeks and canals. Larger fishes and mature adults are generally found in offshore waters, among rocks and coral habitat (CFMC, 2004).

Revenues and Landings:

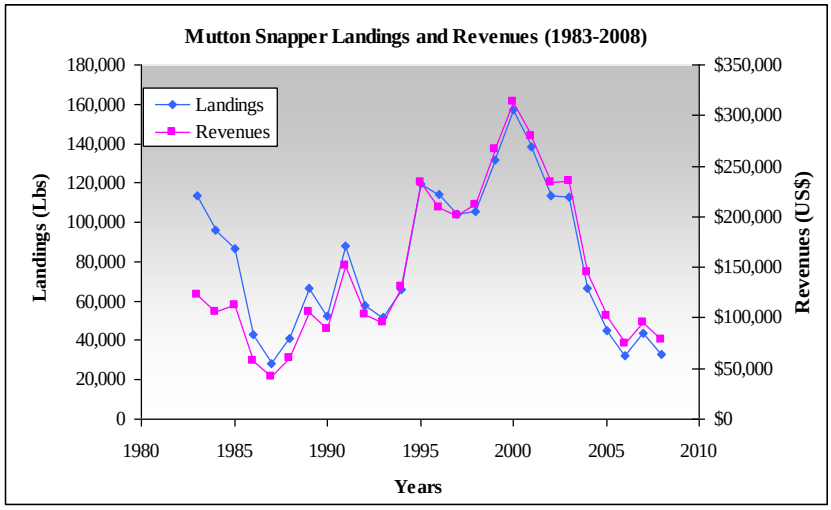

Figure 18: Mutton snapper landings and revenues (1983-2008).

Mutton snapper landings totaled about 32,967 lbs. valued at US$ 78,136 in 2008 (Figure 18). Landings centered on the west coast (45.5%), followed by the south (37.3%) and east (13.6%) coasts. Cabo Rojo, Mayaguez, Salinas, and Aguadilla were the most productive municipalities (Figure 19).

Main Gears: Bottom lines, scuba and fish pots.

Main Regulations: Seasonal closures in federal and Commonwealth waters.

State: Unknown.

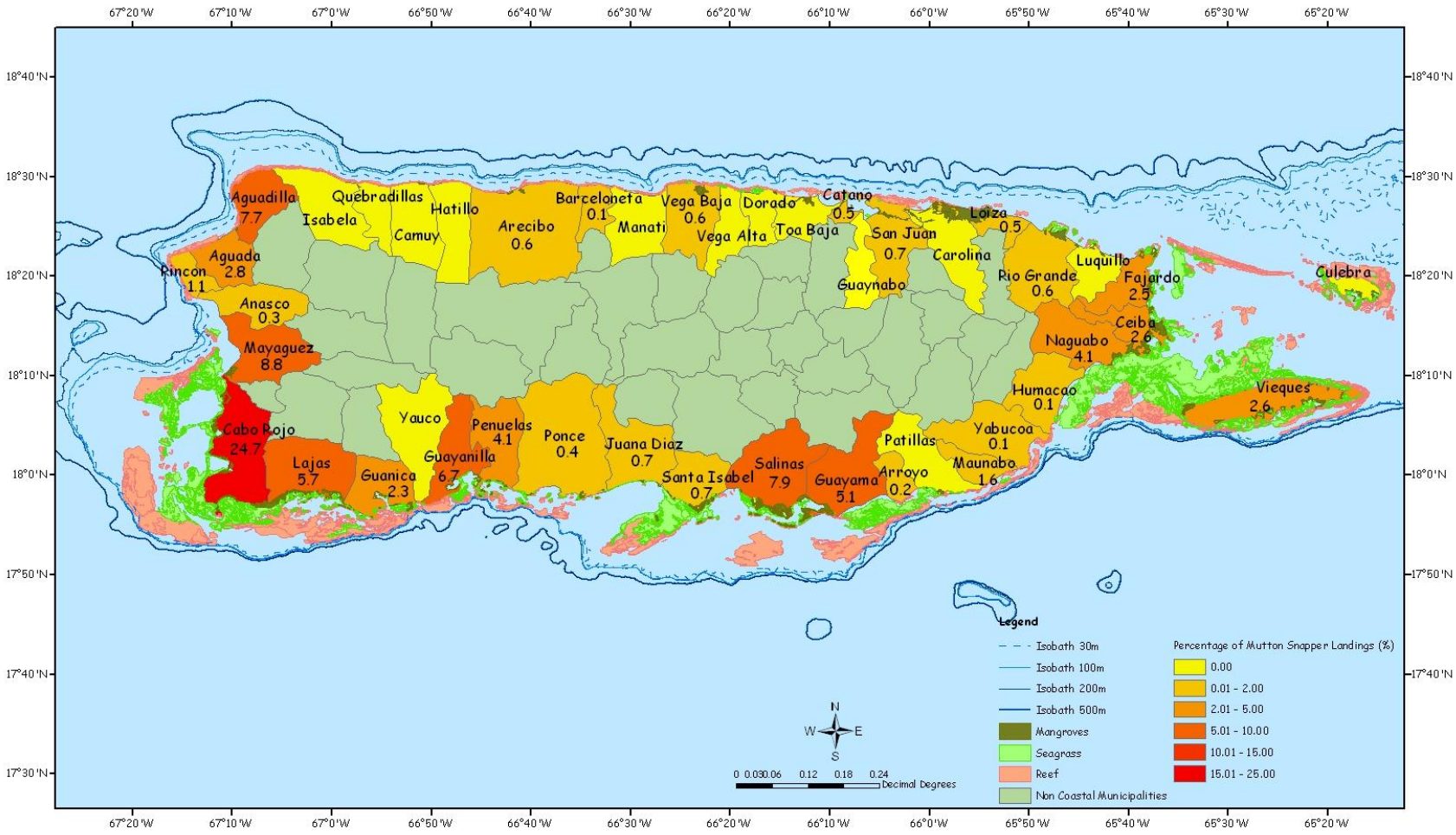

Figure 19: Distribution of Mutton snapper landings (2008)

Name: Yellowtail Snapper (*Ocyurus chrysurus*)

Distribution: Yellowtail snappers occur in the western Atlantic, as far north as Massachusetts and as far south as southeastern Brazil, including Gulf of Mexico and Caribbean Sea. It is most common around the Bahamas, off southern Florida and throughout the Caribbean (Allen, 1985).

Habitat Description: Adults typically inhabit sandy areas near offshore reefs at depths ranging from 10 to 70m, but larger fish can roam greater distances, while smaller individuals remain close to shelter (Muller *et al*., 2003).

Revenues and Landings:

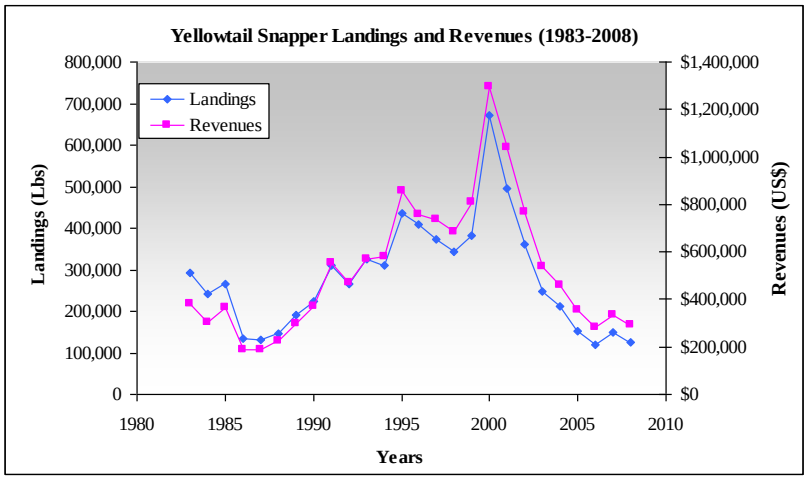

Figure 20: Yellowtail snapper landings and revenues (1983-2008).

In 2008, the commercial fleet landed 125,862 lbs. of yellowtail snapper valued at US$ 294,138 (Figure 20). Most of the landings were from the south coast (28.7%), followed by the east coast (28%) and west coast (24.4%). Overall, the highest percentage of landings came from the municipality of Fajardo (17.8%), followed by the municipalities of Mayaguez (14.6%) and Lajas (12.2%) (Figure 21).

Main Gears: Bottom lines and gillnets.

Main Regulations: Size limit in federal (12 inches of total length) and Commonwealth waters (10.5 inches of total length).

State: Unknown.

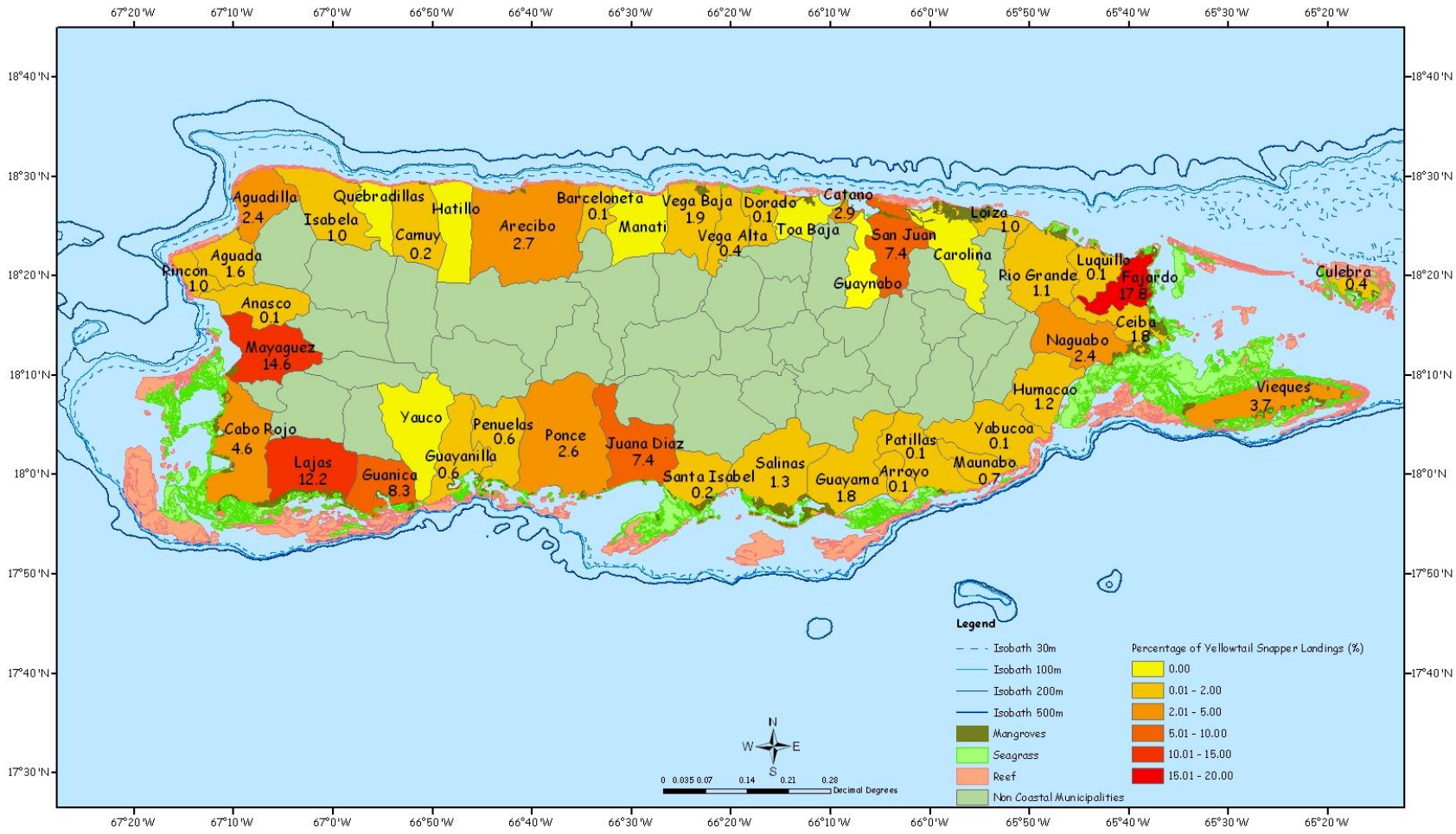

Figure 21: Distribution of Yellowtail snapper landings (2008)

Name: Cardinal Snapper (*Pristipomoides macrophthalmus*)

Distribution: Cardinal snappers occur in the western central Atlantic, including the Straits of Florida, Bahamas, Greater Antilles and the Caribbean coast of Nicaragua and Panama (Allen, 1985).

Habitat Description: They are commonly found in deeper waters of the shelf near the edge of the continental slope (Allen, 1985).

Revenues and Landings:

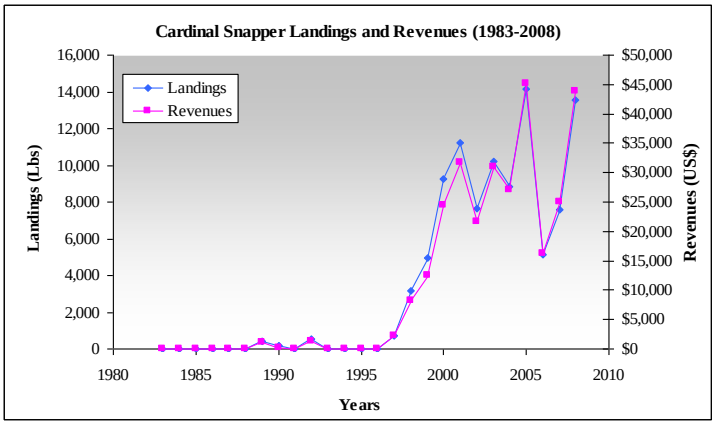

Figure 22: Cardinal snapper landings and revenues (1983-2008).

The landings of cardinal snapper totaled were 13,531 lbs. in 2008 (Figure 22). These landings were valued at US$ 43,914. The west coast (87.8%) accounted for most of the landings, followed by the north coast (6.6%) and east coast (3.5%). Rincón and Cabo Rojo were the most productive municipalities (Figure 23).

Main Gears: Bottom lines and troll lines.

Main Regulations: Not regulated.

State: Unknown.

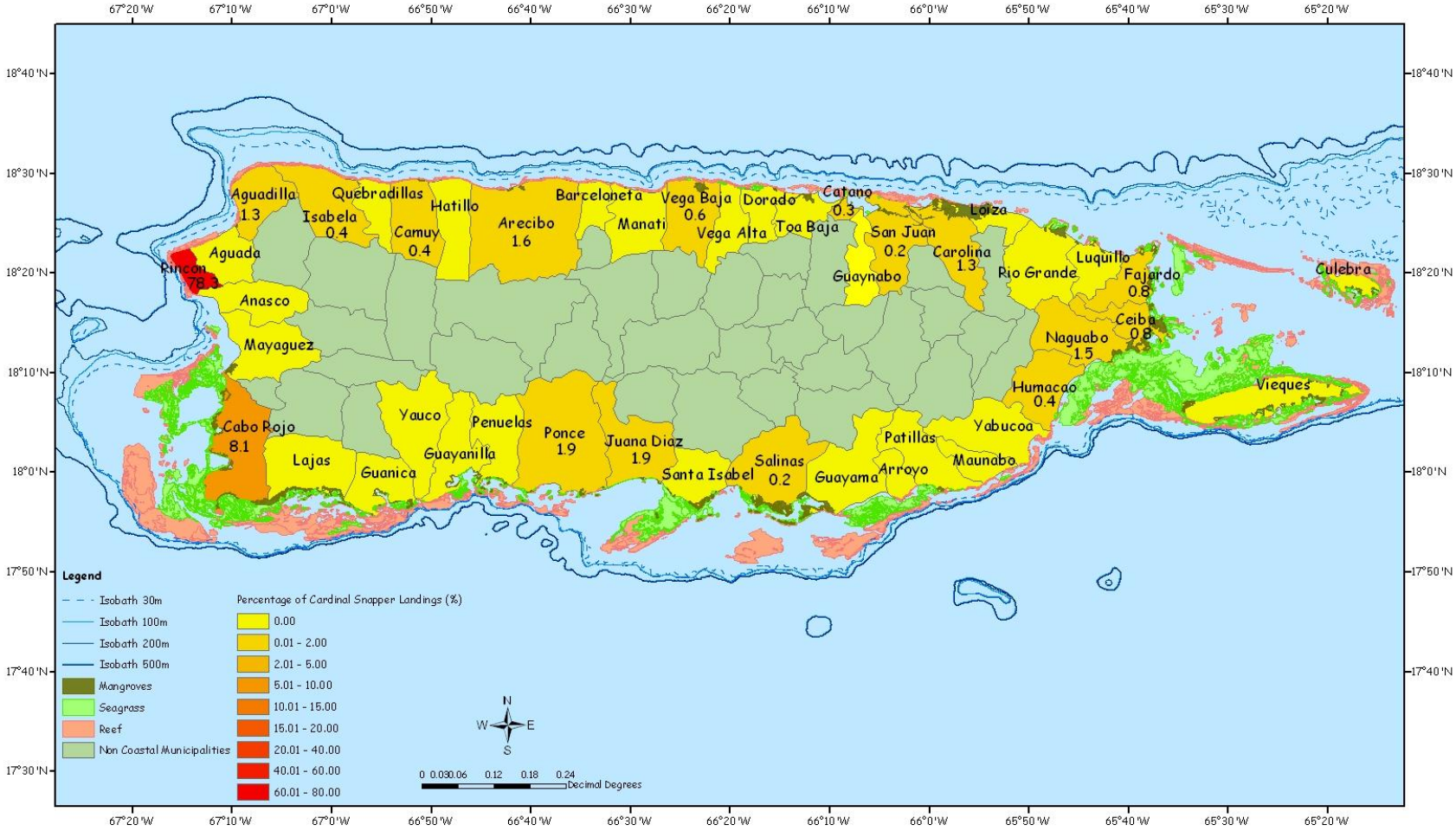

Figure 23: Distribution Cardinal snapper landings (2008)

Name: Misty Grouper (*Epinephelus mystacinus*)

Distribution: Misty grouper occurs in both the western and eastern Atlantic, from Bermuda and North Carolina (USA) to Mexico, including the Gulf of Mexico and Caribbean Sea (Heemsta and Randall, 1993).

Habitat Description: The misty grouper is a bathydemersal, species, living at 30 to 400m depths. Juveniles typically inhabit shallower waters (CFMC, 2004).

Revenues and Landings:

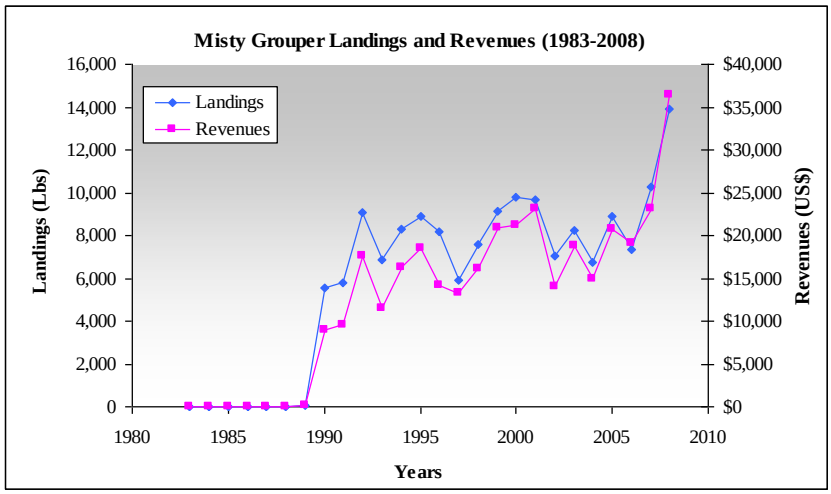

Figure 24: Misty grouper landings and revenues (1983-2008).

In 2008, 13,892 lbs. of misty grouper were landed valued US$ 36,485 (Figure 24). Most of the landings of misty grouper came from the west coast (95.9%). The north (3%) and east (0.2%) coasts contribution to landing was small. Most of the production was landed in the municipalities of Rincón, followed by Humacao and Aguadilla (Figure 25).

Main Gears: Bottom lines.

Main Regulations: Not regulated in Puerto Rico.

State: Overfished, undergoing overfishing.

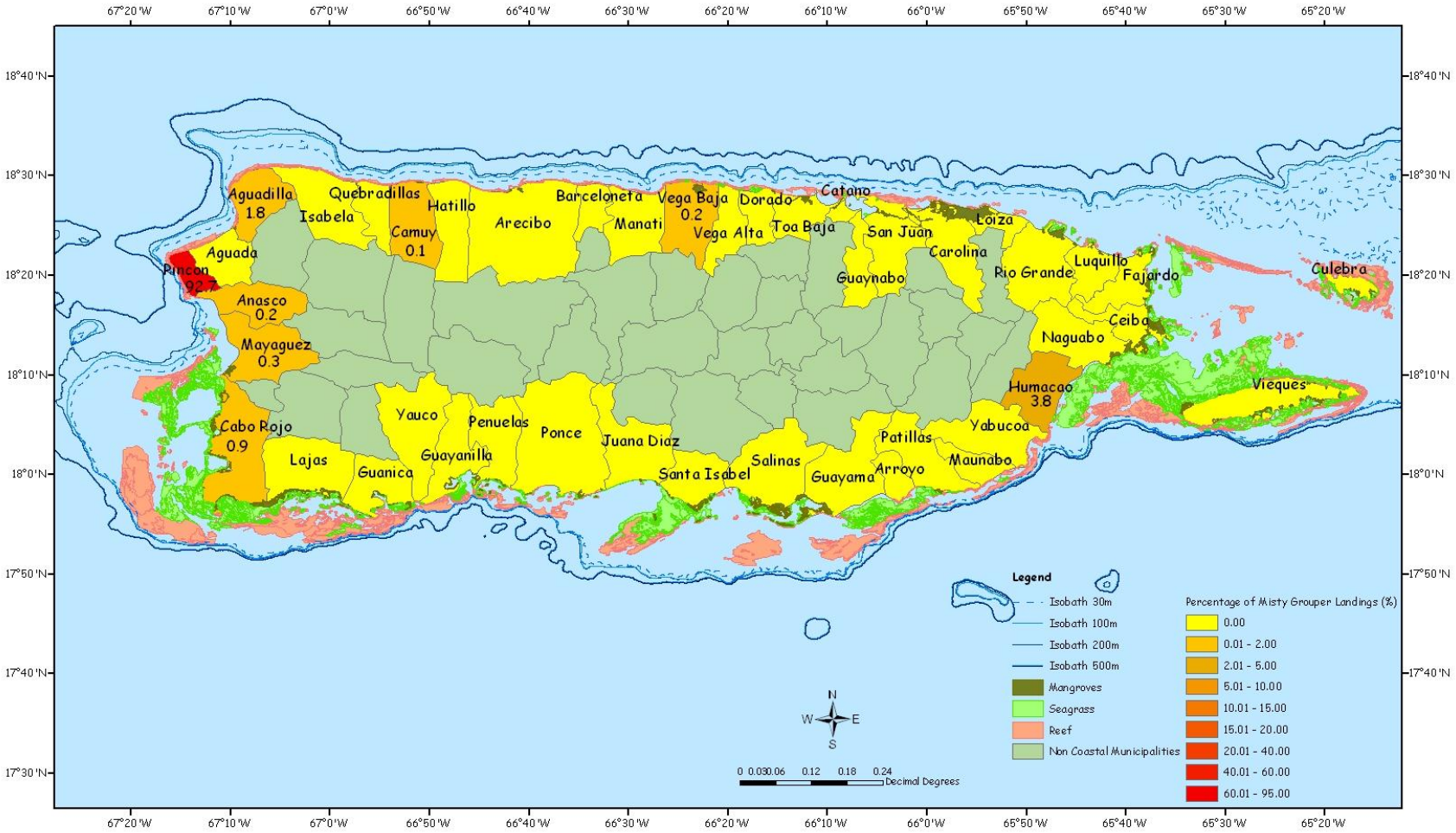

Figure 25: Distribution of Misty grouper landings (2008)

Name: Yellowfin Grouper (*Mycteroperca venenosa*)

Distribution: Yellowfin grouper occurs in the western Atlantic, from Bermuda to Brazil and Guianas, including the Gulf of Mexico and Caribbean Sea (CFMC, 2004).

Habitat Description: Adults inhabit rocky and coral reefs, while juveniles are commonly found in shallow turtle grass beds. They can be found at 2 to 137m depths (CFMC, 2004).

Revenues and Landings:

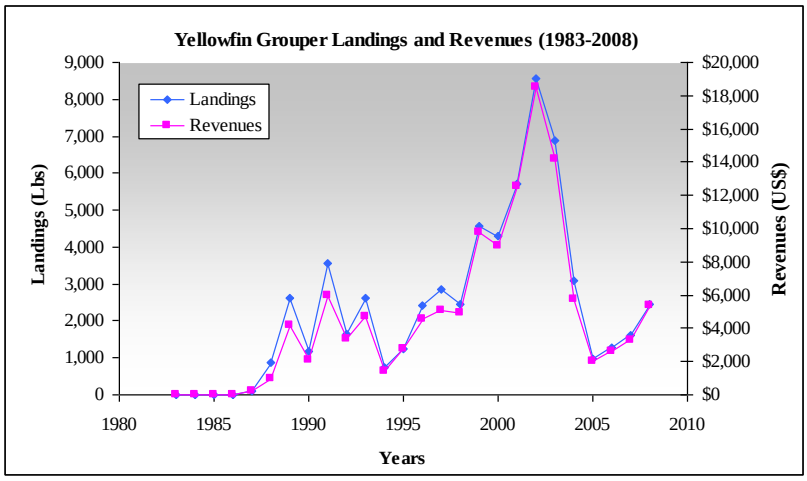

Figure 26: Yellowfin grouper landings and revenues (1983-2008).

In 2008, the majority of the yellowfin grouper caught was landed in the west coast (73.8%), followed by the east coast (26.2%). In the same year, yellowfin grouper landings totaled 2,458 lbs. which were valued at US$ 5,341 (Figure 26). The majority of the catch was landed in Cabo Rojo, followed by Humacao and Rincón (Figure 27).

Main Gears: Scuba and fish pots.

Main Regulations: Seasonal federal and Commonwealth closures.

State: Overfished, undergoing overfishing.

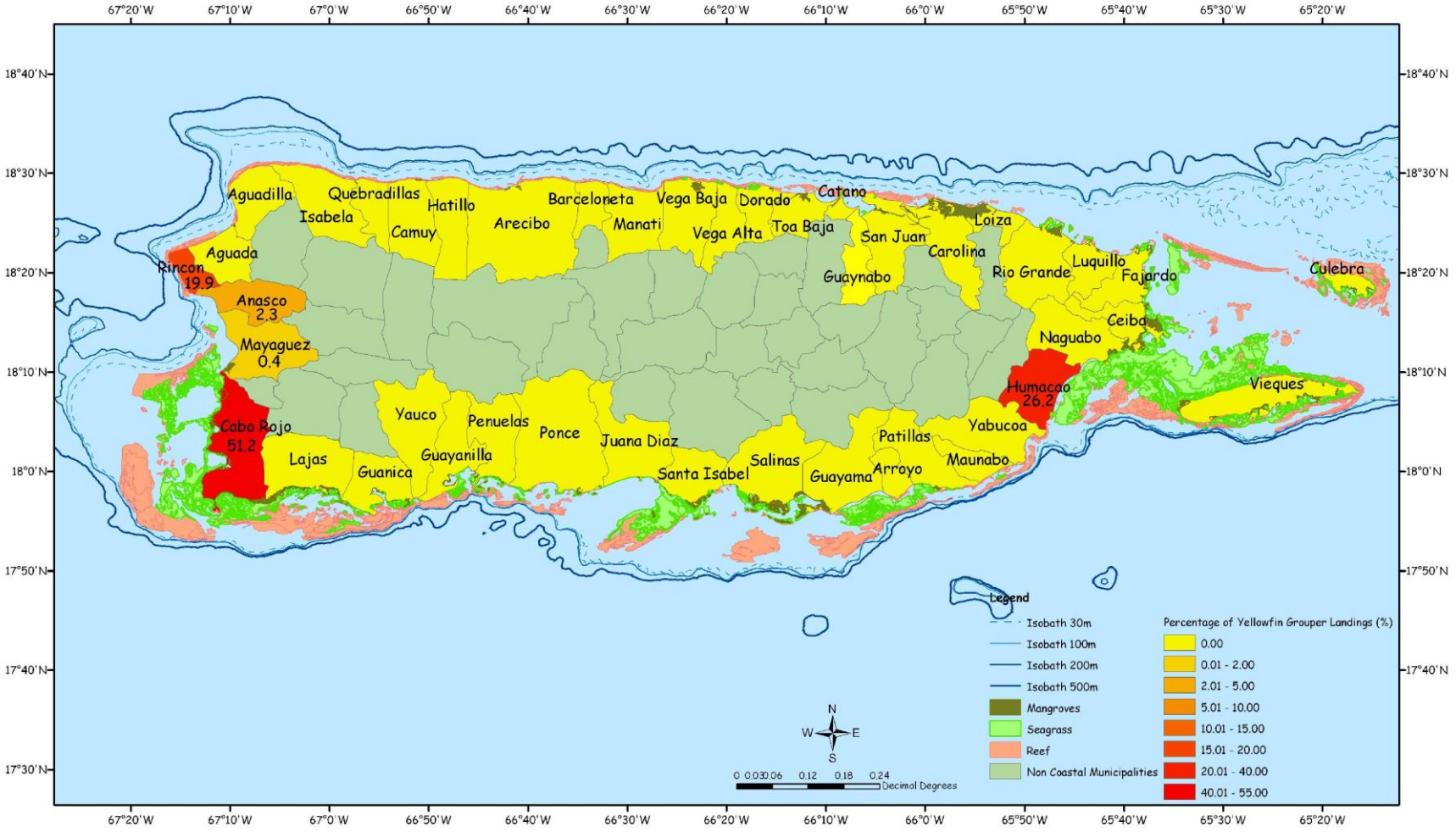

Figure 27: Distribution of Yellowfin grouper landings (2008)

Name: Parrotfish *(Sparisoma spp)*

Distribution: Parrotfishes are widely distributed in the tropical Atlantic, Indian, and Pacific Oceans (Nelson, 1994).

Habitat Description: Parrotfishes are tropical shallow-water fishes that commonly occur on or adjacent to coral reef habitat, but can also be found over rocky shores and substrates. They can occur in shallow waters from 3 to 50m deep (CFMC, 2004).

Revenues and Landings:

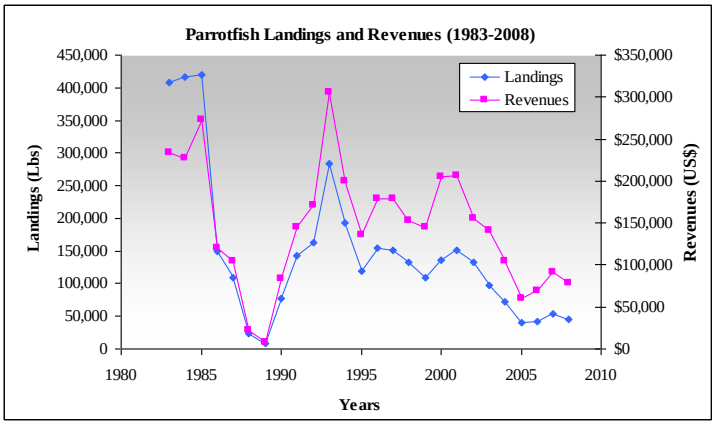

Figure 28: Parrotfish landings and revenues (1983-2008).

In 2008, the highest landings for parrotfish came from the south coast (55.1%) followed by the west (22.7%) and east (12.9%) coasts. In the same year, parrotfish landings and revenues accounted for 44,616 lbs. and US$ 78,317, respectively (Figure 28). The municipalities with the highest landings were Cabo Rojo, Guánica and Guayama (Figure 29).

Main Gears: Scuba, fish pots and bottom lines.

Main Regulations: Not regulated in Puerto Rico

State: Approaching overfished, undergoing overfishing.

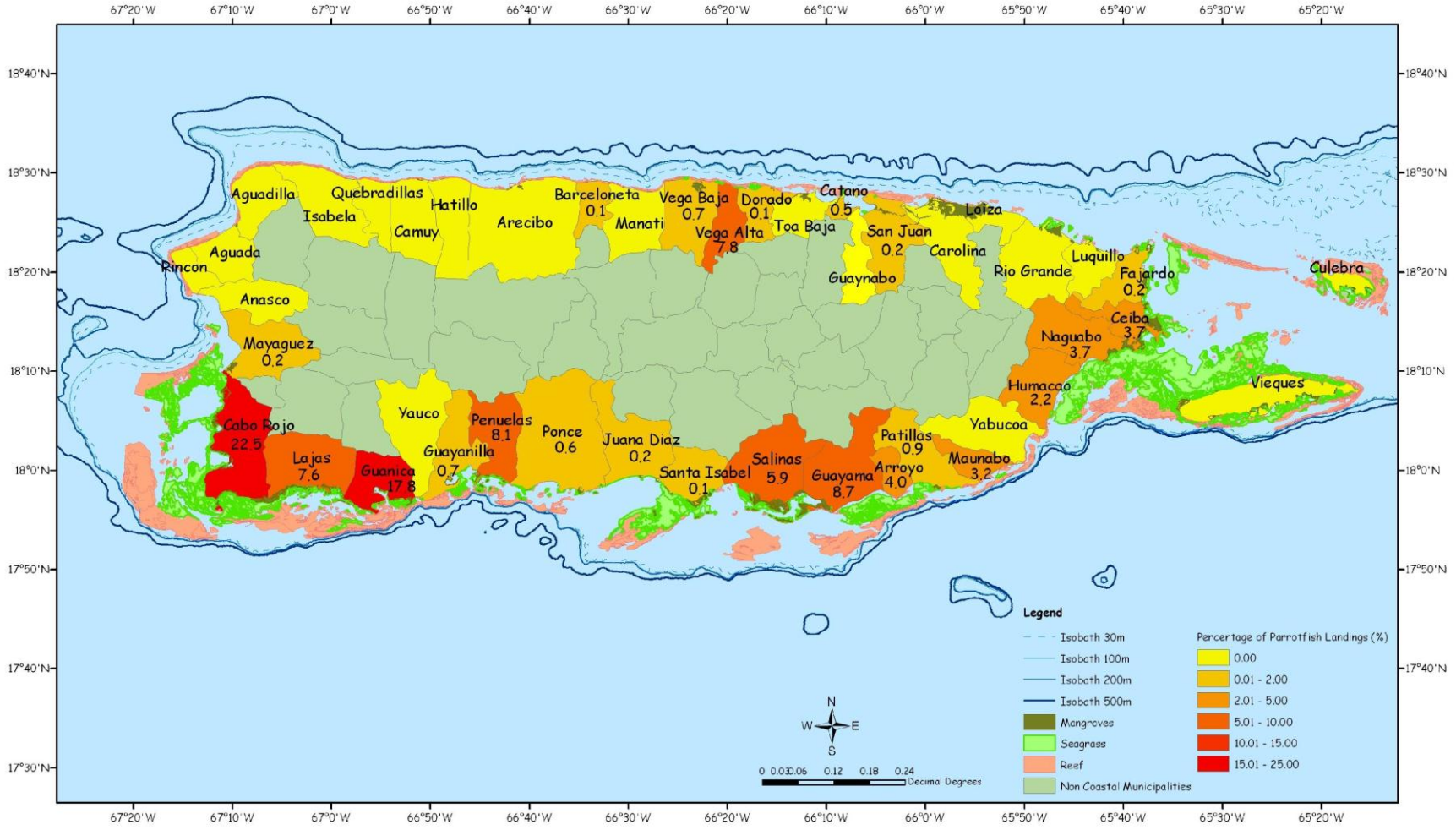

Figure 29: Distribution of Parrotfishes landings (2008)

Name: Boxfish *(Lactophrys spp)*

Distribution: Boxfish are widely distributed in the tropical Atlantic, Indian and Pacific Oceans (CFMC, 2004).

Habitat Description: Boxfish inhabit clear water around coral reefs (and coral reefs associated habitats), from 3 to 80m depth (CFMC, 2004).

Revenues and Landings:

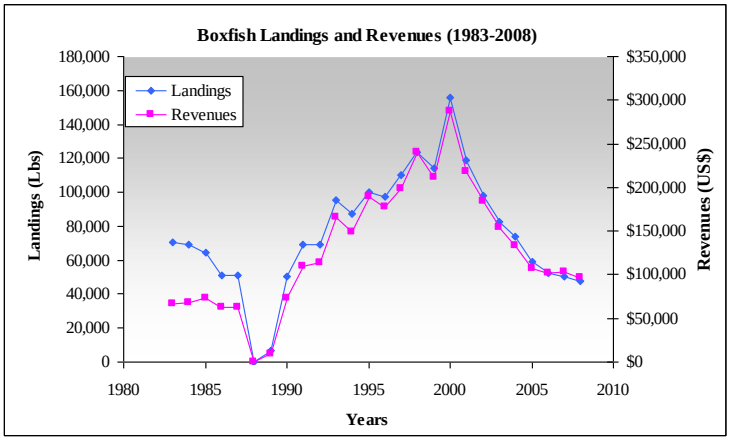

Figure 30: Boxfish landings and revenues (1983-2008).

In 2008, boxfish landings were around 47,811 lbs. valued at US$ 97,206 (Figure 30). Most of the boxfishes landings came from the west coast (58.1%), followed by the south (29%) and the east (12.7%) coasts. Overall, the municipality of Cabo Rojo had the highest landings, followed by Guayama and Lajas (Figure 31).

Main Gears: Fish pot and scuba.

Main Regulations: Not regulated in Puerto Rico.

State: Unknown.

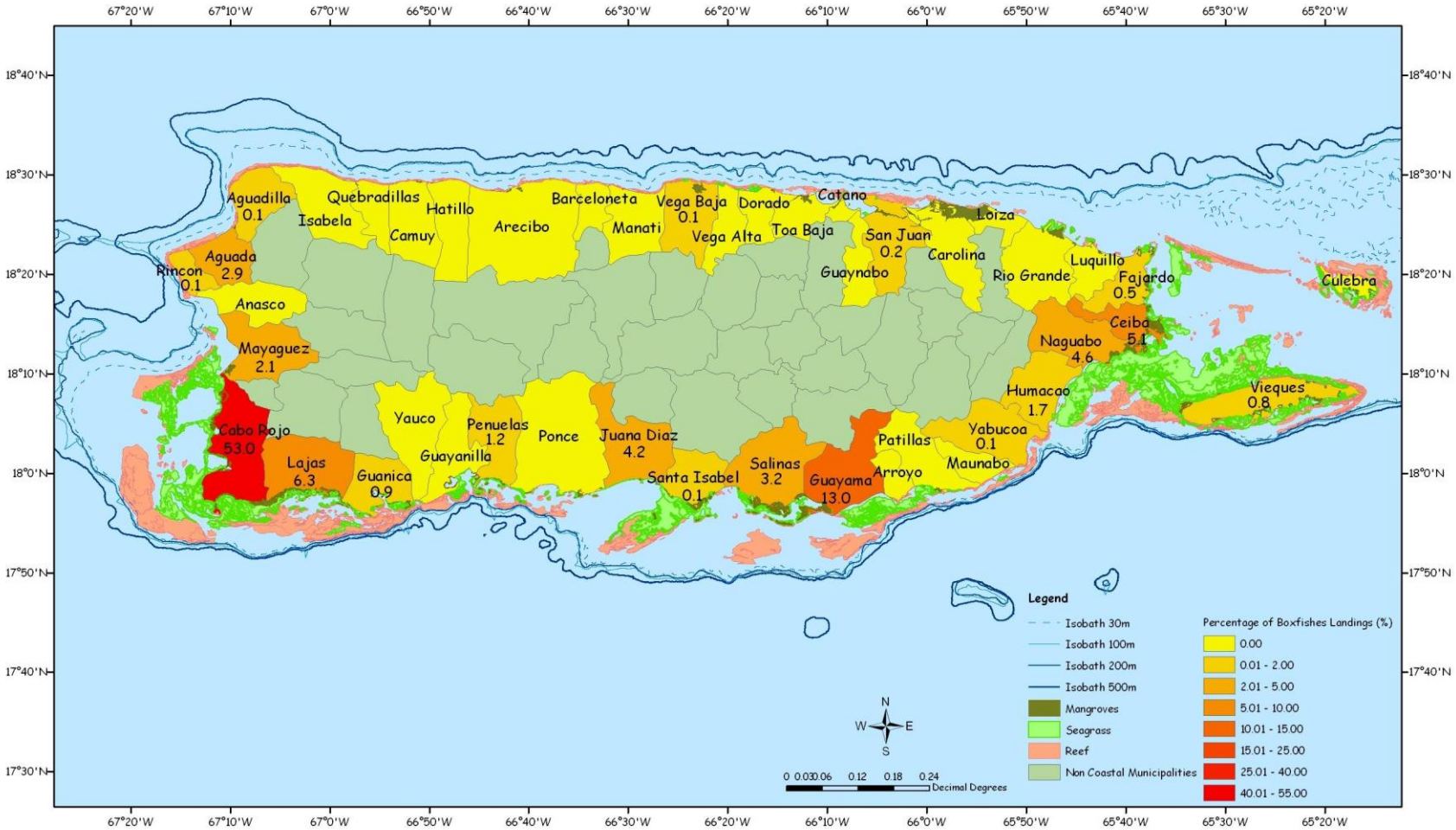

Figure 31: Distribution of boxfishes landings (2008)

Name: White Grunt *(Haemulon plumieri)*

Distribution: The distribution of white grunts is limited to the western Atlantic Ocean, from the Chesapeake Bay to the eastern Gulf of Mexico and Caribbean Sea, and south to Brazil. However, they rarely inhabit waters north of South Carolina. They have been also introduced to Bermuda (CFMC, 2004).

Habitat Description: White grunt is a reef fish that migrates from reefs to seagrass at night to feed. They are commonly found from the shoreline to the outer reef edge in depths of 24m. They are occasionally found offshore over hard bottoms at depths of 35m (CFMC, 2004).

Revenues and Landings:

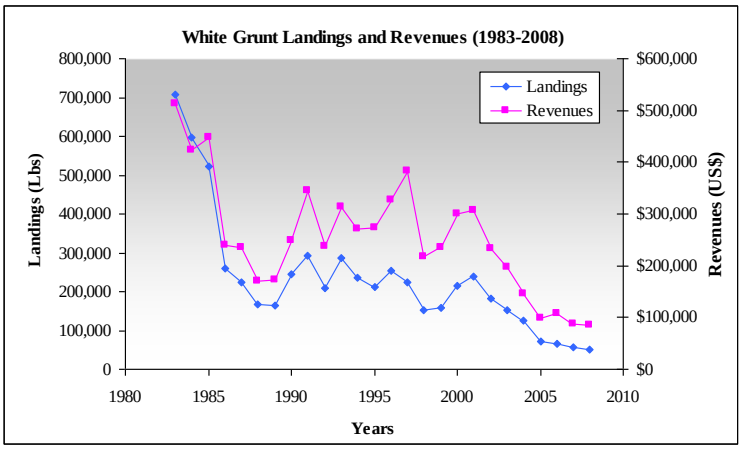

Figure 32: White grunt landings and revenues (1983-2008).

In 2008, white grunt landings were about 50,840 lbs. valued at US$ 84,925 (Figure 32). White grunts are among the most commonly species landed in the east and the south coasts. The majority of the white grunt landings in 2008 came from the south coast (46.4%), followed by the west (28.6%) and the east (22%) coasts. Overall, the municipality of Cabo Rojo had the highest landings for white grunt, followed by Guayama, and Lajas (Figure 33).

Main Gears: Fish pots, gillnets and bottom lines.

Main Regulations: Size limit (8 inches of fork length) in Commonwealth waters.

State: Unknown.

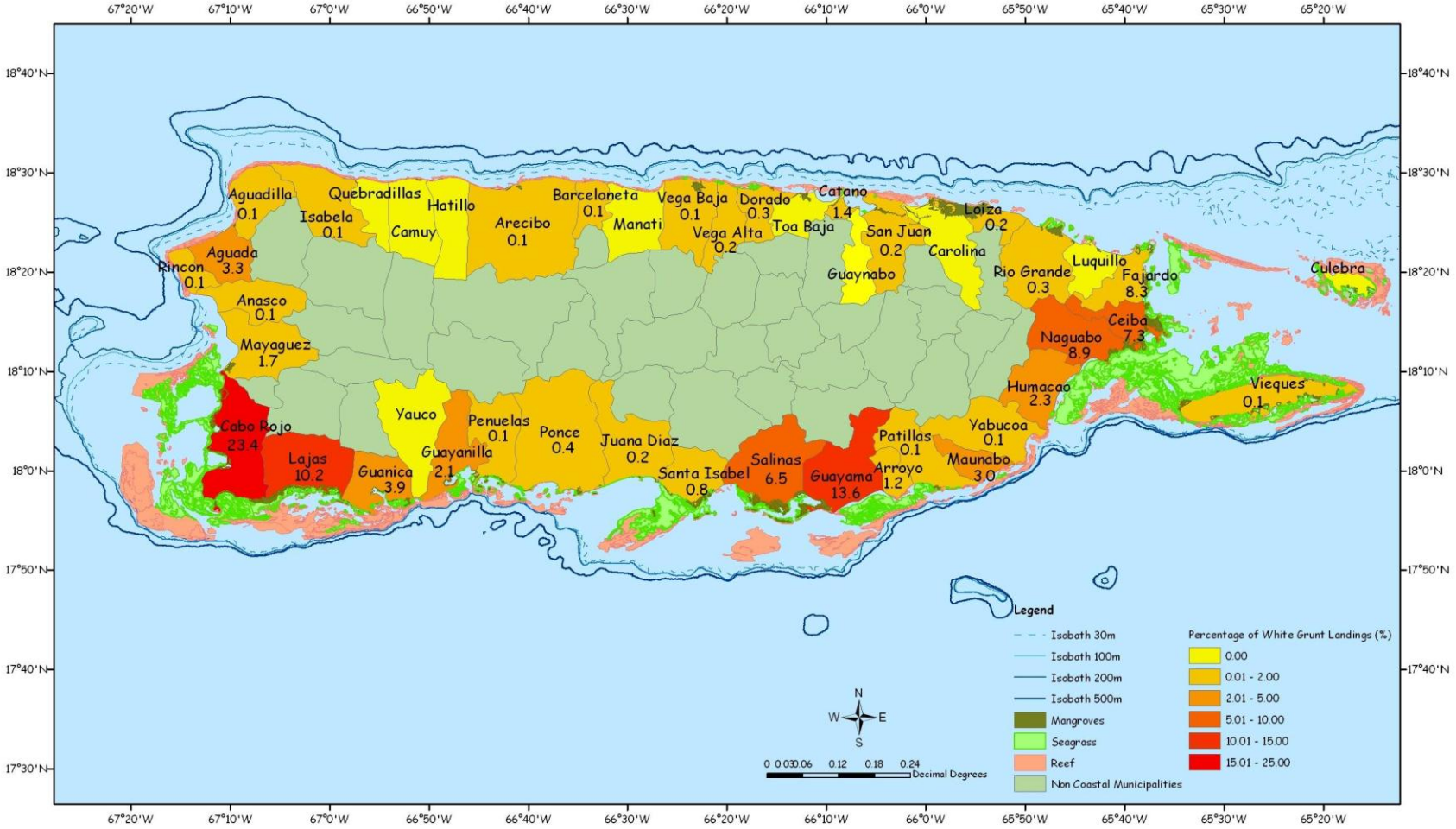

Figure 33: Distribution of White grunt landings (2008)

Name: Hogfish *(Lachnolaimus maximus)*

Distribution: Hogfish occurs in the Western Atlantic, from Nova Scotia (Canada) to northern South America, including the Gulf of Mexico and Caribbean Sea (CFMC, 2004).

Habitat Description: Hogfish is found over coral reef habitats at depths from 3 to 30m. It is often encountered where gorgonians are abundant. The hogfish is widely distributed along the edges of the reef, forming small groups. It prefers locations with hard sand and rock bottoms near shallow patch reefs just inshore and offshore from the main reef structure. Larger individuals occur in the main reef area while smaller fish reside among the patch reefs (CFMC, 2004).

Revenues and Landings:

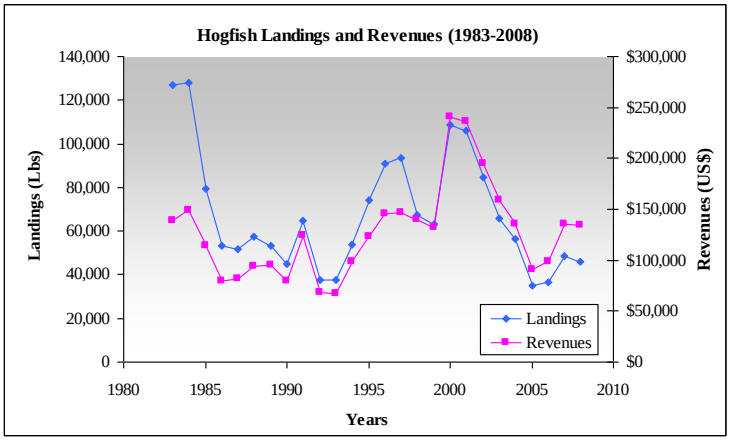

Figure 34: Hogfish landings and revenues (1983-2008).

Hogfish landings in 2008 were about 45,840 lbs. valued at US$ 134,448 (Figure 34). Most of the landings came from the south coast (45.6%), followed by the west (31.9%) and the east (21.8%) coasts. Overall, the municipality of Cabo Rojo had the highest landings, followed by Peñuelas and Guánica (Figure 35).

Main Gears: Scuba and fish pots.

Main Regulations: Not regulated in Puerto Rico.

State: Unknown

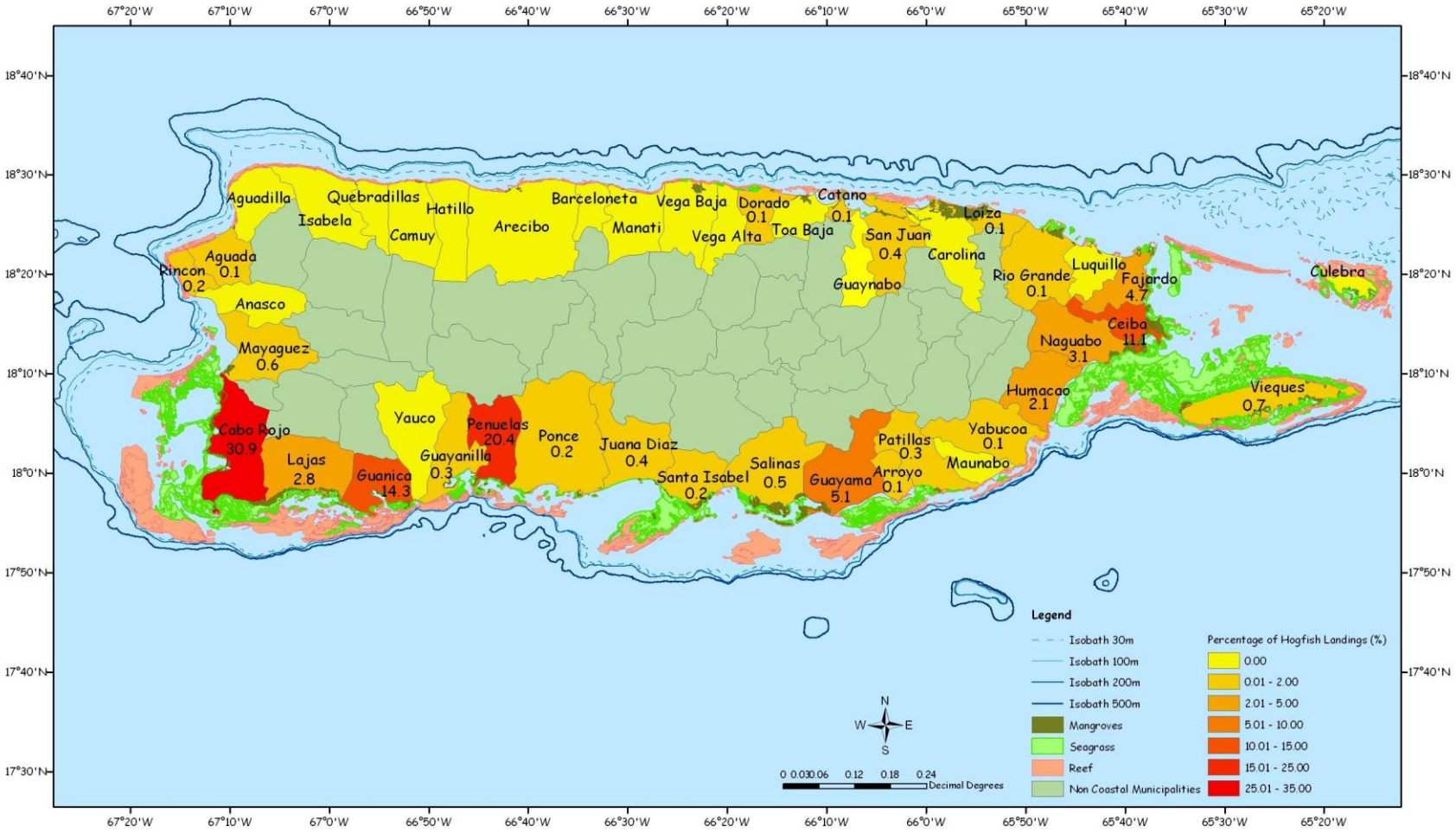

Figure 35: Distribution of hogfish landings (2008)

Name: Ballyhoo *(Hemiramphus brasiliensis)*

Distribution: Ballyhoo can be found in waters off Florida, the Bahamas and the Caribbean (Robins and Ray, 1986).

Habitat Description: Ballyhoo is a coastal pelagic specie, most commonly found around reefs and shoals, but also can be found from deep waters to larger bays (Robins and Ray, 1986).

Revenues and Landings:

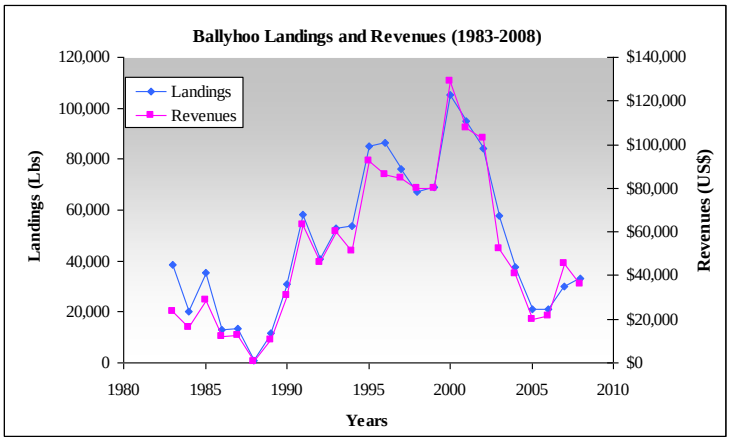

Figure 36: Ballyhoo landings and revenues (1983-2008).

In 2008, ballyhoo's landings and revenues were 33,130 lbs. and US$ 35,975, respectively (Figure 36). The majority of the landings came from the west coast (69.7%), followed by the south (21.6%) and the east (5.2%) coasts. Overall, the municipality of Cabo Rojo had the highest landings, followed by Lajas and Aguadilla (Figure 37).

Main Gears: Bottom lines, troll lines and gillnets.

Main Regulations: Beach seine ban; use of juveniles as bait fish is prohibited.

State: Unknown.

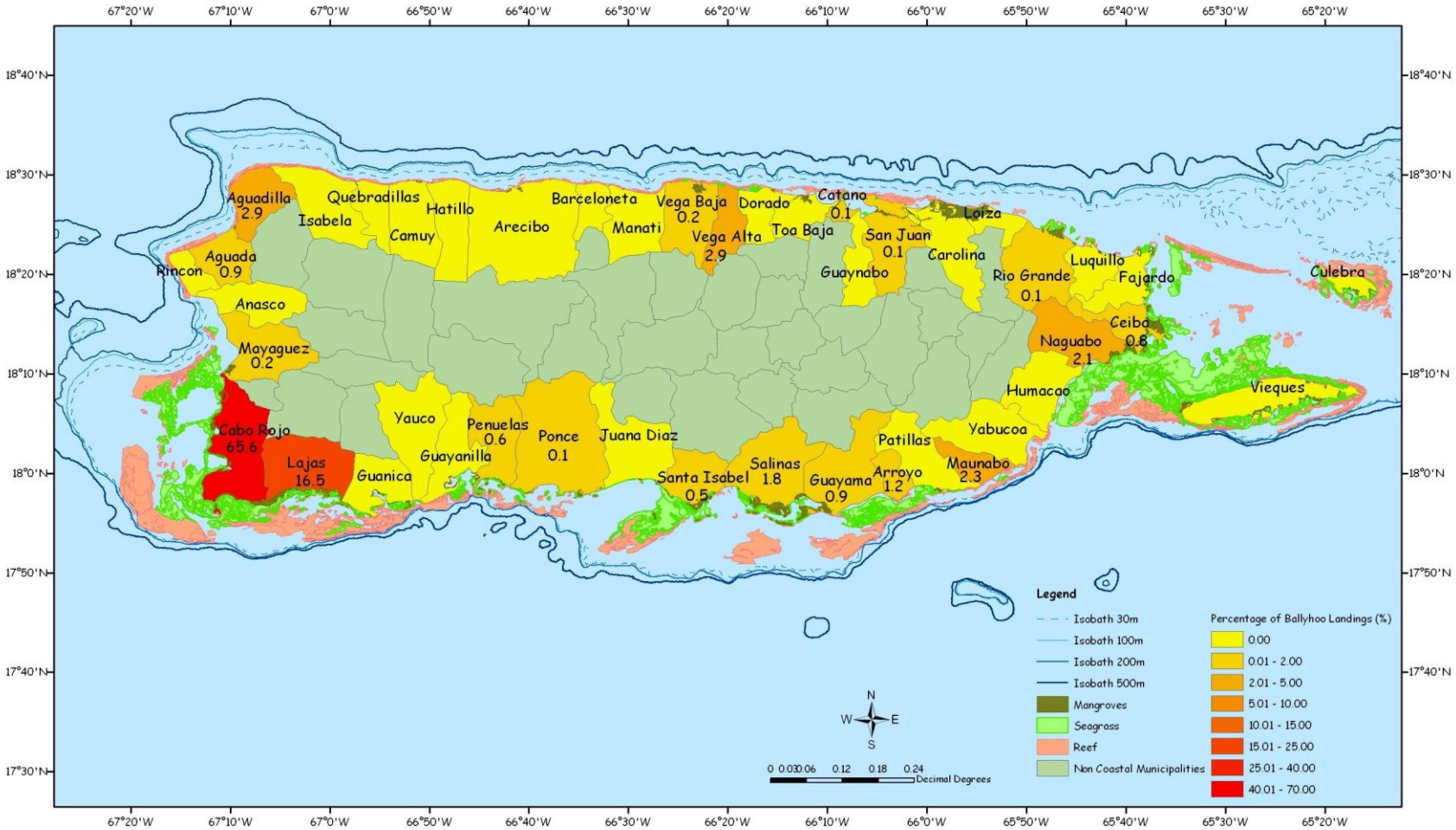

Figure 37: Distribution of Ballyhoo landings (2008)

Name: Porgies (*Sparidae*)

Distribution: Porgies are distributed in tropical and temperate waters of the Atlantic, Indian, and Pacific Oceans (CFMC, 2004).

Habitat Description: Porgies can be found over mud bottoms in mangrove sloughs, on vegetated sand bottoms, sometimes in brackish water and, more frequently on coral bottoms and reefs areas near mangroves. They inhabit coastal waters from 3 to over 200m depth (CFMC, 2004).

Revenues and Landings:

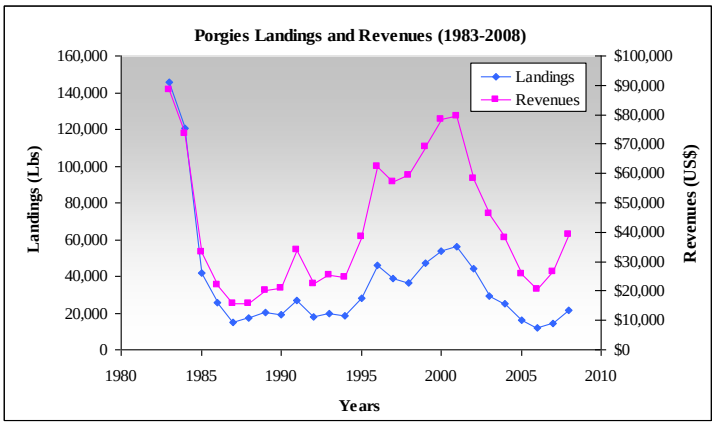

Figure 38: Porgy landings and revenues (1983-2008).

In 2008, the commercial fleet landed 21,751 lbs. of porgies valued at US$ 39,002 (Figure 38). Most of the landings came from the south coast (67.1%), followed by the east (21%) and the west (10.4%) coasts. Overall, the municipality of Lajas accounted for the highest landings of porgies, followed by Salinas and Cabo Rojo (Figure 39).

Main Gears: Gillnets and fish pots.

Main Regulations: Not regulated in Puerto Rico.

State: Unknown.

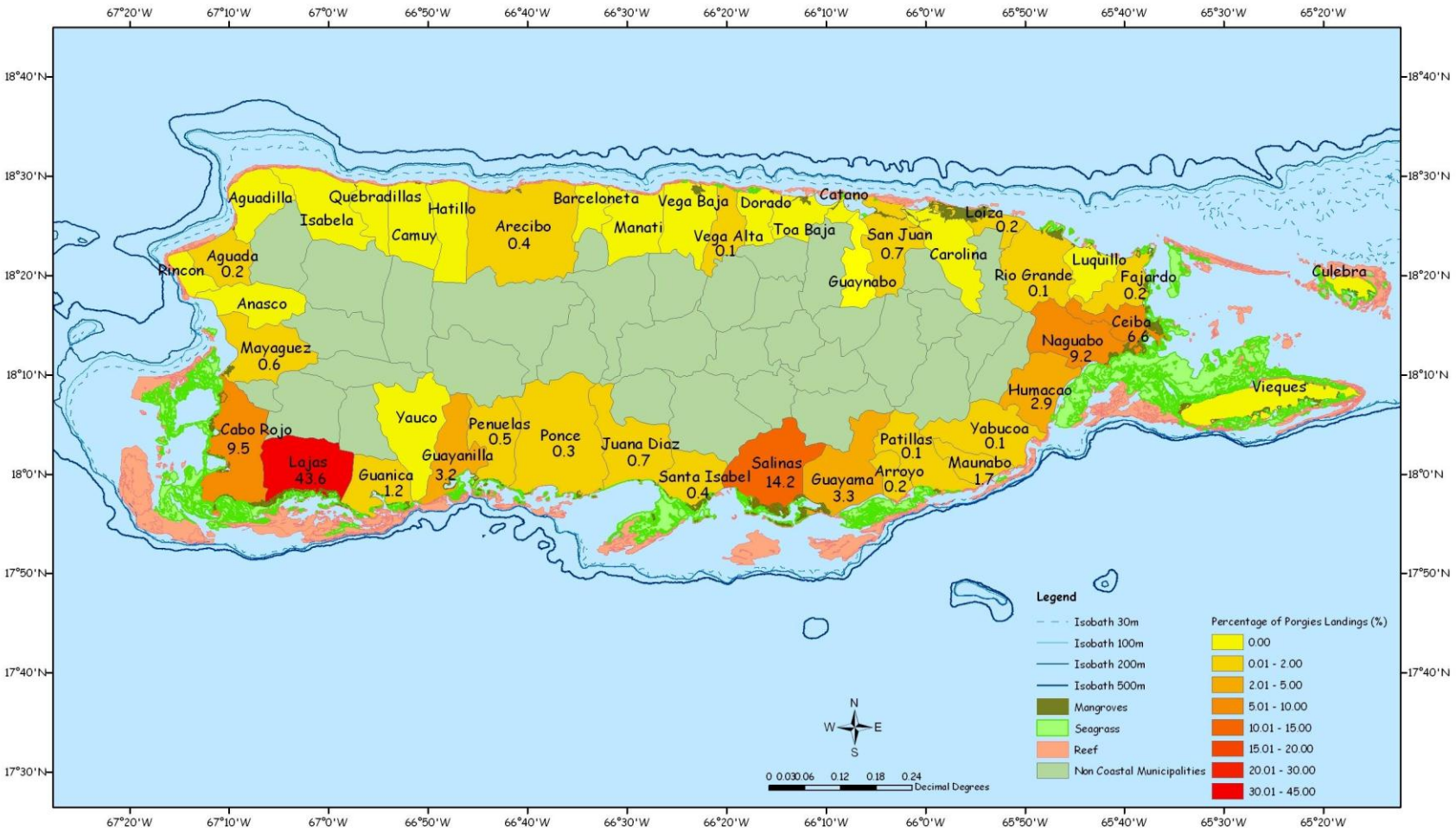

Figure 39: Distribution of Porgy landings (2008)

Name: Dolphinfish (*Coryphaena hippurus*)

Distribution: Dolphinfish is a highly migratory pelagic species distributed throughout the tropical and subtropical waters of the world. It has been reported in the Atlantic, Pacific and Indian Oceans. They are abundant in the Gulf of Mexico, the Florida current, and throughout the Caribbean. In the eastern Atlantic Ocean, dolphinfish are found between the Bay of Biscay (France) and the mouth of the Congo and as far south as the southern tip of Africa. Populations in the eastern Pacific Ocean range from the coast of Oregon and California south to the Galapagos Islands and Peru. They also occur in the northern and central Indian Ocean and throughout the Mediterranean Sea (FLMNH, 2011).

Habitat Description: Dolphinfish are oceanic pelagic fish, generally restricted to waters warmer than 68º F. They are sometimes known to follow large ships and to aggregate under large floating mats of sargassum. They are also found near the coast, in depths from 0 to 85m (FLMNH, 2011).

Revenues and Landings:

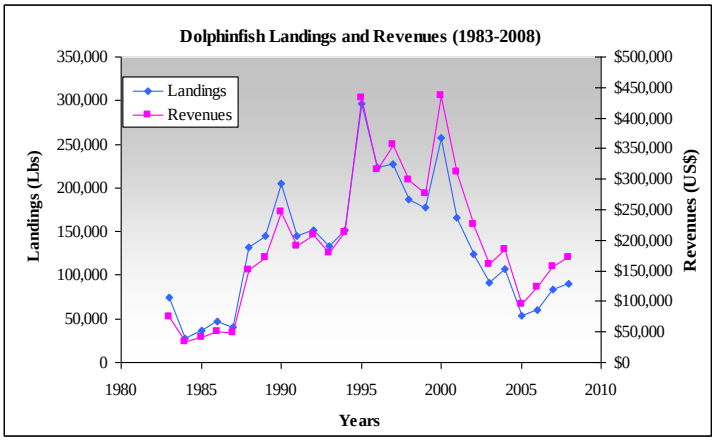

Figure 40: Dolphinfish landings and revenues (1983-2008).

In 2008, dolphinfish landings were about 90,228 lbs. valued at US$ 172,368 (Figure 40). Most of the landings came from the west coast (53.9%), specifically, the municipality of Aguadilla. The south and the north coasts accounted for 32.9% and 11.7% of the landings, respectively (Figure 41).

Main Gears: Troll lines and bottom lines.

Main Regulations: No restrictions for commercial fisheries.

State: Unknown.

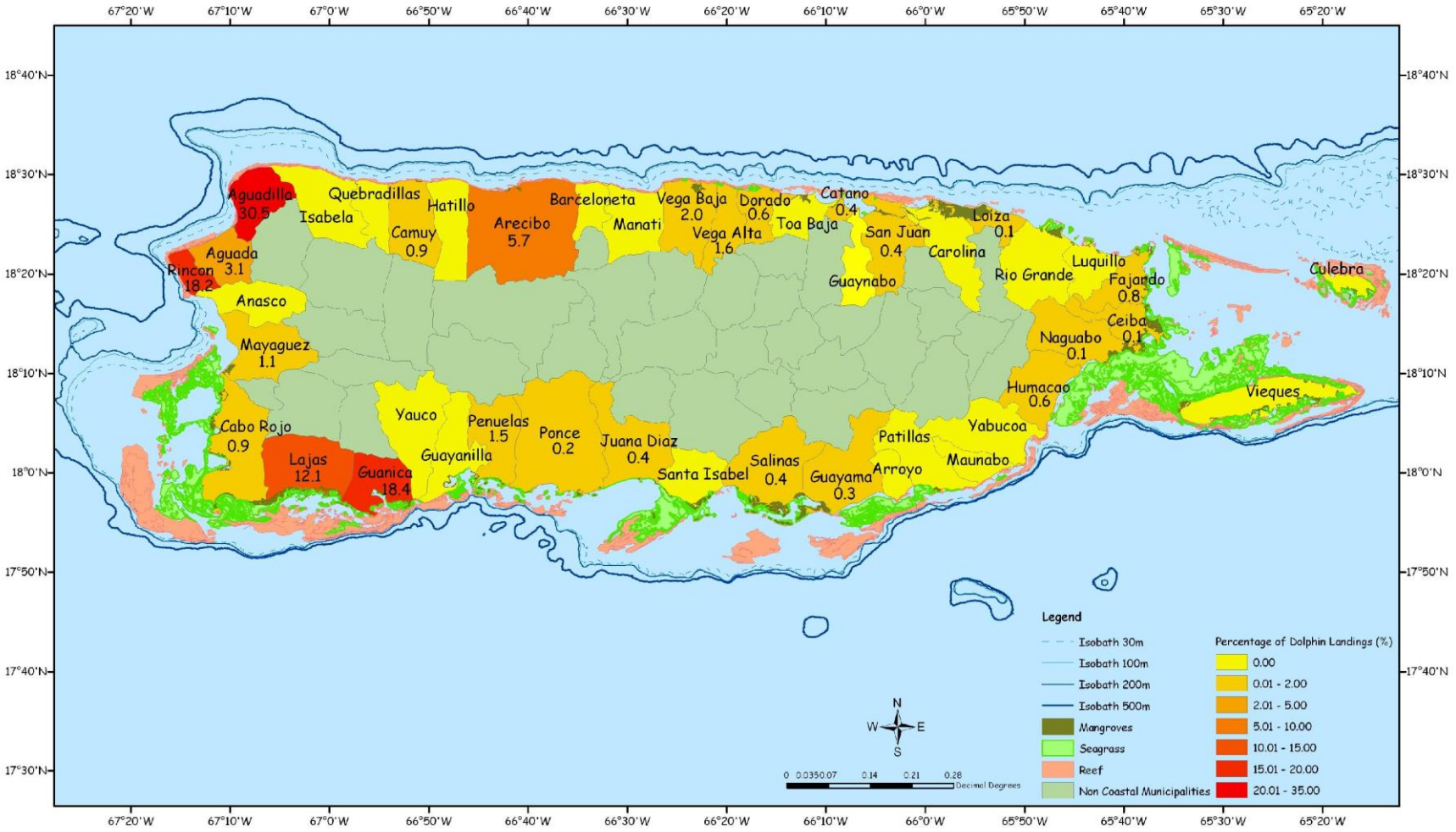

Figure 41: Distribution of Dolphinfish landings (2008)

Name: Wahoo *(Acanthocybium solandri)*

Distribution: Wahoo are found in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. They are highly seasonal in the north Atlantic off the Carolinas (US) and Bermuda, with greater abundance during the warmer summer months. They are distributed in the Gulf of Mexico and off the west coast of Central America. The wahoo is present in the Mediterranean Sea and the Indian Ocean, from the east coast of Africa to the waters off Sri Lanka. Additionally, they are found in the Indo-Pacific and in the central Pacific Ocean (FLMNH, 2011).

Habitat Description: Wahoo inhabit the pelagic area of tropical and subtropical waters. They congregate near drifting objects including *sargassum*. Wahoo moves according to the seasons, traveling into cooler waters during warm summer months (FLMNH, 2011).

Revenues and Landings:

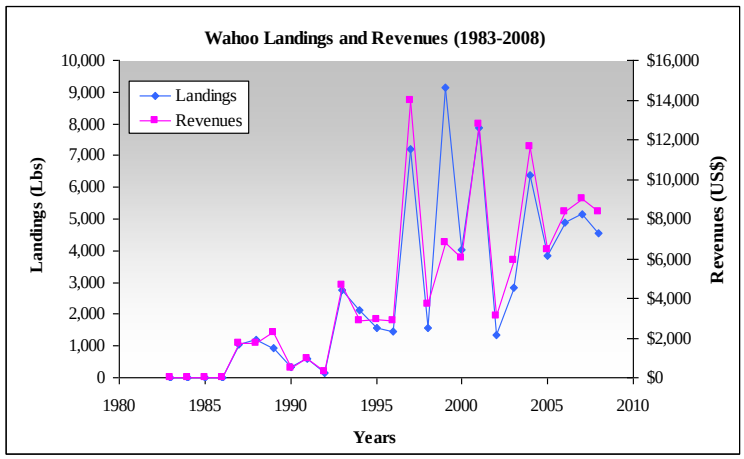

Figure 42: Wahoo landings and revenues (1983-2008).

In 2008, the majority of wahoo landings came from the west coast (66.2%) followed by the south (32.3%) and the north (1.5%) coasts. In the same year, wahoo's landings and revenues were 4,561 lbs. and US$ 8,332 (Figure 42). The municipalities of Guánica, Aguadilla and Aguada accounted for the highest landings (Figure 43).

Main Gears: Bottom lines and troll lines.

Main Regulations: No restrictions for Puerto Rico commercial fisheries.

State: Unknown.

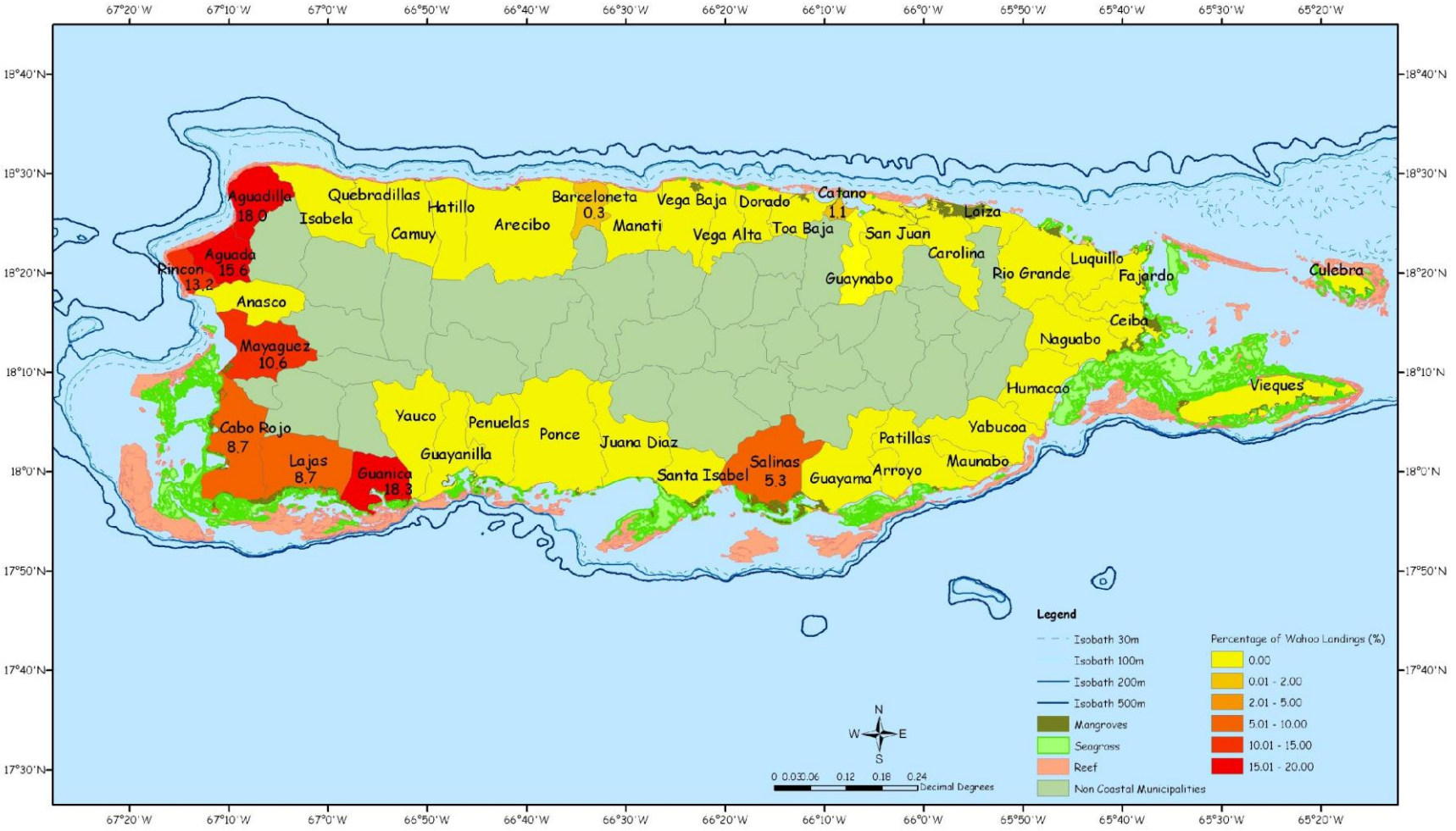

Figure 43: Distribution of Wahoo landings (2008)

Name: King Mackerel (*Scomberomorus cavalla*)

Distribution: King mackerels are found along the western coast of the Atlantic Ocean from Massachusetts (US) to Rio de Janeiro (Brazil) and the Gulf of Mexico. The Atlantic Ocean and Gulf of Mexico stocks mix in south Florida waters (FLMNH, 2011).

Habitat Description: King mackerel inhabit the open waters near the coast. They are found at depths of 35 to 180m (FLMNH, 2011).

Revenues and Landings:

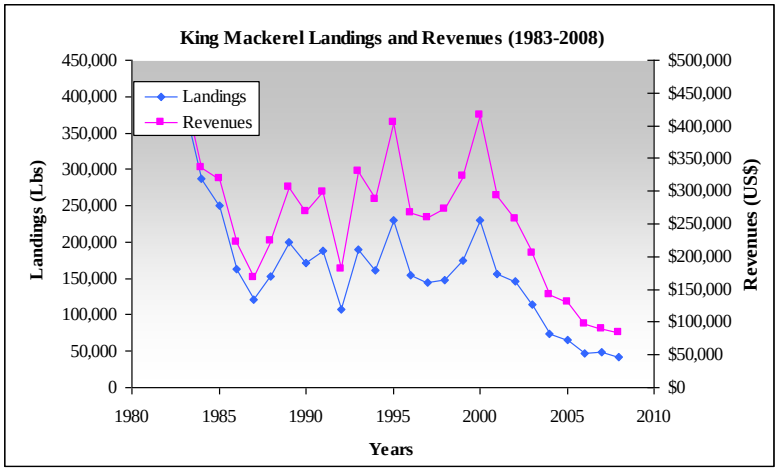

Figure 44: King mackerel landings and revenues (1983-2008).

In 2008, most of king mackerel landings came from the west coast (45.9%) followed by the south (22%) and north (20.3%) coasts. In the same year, the landings and revenues for king mackerel totaled 42,419 lbs. and US$ 83,410, respectively (Figure 44). The municipalities with the highest landings were Mayaguez, Arecibo and Cabo Rojo (Figure 45).

Main Gears: Bottom lines and troll lines.

Main Regulations: Size limit (20 inches of fork length); maintained with head and fins intact; mesh size for gill net (4.75”); seasonal closure.

State: Unknown.

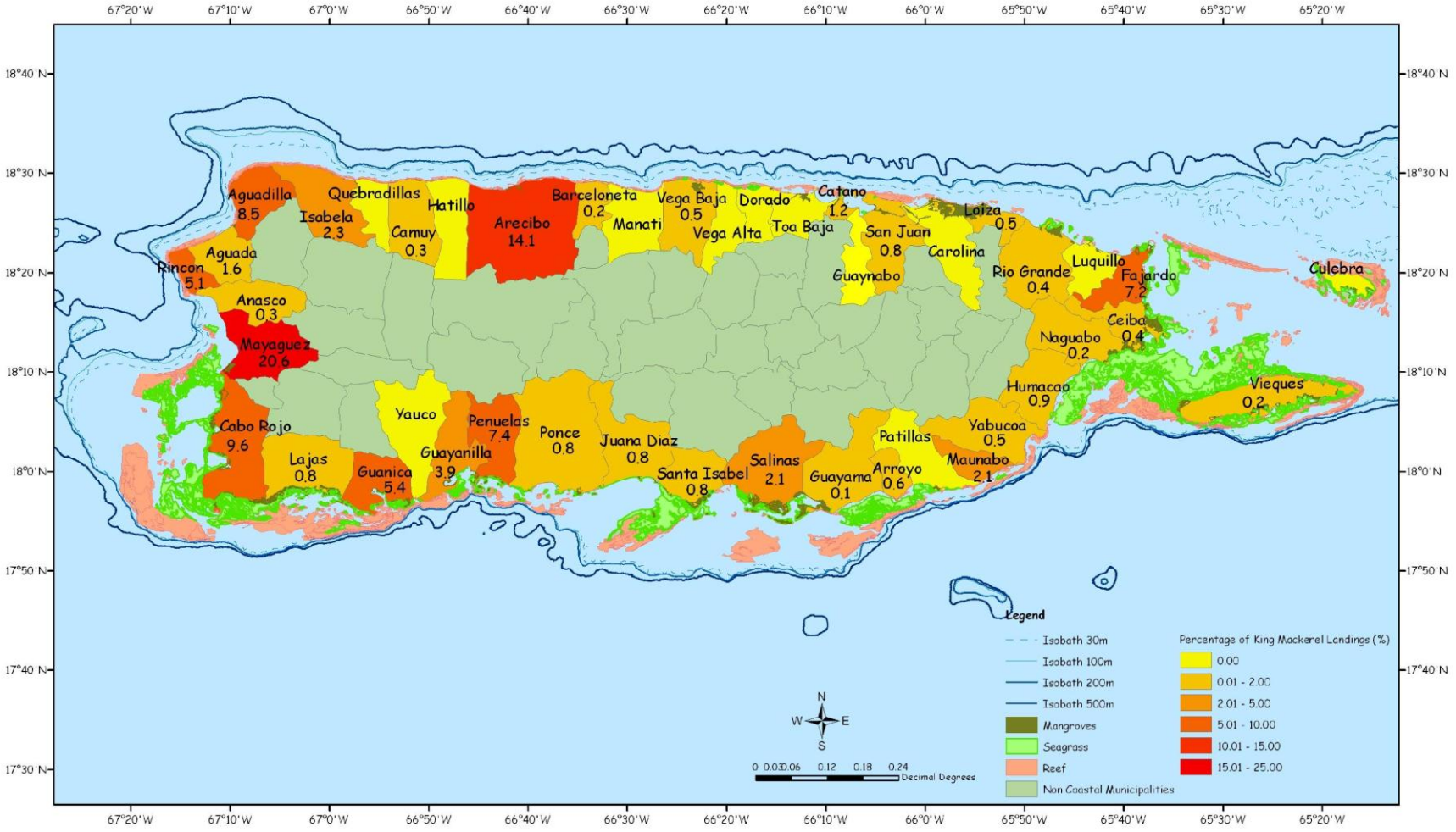

Figure 45: Distribution of King mackerel landings (2008)

Name: Cero Mackerel (*Scomberomorus regalis*)

Distribution: Cero mackerels are found in the western Atlantic Ocean from Massachusetts (US) south to Brazil. Cero are especially common in the Caribbean, Bahamas, and Florida (FLMNH, 2011).

Habitat Description: Cero mackerel are found over coral reefs, wrecks, and along ledges. They can be found at depths ranging from 1 to 20m and are usually seen in mid-water and near the water's surface (FLMNH, 2011).

Revenues and Landings:

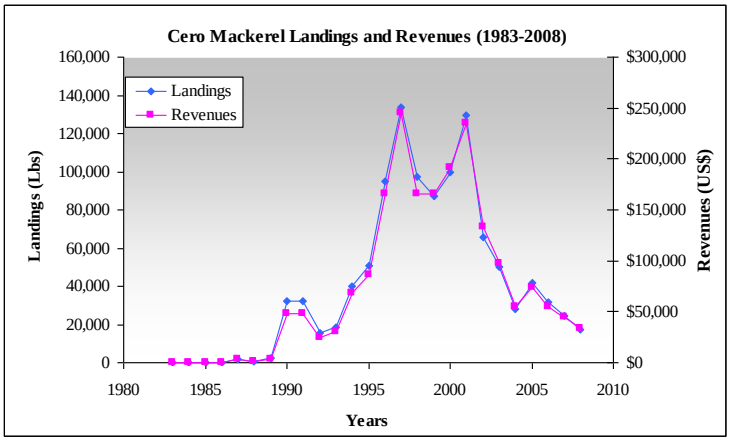

Figure 46: Cero mackerel Landings and Revenues (1983-2008).

In 2008, the highest landings for cero mackerel came from the south coast (29.7%) followed by the west (28.8%) and north (26.4%) coasts. In the same year, cero mackerel's landings and revenues totaled 17,324 lbs. and US$ 33,471, respectively (Figure 46). The municipalities with the highest landings were Ponce, Cabo Rojo and Arecibo (Figure 47).

Main Gears: Bottom lines, troll lines and gillnets.

Main Regulations: Size limit (16 inches of fork length).

State: Unknown

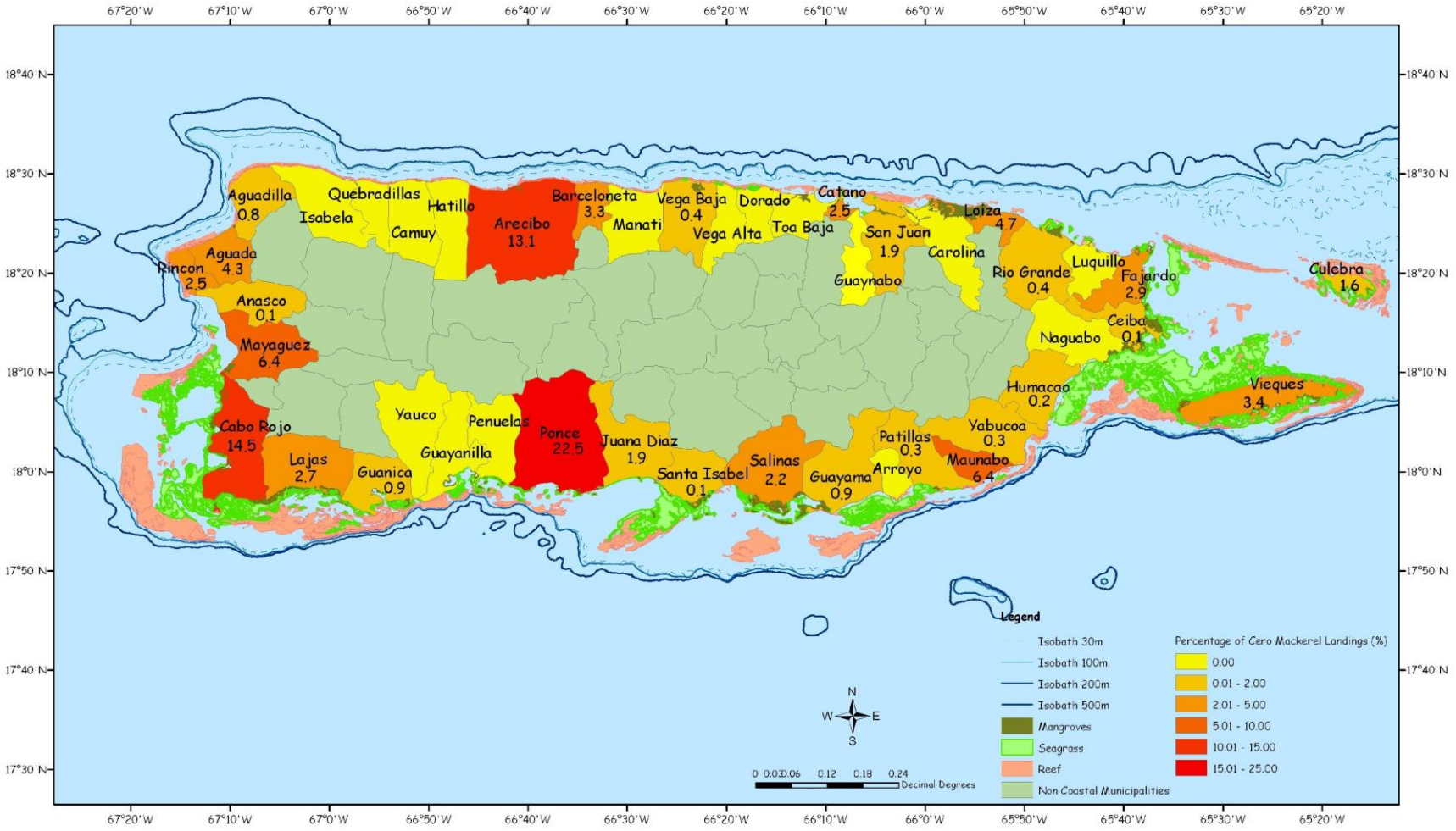

Figure 47: Distribution of Cero mackerel landings (2008)

Name: Skipjack Tuna (*Katsuwonus pelamis*)

Distribution: Skipjack tuna are found in tropical, subtropical, and temperate zones of the Pacific, Atlantic, and Indian Oceans (NMFS, 2011b).

Habitat Description: Skipjack tuna is a highly migratory pelagic species that primarily lives in open ocean, although they may spend part of their life cycle in near shore waters. They can be found in surface waters and depths up to 260m. during the day, but they can also stay near the surface at night. Groups of skipjack tuna are likely associated to convergence zones, boundaries between cold and warm water masses (e.g. the polar front), upwelling, and other hydrographical discontinuities (NMFS, 2011b).

Revenues and Landings:

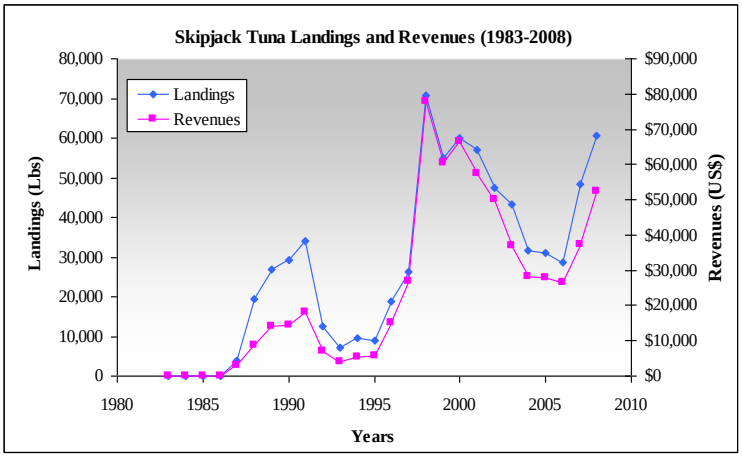

Figure 48: Skipjack tuna landings and revenues (1983-2008).

In 2008, Skipjack tuna was the 5th largest landed species in the west coast. Most of the landings came from the west coast (98.2%), primarily from Aguadilla, followed by Rincón (Figure 49). In 2008, skipjack tuna landings and revenues totaled 60,712 lbs. and US$ 52,311, respectively (Figure 48).

Main Gears: Troll lines and bottom lines.

Main Regulations: No size limit or quota.

State: Unknown.

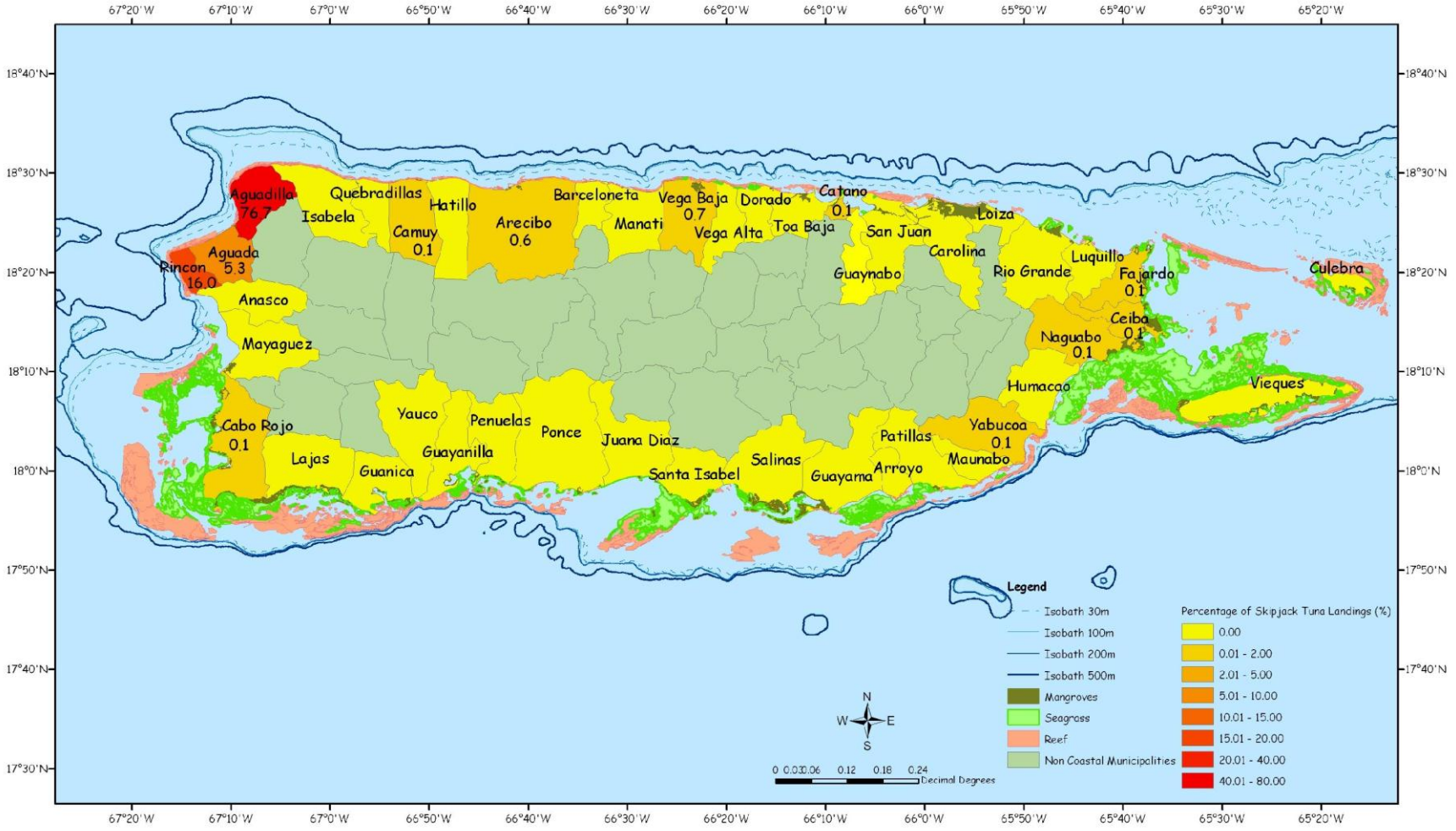

Figure 49: Distribution of Skipjack tuna landings (2008)

Name: Blackfin Tuna *(Thunnus atlanticus)*

Distribution: Blackfin tuna are found in the western Atlantic Ocean from Massachusetts (US) south to Rio de Janeiro (Brazil), including the Gulf of Mexico and Caribbean Sea. They are generally abundant in tropical regions (FLMNH, 2011).

Habitat Description: The blackfin tuna is a highly migratory species, moving into more temperate waters during the summer months, remaining above 70°F (21°C). It inhabits oceanic waters in close proximity to the coastline and prefers clean and warm waters, typically seaward of the continental shelf (FLMNH, 2011).

Revenues and Landings:

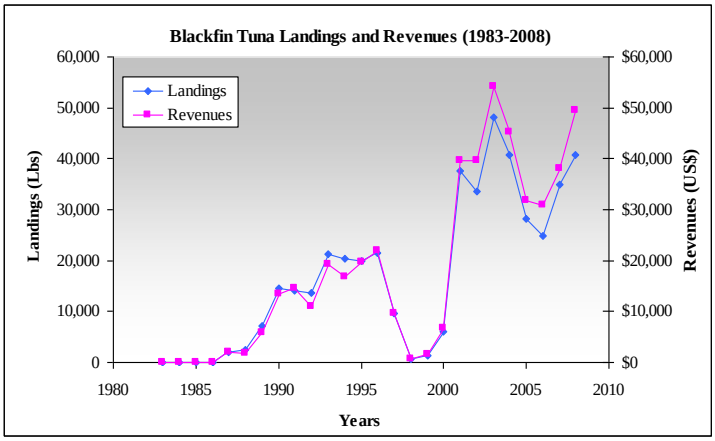

Figure 50: Blackfin tuna landings and revenues (1983-2008).

In 2008, blackfin tuna's landings and revenues totaled 40,827 lbs. and US$ 49,366 (Figure 50), respectively. The majority of blackfin tuna landings were derived from the west coast (96.5%), with significant fewer landings from the east (1.5%) and south (1.4%) coasts. The municipalities with the highest landings were Aguadilla, Rincón and Aguada (Figure 51).

Main Gears: Bottom lines and troll lines.

Main Regulations: No limited quotas or size.

State: Unknown.

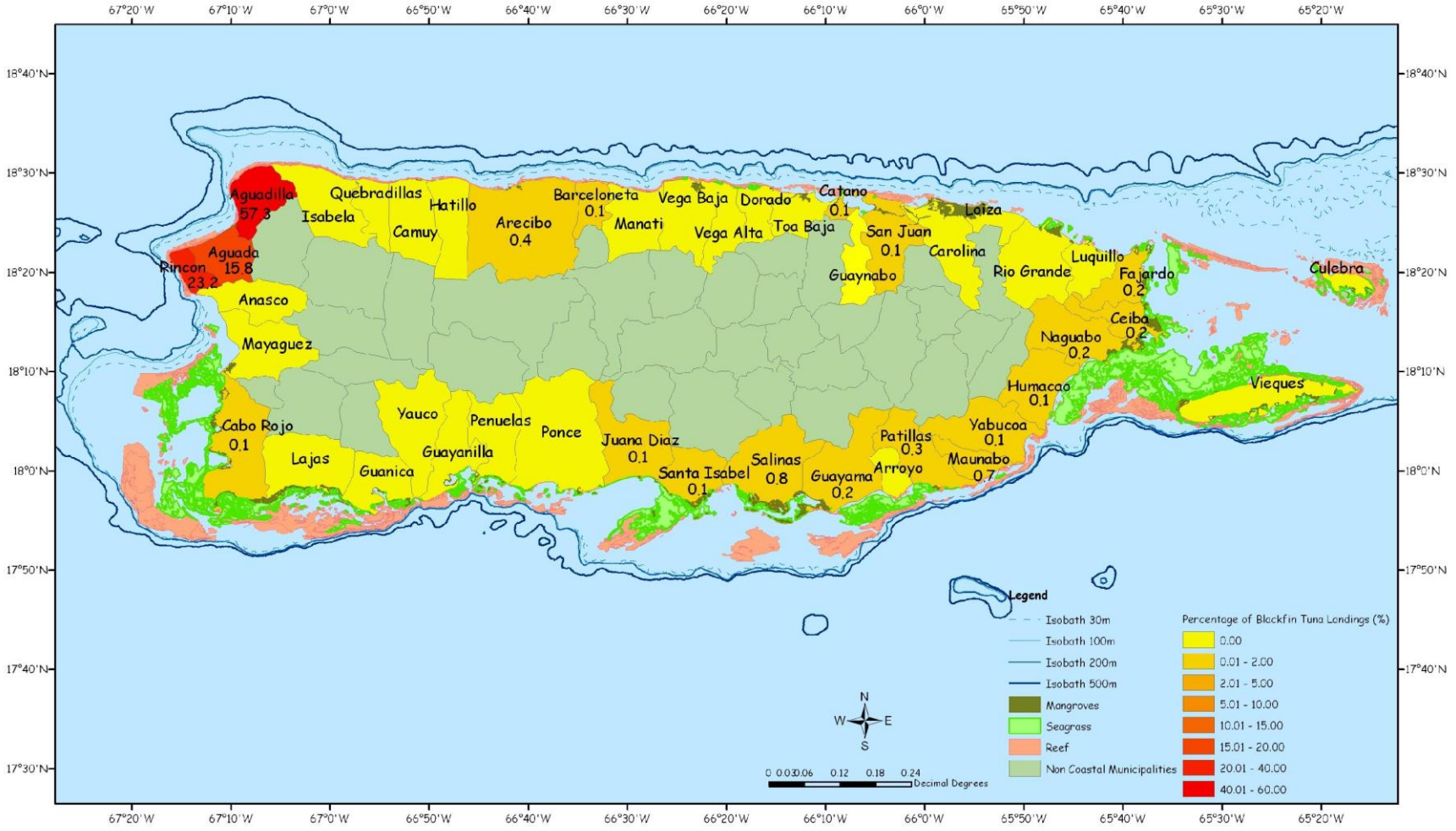

Figure 51: Distribution of Blackfin tuna landings (2008)

Name: Yellowfin Tuna *(Thunnus albacares)*

Distribution: Yellowfin tunas are found worldwide in tropical and subtropical waters, from latitudes of approximately 40°N to 35°S. They are absent in the Mediterranean Sea (FLMNH, 2011).

Habitat Description: Yellowfin tuna is a pelagic, oceanic fish, living above and below the thermocline, at temperatures of 65 to 88°F (18-31°C). It is generally found in the upper 100m of the water column. Juveniles form mixed schools with skipjack and juvenile bigeye tuna and are mainly limited to surface waters. Larger fish are found in surface and sub-surface waters. (FLMNH, 2011).

Revenues and Landings:

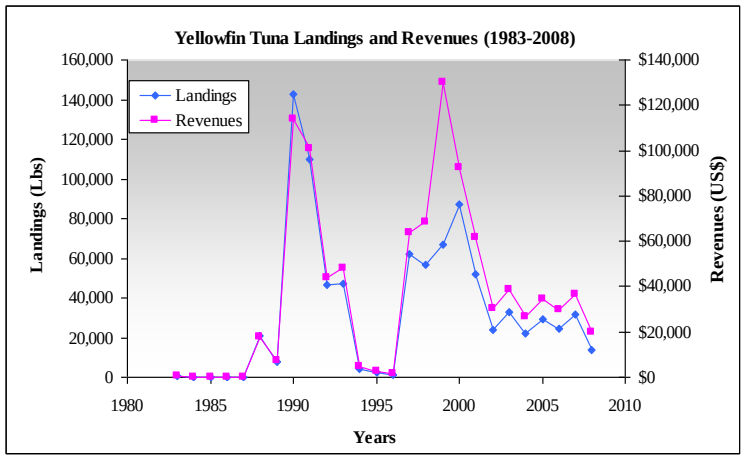

Figure 52: Yellowfin tuna landings and revenues (1983-2008).

In 2008, yellowfin tuna landings and revenues totaled 13,537 lbs. and US$ 19,752 (Figure 52), respectively. Most of the yellowfin tuna landings came from the west coast (96.2%), with significantly fewer landings from the east (2.5%) and north (0.9%) coasts. The municipalities with the highest landings were Aguadilla, Aguada and Rincón (Figure 53).

Main Gears: Bottom lines and troll lines.

Main Regulations: Size limit (27 inches of total length) and up to a maximum of 3 per trip.

State: Unknown.

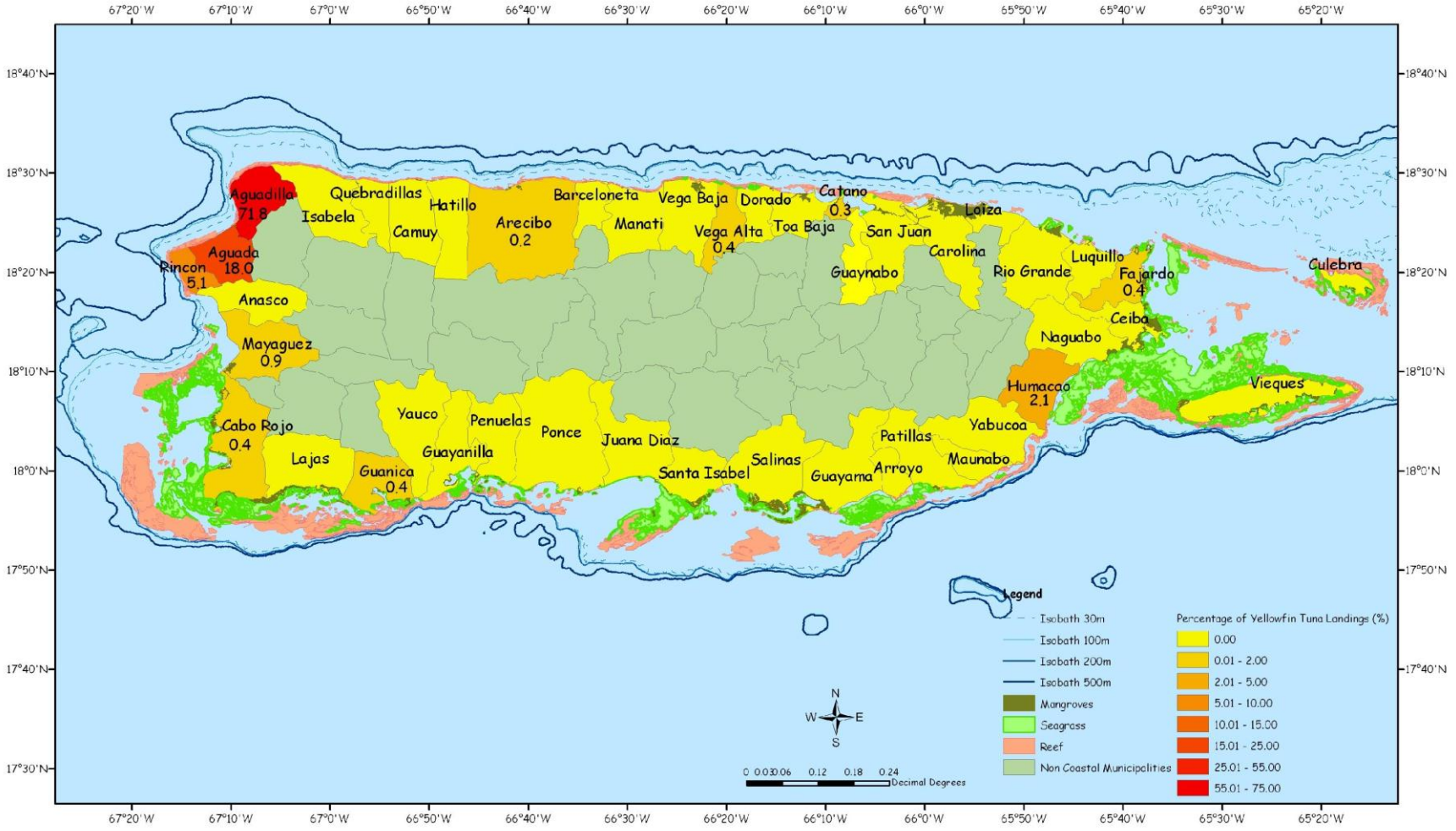

Figure 53: Distribution of Yellowfin tuna landings (2008)

Name: Albacore Tuna (*Thunnus alalunga*)

Distribution: Albacore tuna are found in tropical, subtropical, and temperate zones of the Pacific, Atlantic, and Indian Oceans (NMFS, 2011b).

Habitat Description: Juveniles are often found near oceanic fronts or temperature discontinuities (Collette and Nauen, 1983). Adults inhabit water of depths up to 380m and can also be found in deeper waters searching for prey (NMFS, 2011b).

Revenues and Landings:

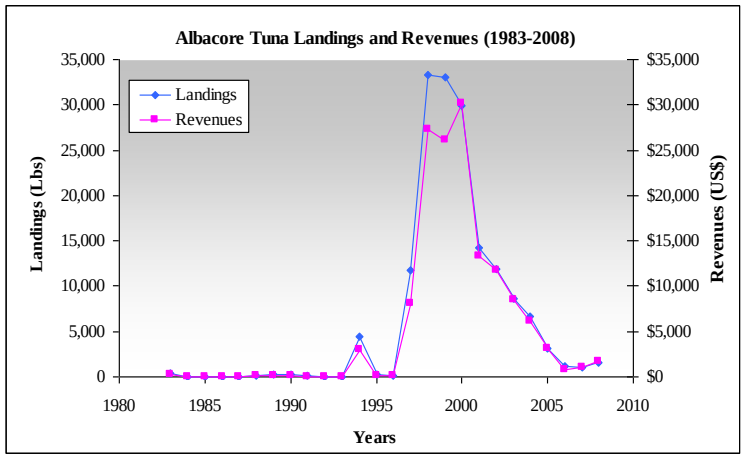

Figure 54: Albacore tuna landings and revenues (1983-2008).

In 2008, albacore tuna's landings and revenues totaled 1,533 lbs. and US$ 1,748 (Figure 54), respectively. The majority of albacore tuna landings came from the west coast (98.8%) followed by the north (1.2%) coast with significantly fewer landings. The municipalities of Rincón, followed by Cabo Rojo and Arecibo received most of the landings (Figure 55).

Main Gears: Troll lines and bottom lines.

Main Regulations: No size limit or quota.

State: Unknown.

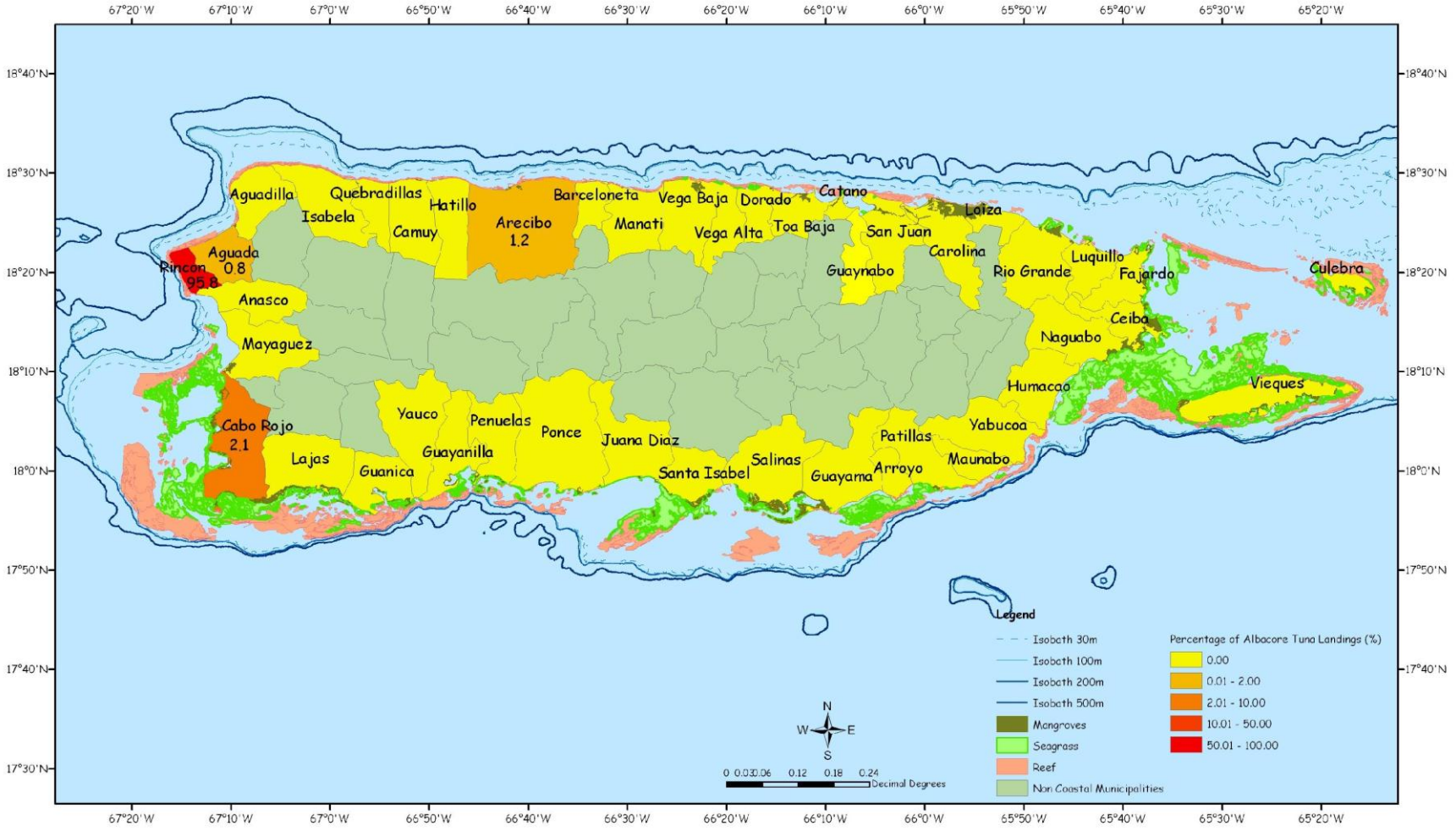

Figure 55: Distribution of Albacore tuna landings (2008)

Name: Requiem Shark *(Carcharhinus spp.)*

Distribution: Requiem sharks can be found in tropical coastal waters worldwide (FAO, 2011).

Habitat Description: Requiem sharks are migratory, live-bearing sharks of warm seas (sometimes of brackish or fresh water). They are adapted for a wide range of aquatic habitats, including shallow coastal habitats, deep-water ocean floor habitats, and the open ocean (FAO, 2011).

Revenues and Landings:

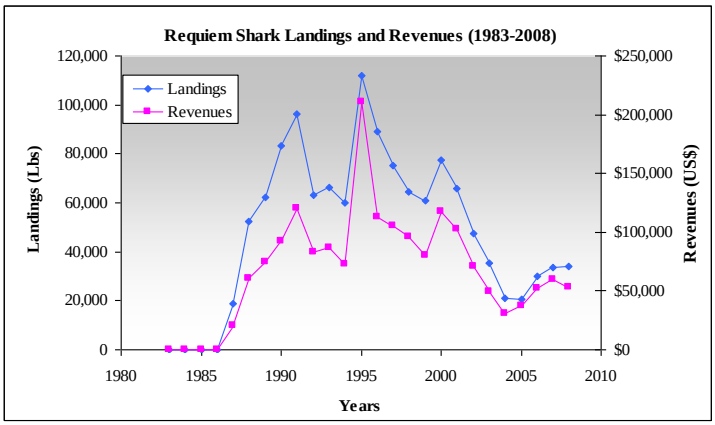

Figure 56: Requiem shark landings and revenues (1983-2008).

In 2008, commercial fleet landed 33,813 lbs. of requiem sharks valued at US$ 52,935 (Figure 56). The majority of the requiem shark catches in 2008 were landed in the west coast (70.4%), followed by the east (15.6%) and the south (9%) coasts. The municipality of Rincón accounted for the highest landings, followed by Cabo Rojo and Naguabo (Figure 57).

Main Gears: Bottom lines and long lines.

Main Regulations: None (for the species caught).

State: Unknown.

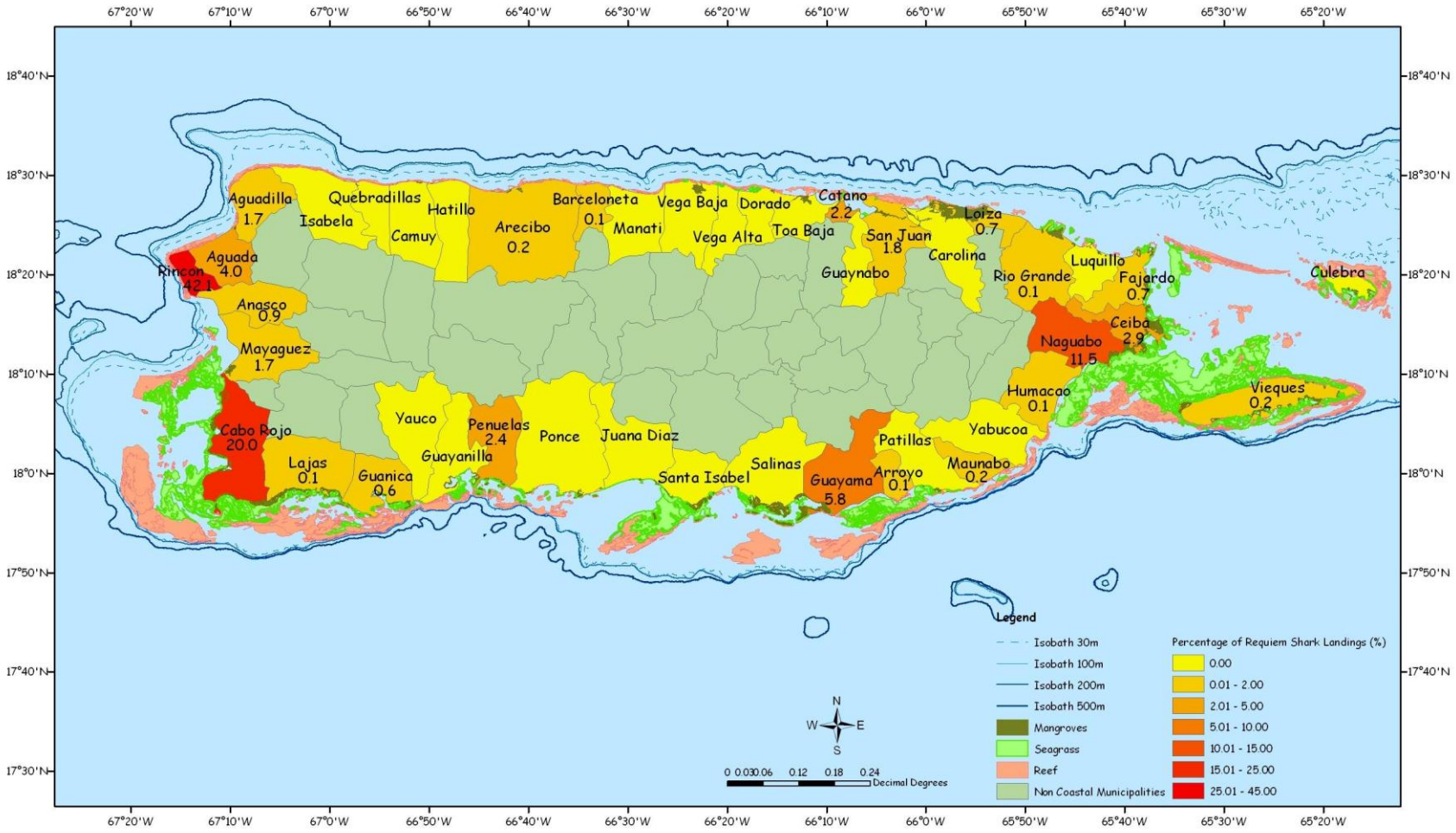

Figure 57: Distribution of Requiem shark landings (2008)

Conclusion

This report provides an overview of the main commercial fisheries in the Commonwealth of Puerto Rico. This study underscores that there is great level of uncertainty about the condition of many finfish and shellfish stocks. Only a handful of commercially valuable species have undergone formal biological assessments. Because of incomplete scientific information and, at times, limited confidence on the available information, managers have been reluctant to make major management decisions since they disagree on the level of acceptable risk (NMFS, 2009). Conservative or risk-averse management actions tend to rebuild stocks faster but usually generate greater short-term impacts on the fishing communities, whereas riskier approaches usually minimize short-term economic dislocations but take longer (or fail) to recuperate over-exploited stocks (NMFS, 2009). This reluctance to undertake risk-averse actions is more evident in the U.S. Caribbean, where most fishermen have moderate levels of formal education and high levels of fishing dependence, which limit their employability outside the fisheries sector.

Since the reauthorization of the MSA, NMFS has renewed its efforts to end overfishing. The MSA introduced new provisions like the establishment of annual catch limits and accountability measures, which are expected to invigorate the management process by promoting more conservative management approaches and increasing accountability. Although, it is premature to speculate on the ultimate

success of these new mandates; optimistically, they will set the foundation for healthier fisheries and economically viable fishing communities.

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