Fishery-Dependent Monitoring in the Florida Keys: A Summary of Twelve Years of Data

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ABSTRACT

In 1985, the State of Florida and the National Marine Fisheries Service began a cooperative program to collect data from Florida's commercial marine fisheries. In this program catch-and-effort data are obtained from the commercial-fishery landings recorded at wholesale fish houses (Florida Marine Fisheries Information System Trip Ticket System, TTS) and data about specific catch are obtained from interviews of commercial fishers at dockside (Trip Interview Program, TIP). These two long-term data bases provide fishery managers with the critical information needed to evaluate fisheries and to assess the effectiveness of fisheries regulations. Landings data are collected from the TTS and include species composition, market category, catch weight, and fishing location. In TIP other information such as fishing gear used and fishing depth and location is collected. These catches are also sampled to collect biostatistical data including species, sample weight, length-frequencies, and sex. In the Florida Keys, the TTS has collected data from more than 750,000 fishing trips, and the TIP has collected interview data from more than 3000 individual catches as well as biostatistical data from more than 100 species. The waters of the Florida Keys are essentially an extension of the Caribbean marine ecosystem, and a summary of data collected in the TTP and TIP monitoring programs established in the Keys illustrates the usefulness of such fisheries-dependent data-collection programs to fishery scientists throughout the Caribbean Basin.

KEY WORDS: Caribbean basin, fishery management, biostastical data.

INTRODUCTION

In 1985, the U. S. Department of Commerce National Marine Fisheries Service (NMFS) and the Florida Fish and Wildlife Conservation Commission's (formerly Florida Department of Environmental Protection) Florida Marine Research Institute (FMRI) entered into a long-term agreement to collect data from Florida's commercial marine fisheries and to provide that information to federal and state fishery managers. This agreement, known as the Federal/State Cooperative Statistics Agreement, brought about the creation of two programs:

the Trip Ticket System (TTS) and the Trip Interview Program (TIP). Florida Administrative Code Chapter 62R 5 requires that at the point of first wholesale transaction specific landings and effort data from all sales of saltwater products landed in the state be recorded and be reported to the state on a monthly basis. These data are then entered into the Marine Fisheries Information System Trip Ticket System (TTS) data base and made available to fishery scientists and managers. In the Trip Interview Program (TIP), FMRI's Port Agents conduct dockside interviews of fishers landing commercial catches at wholesale fish houses and collect bioprofile and catch-and-effort data. Port Agents are stationed at selected ports throughout Florida to visit commercial fish houses in their assigned areas to interview commercial fishers and collect data about fishing effort, species caught, and weight-and length-frequencies of fish caught in specific catches. Data from each Port Agent are entered into the TIP and sent to FMRI and NMFS.

This paper presents data from the TTS and TIP to illustrate the types of information available to fishery scientists and the usefulness of such data collection programs for fishery research and management. Information collected under the Cooperative Statistics Agreement includes landings data from more than 750,000 fishing trips during which 251 million pounds of 97 species were landed in the Florida Keys since 1985 (Table 1). Biological and catch-and-effort data were collected from 3168 fishing trips and 109 species (Table 2). Because fish houses combine some species into market categories that include several species (Table 1) and Port Agents identify catches sampled to the species level (Table 2), Table 2 lists more species than Table 1 does.

I selected dolphinfish, mutton snapper, and spiny lobster to illustrate the types of long term data that are readily available. The dolphinfish fishery is minimally regulated; the mutton snapper fishery has experienced several regulatory changes over the past several years, and the spiny lobster fishery is strongly regulated and is currently operating under an effort-reduction plan.

DISCUSSION

Regulations for commercially landed dolphinfish are minimal: currently the only regulation is a minimum size limit of 508 mm fork length. Landings and number of fishing trips for dolphinfish varied but generally increased over time (Figure 1). Trip interview data showed that the sizes of dolphinfish landed were concentrated in the lower portion of the size distribution in all years and that the mean size varied by year (Figure 2). The generally increasing trend in dolphinfish landings and fishing trips may be due the fact that fishers entering this fishery because of their inability to qualify for state and federal commercial fishing licences. The cause of the sharp decline in dolphinfish landings and trips between 1991 and 1993 is unknown. Because most dolphinfish landed in the

Keys are small and landings and fishing trips are increasing, additional research- and possibly additional management-of dolphinfish is warranted.

Current regulations for mutton snapper include requirements for state and federal permits to land commercial quantities enacted in 1990, a closed season in May and June during the spawning season and a specific area (Riley's Hump) west of Key West, where a spawning aggregation occurs, closed to all fishing during the same time period enacted in 1992, and a minimum size limit of 406 mm total length enacted in 1994 (prior size limit 305 mm).

Table 1. Finfish and invertebrate species landed commercially in Monroe County (Florida Keys) 1986-1997.

Epinephelus adscensionis
Epinephelus drummondhayi
Epinephelus flavolimbatus
Epinephelus guttatus
Epinephelus itajara
Epinephelus morio
Epinephelus nigritus
Epinephelus niveatus
Epinephelus striatus
Mycteroperca bonaci
Mycteroperca microlepis
Mycteroperca phenax
Mycteroperca venenosa
Serranidae spp.
Lutjanus analis
Lutjanus campechanus
Lutjanus griseus
Lutjanus synagris
Lutjanus vivanus
Lutjanus spp.
Ocyurus chrysurus
Rhomboplites aurorubens
Caranx crysos
Caranx hippos
Decapterus punctatus
Trachinotus carolinus
Trachinotus falcatus
Carangidae spp.
Seriola spp.
Scomberomorus cavalla
Scomberomorus maculatus
Scomberomorus spp.
Acanthocybium solanderi
Euthynnus alletteratus
Euthyunns pelamis
Thunnus alanuga
Thunnus albacares
Thunnus atlanticus
Thunnus obesus
Thunnus thynnus
Makaira nigricans
Tetrapturus albidus
Xiphias gladius
Cynoscion arenarius
Cynoscion nothus
Cynoscion nebulosus
Cynoscion regalis
Caulolatilus chrysops
Caulolatilus microps
Mugil cephalus
Mugil curema
Alosa sapidissima
Brevoortia tyrannus
Chloroscombrus chrysurus
Coryphaena hippurus
Cubiceps athenae
Diplectrum formosum
Elops saurus
Harengula jaguana
Hemiramphus brasiliensis
Lagodon rhomboides
Lachnolaimus maximus
Leiostomus xanthurus
Odontoscion dentex
Opisthonema oglinum
Pogonias chromis
Pomatomus saltatrix
Rachycentron canadum
Sciaenops ocellatus
Aridae spp.
Balistidae spp.
Centropristis spp.
Haemulidae spp.
Mullidae spp.
Sparidae spp.
Anguilliformes
Rajiformes
Squaliformes
Misc. Baitfish
Misc. Foodfish
Misc. Industrial fish
Argopecten irradians
Busycon contrarium
Callinectes sapidus
Cassis tuberosa
Menippe mercenaria
anulirus argus
Demospongia spp.
Loliginidae spp.
Mercenaria spp.
Octopoda spp.
Ostreidae spp.
Farfantepenaeus aztecus
Farfantepenaeus duorarum
Farfantepenaeus setiferus
Pleotlus rbustus
Sicyonia brevirostris

Table 2. Finfish and invertebrate species sampled by the Trip Interview Program in Monroe County (Florida Keys) 1986-1997.

Epinephelus adscensionis	*Calamus bajonado*	*Mugil curema*
Epinephelus drummondhayi	*Calamus calamus*	*Urophycis floridanus*
Epinephelus flavolimbatus	*Calamus leucosteus*	*Alectis ciliaris*
Epinephelus guttatus	*Calamus nodosus*	*Elops saurus*
Epinephelus itajara	*Calamus penna*	*Panulirus argus*
Epinephelus morio	*Pagrus pagrus*	*Scyllarides nodifer*
Epinephelus mystacinus	*Stenotomus caprinus*	*Scyllarides aequinoctialis*
Epinephelus nigritus	*Haemulon album*	*Geryon fenneri*
Epinephelus niveatus	*Haemulon carbonarium*	*Menippe mercenaria*
Epinephelus striatus	*Haemulon parrai*	
Mycteroperca bonaci	*Haemulon plumieri*	
Mycteroperca interstitialis	*Haemulon sciurus*	
Mycteroperca microlepis	*Anisotremus virginicus*	
Mycteroperca phenax	*Cynoscion arenarius*	
Mycteroperca venenosa	*Cynoscion nothus*	
Lutjanus analis	*Cynoscion nebulosus*	
Lutjanus apodus	*Pogonias cromis*	
Lutjanus buccanella	*Caulolatilus chrysops*	
Lutjanus campechanus	*Caulolatilus microps*	
Lutjanus cyanopterus	*Scarus coeruleus*	
Lutjanus griseus	*Scarus croicensis*	
Lutjanus jocu	*Scarus guacamaia*	
Lutjanus synagris	*Scarus vetula*	
Lutjanus vivanus	*Sparisoma viride*	
Apsilus dentatus	*Balistes capriscus*	
Etelis oculatus	*Canthidermis sufflamen*	
Ocyurus chrysurus	*Hemiramphus balao*	
Rhomboplites aurorubens	*Hemiramphus brasiliensis*	
Pristipomoides aquilonaris	*Hyporhamphus unifasciatus*	
Caranx bartholomaei	Exocoetidae	
Caranx crysos	Belonidae	
Caranx hippos	*Tylosurus crocodilus*	
Caranx ruber	*Holocentrus ascensionis*	
Seriola dumerili	*Holocentrus rufus*	
Seriola rivoliana	*Kyphosus incisor*	
Seriola zonata	*Kyphosus sectatrix*	
Trachinotus carolinus	*Neomerinthe hemingwayi*	
Trachinotus falcatus	*Priacanthus arenatus*	
Elagatis bipinnulata	*Lobotes surinamensis*	
Selar crumenophthalmus	*Acanthurus coeruleus*	
Selene vomer	*Chaetodipterus faber*	
Euthynnus alletteratus	*Helicolenus dactyl*	
Euthynnus pelamis	*Sphyraena barracuda*	
Thunnus atlanticus	*Hyperoglyphe perciformis*	
Sarda sarda	*Rachycentron canadum*	
Scomberomorus cavalla	*Coryphaena hippurus*	
Scomberomorus maculatus	*Pomatomus saltatrix*	
Scomberomorus regalis	*Paralichthys albigutta*	
Acanthocybium solanderi	*Paralichthys lethostigma*	
Xiphias gladius	*Lachnolaimus maximus*	

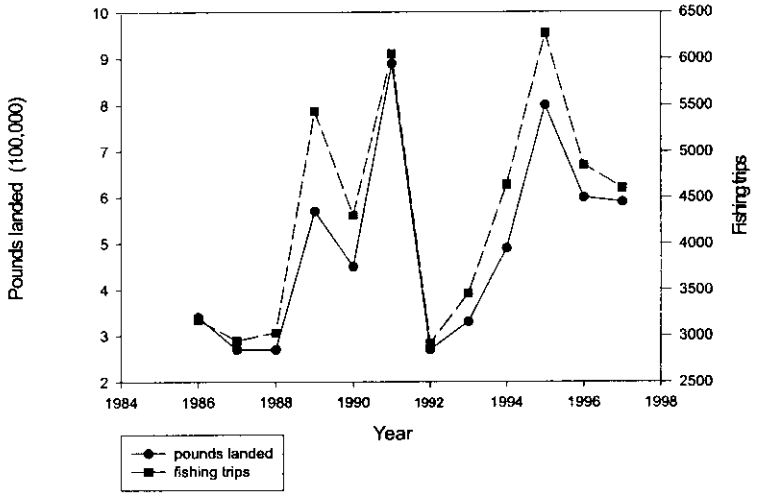

Figure 1. Landings in pounds and number of fishing trips for dolphinfish from the Florida Keys, 1986-97.

Landings and fishing trips increased until 1991 and then declined; the landings became stable in 1995, but the number of fishing trips continued to decline (Figure 3). The reversal of trends in fishing trips and landings is most likely due to the 1990 regulations requiring state and federal permits, the 1994 imposition of a minimum size limit, and seasonal and spatial closures. The reason for the decline in fishing trips while landings have stabilized is unclear but may be a result of lower fishing pressure. Data from trip interviews revealed a bimodal distribution of lengths and further analysis indicated differences in size between fishing areas (Figure 4).The bimodal size distribution is likely caused by the exploitation of large fish in a spawning area west of Key West; the bimodal distribution may become less obvious as the effects of the closed season and fishing area in that location manifest themselves.

Spiny lobster have been extensively regulated for the past several years. A size limit requiring spiny lobsters to be over 76.2 mm carapace length was enacted in 1987. In 1990 live wells (flowing seawater systems) to transport undersized spiny lobsters used as attractants were required. A staged trap reduction plan began in 1992 and in 1993 a restricted species endorsement was required to land commercial quantities.

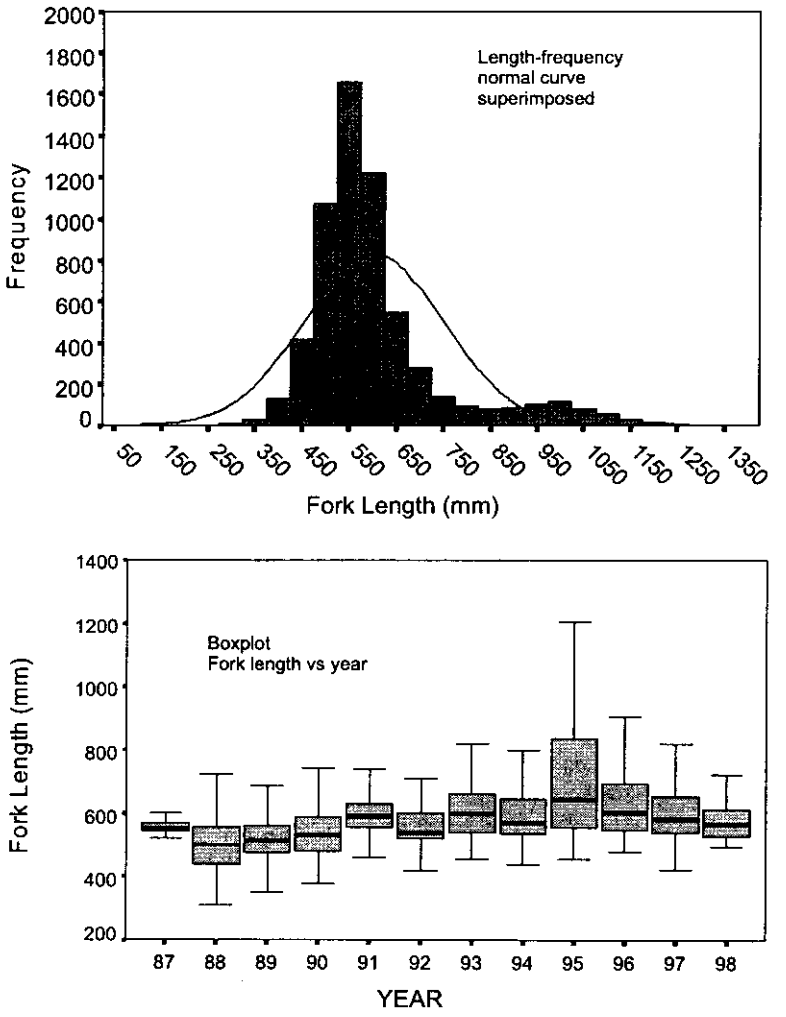

Figure 2. Length-Frequency and box-and-whisker plots by year for dolphinfish sampled from commercial catches in the Florida Keys, 1987-1998. Boxes represent the interquartile range, which includes 50% of fork-length values for each year. Whiskers extend from the boxes and indicate highest and lowest values at the 95% confidence level, excluding outliers. Lines in the boxes represent median fork-lengths for each year.

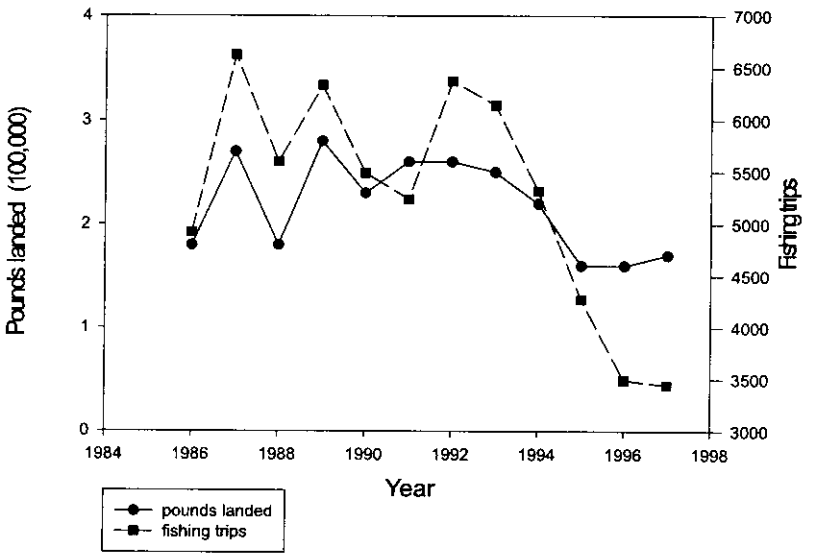

Figure 3. Commercial landings in pounds and number of fishing trips for mutton snapper from the Florida Keys, 1986-1997.

Landings fluctuated around a mean of 6.4 million pounds. Fishing trips increased until 1991, decreased until 1993 and have slowly increased again (Figure 6). Length frequency- distributions indicated that small lobsters were most commonly caught; size did not change from year to year or month to month (Figure 6). Lobsters caught west of Key West or from well north of the middle Keys were larger than those from other fishing areas. Near-record-level landings of spiny lobster during 1994-97 may have been a result of reduced mortality of undersized lobsters used as attractants. The increase in pounds landed per trip was likely a result of required permits and trap reduction, both of which have acted to reduce excess fishing effort. So far, the mean size of spiny lobsters landed has not increased in spite of regulations. The larger lobsters were from fishing areas north of the Keys and well west of Key West that have been exploited only recently.

Subtle trends or other aspects of a fishery may be apparent in the data from sampling programs such as ours and may indicate problems that should be examined by targeted research programs. Data from programs such as ours can be used in sophisticated analyses. Acosta and Beaver (in press) used data from yellowtail snapper landings and the biostatistical sampling program to determine

population dynamics in the commercial fishery and to provide a preliminary stock assessment. Acosta and Appledoorn (1992) used data from a biostatistical sampling program in Puerto Rico to estimate growth, mortality and yield per recruit for lane snapper. Muller et al. (1997) used data from spiny lobster landings and trip interviews to develop an age structured population model that indicated increased lobster abundance and lowered fishing mortality despite increased landings.

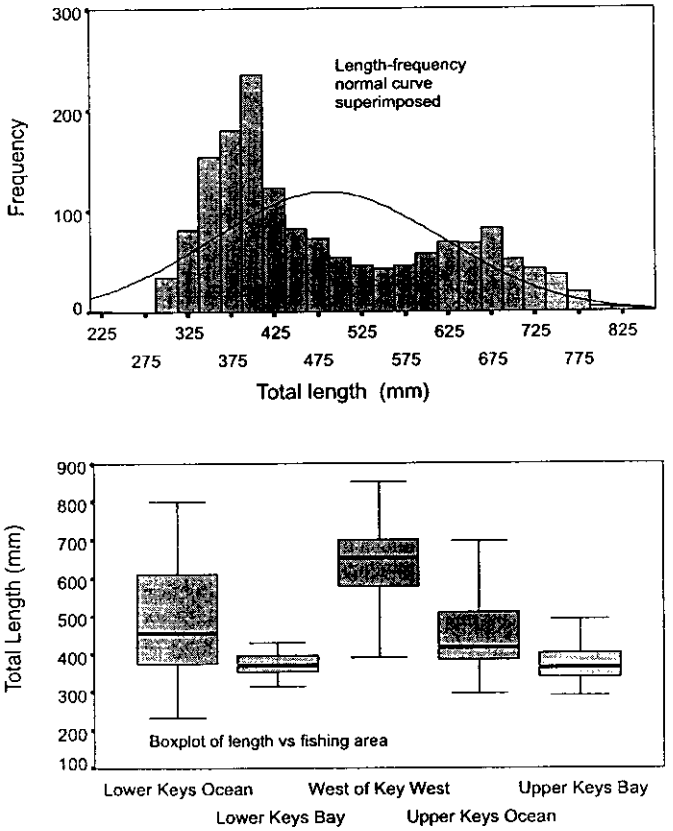

Figure 4. Length-frequency and box-and-whisker plot by fishing area for mutton snapper sampled from commercial catches in the Florida Keys, 1986-1997. Boxes represent the interquartile range, which includes 50% of total length values for each fishing area. Whiskers extend from the boxes and indicate highest and lowest values at the 95% confidence level, excluding outliers. Lines in the boxes represent median total lengths for each fishing area.

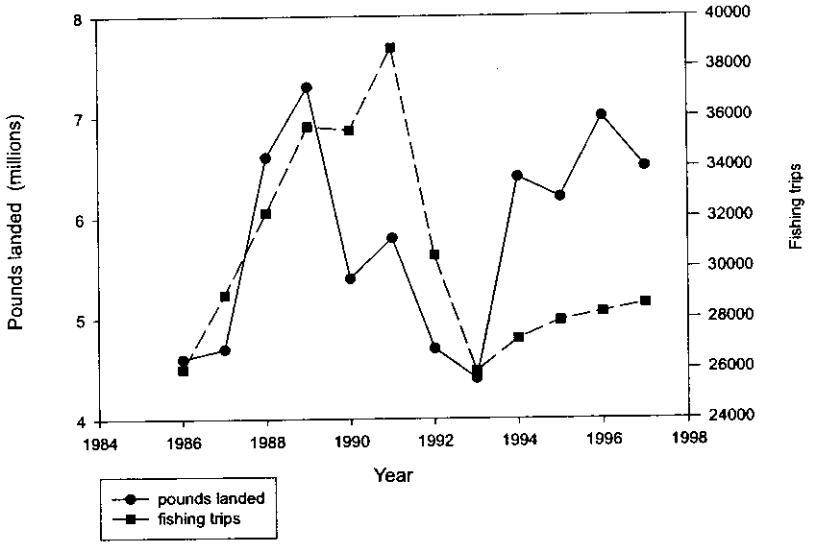

Figure 5. Commercial landings in pounds and number of fishing trips for spiny lobster from the Florida Keys, 1986-1997.

In the two programs discussed herein, it is imperative that commercial fishers provide reliable information to be recorded on trip tickets and to the port Agents conducting dockside interviews. Trusting relationships must be established and maintained between those reporting and those collecting the data. Data must also be used appropriately because of the biases inherent in these programs. Two examples of inherent biases are that size limits and closed seasons will affect size and landings data and that Port Agents will of course be sampling only the species landed by the fishers.

In the two programs discussed in this paper, catch-and-effort data based on Florida's commercial-fishery landings records and specific catch data obtained from commercial fishers at dockside were collected. Advantages to using data collection programs such as these are evident: large amounts of data can be collected efficiently; landings data reported by dealers are likely to be accurate; a single Port Agent can cover territory equivalent to medium-sized countries in the Caribbean; simple analyses of the data readily show changes or trends in a fishery, such as those resulting from changes in fishery regulations; and over long periods, sufficient data can be accumulated to allow stock assessments and population analyses to be made.

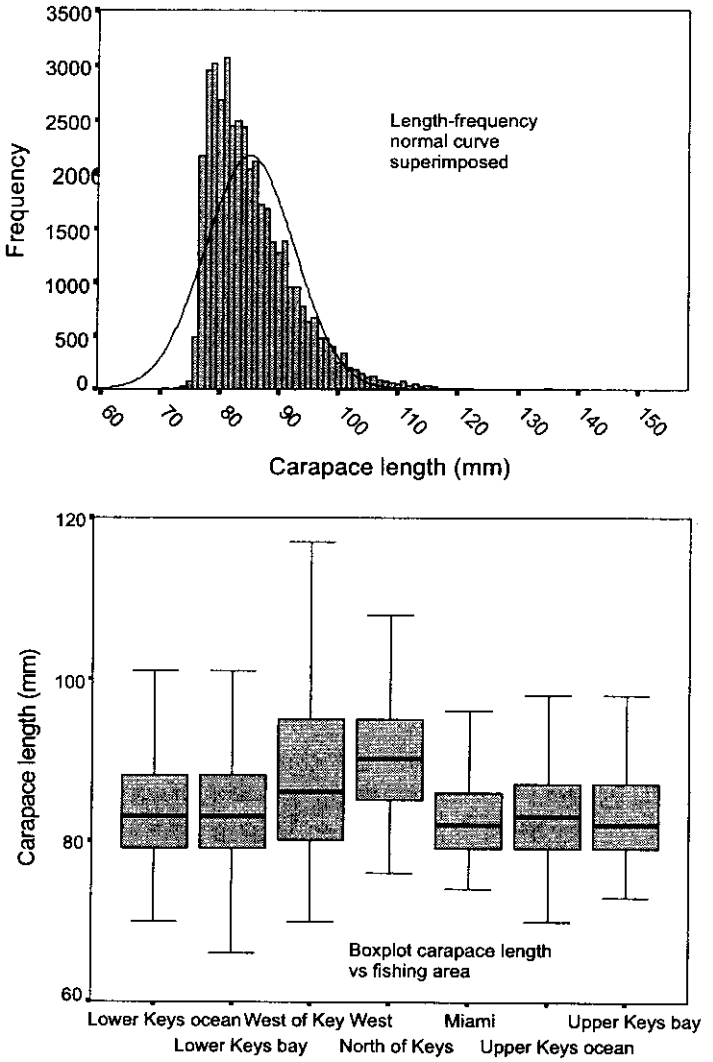

Figure 6. Length-Frequency and box-and-whisker plots of carapace length by fishing area for spiny lobster sampled from commercial catches in the Florida Keys, 1987-1997. Boxes represent the interquartile range, which includes 50% of carapace length values for each fishing area. Whiskers extend from the boxes and indicate highest and lowest values at the 95% confidence level, excluding outliers. Lines in the boxes represent median carapace lengths for each fishing area.

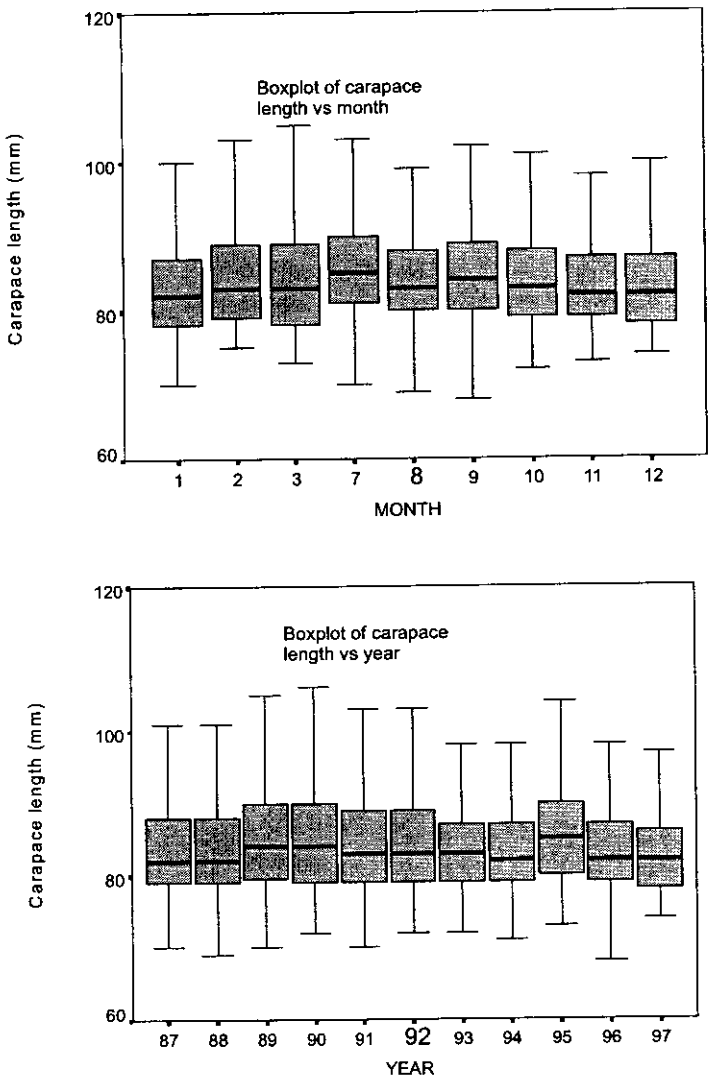

Figure 7. Box-and-whisker plots of carapace length vs month and year for spiny lobster sampled from commercial catches in the Florida Keys, 1987-1997. Boxes represent the interquartile range, which includes 50% of carapace length values for each month and year. Whiskers extend from the boxes and indicate highest and lowest values of carapace lengths at the 95% confidence level, excluding outliers. Lines in the boxes represent median carapace lengths for each month and year.

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