GULF AND CARIBBEAN FISHERIES INSTITUTE, INC.

COMPARISON OF SIZE OF CAPTURE USING HOOK AND LINE, FISH TRAPS AND GILL NETS OF FIVE SPECIES OF COMMERCIAL FISH IN PUERTO RICO DURING 1988-90.

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ABSTRACT

Puerto Rico's fishery is artisenal, multispecies, multigear and shows a number of indications of overfishing (e.g. markedly decreased reported landings since the early 1980's, and changes in species catch composition). To further evaluate resource status and to enable the development of effective resource management it was necessary to obtain size frequency data by species and by gear type.

Port Agents of the Biostatistics Program of the Fisheries Research Laboratory (Puerto Rico Department of Natural Resources) randomly selected complete landings, identified all fish by species, measured (fork lenght in millimeters) and weighed (in grams). Approximately 60,000 fishes caught by commercial fishermen were measured around the 42 coastal municipalities of the Island of Puerto Rico during 1988 - 1990, inclusive. Five of the most frequently-reported species were used for examination of size frequency data: Haemulon plumieri, Lutianus synagris, L. vivanus, Ocyurus chrysurus and Epinephelus guttatus. Comparison of length frequency distributions by species, by gear type (hook and line, fish trap and gill net) and by coast were made using the Kolmogorov-Smirnov test.

Results showed that for H. plumieri, and L. synagris, gill nets and hook an line caught significantly larger fish than fish traps. A higher percentage of fish was caught prior to sexual maturity by fish trap in L. vivanus (90% of total measured fish), O. chrysurus (37% total measured fish) and E. guttatus (31% of total measured fish) than by either hook and line or gill

net. In general, smaller individuals of each species for a given gear type were taken on the south coast than on the other coasts. The data indicate that certain recomendations regarding gear modifications may be made to reduce the capture of juvenile, or particulary small individuals of certain important species.

Key Words: Commercial Fisheries, Hook and Line, Gill Net and Fish Trap

RESUMEN

La pesquería en Puerto Rico es artesanal, multiespecie, multiarte y ha demostrado un número de indicaciones de sobrepesca (disminución en los desembarcos reportados desde temprano en la década de los 1980 y cambios en la composición de las especies capturadas). Para apoyar el status del recurso evaluado y para capacitar el desarrollo de la administración efectiva del recurso fue necesario obtener datos de frecuencia de tamaño por especie y por tipo de arte.

Agentes pesqueros del Programa de Bioestadísticas del Laboratorio de Investigaciones Pesqueras (Departamento de Recursos Naturales de Puerto Rico) seleccionaron al azar desembarcos completos, identificando todos los peces por especie, midiéndolos (largo horquilla en milímetros) y pesándolos (en gramos). Aproximadamente 60,000 peces capturados por los pescadores comerciales fueron medidos en los 42 municipios costaneros de la isla de Puerto Rico entre 1988 - 1990. Cinco de las especies reportadas con mayor frecuencia, fueron utilizadas para exámenes de información de frecuencia de tamaño: Haemulon plumieri, Lutjanus synagris, L. vivanus, Ocyurus chrysurus y Epinephelus guttatus. Las comparaciones de las distribuciones de larga frecuencia por especies, por tipo de arte (anzuelo, trampa de peces y trasmallo) y por costa fueron hechas usando la prueba Kolmogorov-Smirnov.

Los resultados muestran que para H. plumieri y L. synagris, los trasmallos y anzuelos capturan peces de mayor longitud que cuando se usa la trampa de peces. Un alto porcentaje de los

peces fueron capturados antes de alcanzar su madurez sexual por trampas de peces en L. vivanus (90% del total de los peces medidos), Q. chrysurus (37% del total de los peces medidos) y E. guttatus (31% del total de los peces medidos) más que con el anzuelo o el trasmallo. En general, pequeños individuos de cada especie para un tipo de arte dado son capturados más en la costa sur que en las otras costas. La información indica que ciertas recomendaciones acerca de las modificaciones del tipo de arte de la pesca deben hacerse para reducir la captura de juveniles, o de pequeños individuos en ciertas especies importantes.

Palabras Claves: Pesquería Comercial, Anzuelo, Trasmallo, Trampa de peces.

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INTRODUCTION

The Fisheries Research Laboratory (FRL) of the Department of Natural Resources of Puerto Rico is an institution which as one of its goals, monitors the status of fisheries resources of Puerto Rico. The FRL Statistics Division collects information on commercial fisheries landings from ninety two fishing centers in the forty-two coastal municipalties of Puerto Rico, including Vieques and Culebra. This information is based on the voluntary cooperation of commercial fishermen. Three types of information are collected by the Statistics Division: a) landings (total reported pounds of fish and shellfish landed by species and by location); b) biostatistics (identification of intact catches by species, measured by length and weight); c) census of the fishery (number of active fishermen, vessels and gears).

Since the early nineteen eighties a marked decrease in most commercial species of fish and shellfish has been observed in Puerto Rico´s reported landings data. Several management plans are currently in effect in both state and federal waters (spiny lobster plan) or in federal waters (Nassau grouper, yellowtail snapper minimum size restrictions).

Puerto Rico´s fishery is artisanal, multispecies and multigear. Each gear exploits the resource in a different way producing a different species composition and different sizes of individuals. To better evaluate resource status and to more effectively develop and monitoring resource management it is

necessary to understand the effect of gear type on catch profile. The objectives of this investigation were: 1) to compare length frequency distributions (LFD) of commercial captures in Puerto Rico for five commercial fish species using biostatistical data collected from 1988-90 for a) hook and line, fish traps and gill nets and b) by coast; and 2) to determine the percentage of individuals taken below estimated size at sexual maturation by species and gear.

METHODS

Five port agents of the FRL Statistics Division visited Island fishing centers, identified all species in intact catches and measured fork length (FL) in millimeters of each caught fish. Approximately 60,000 fish were measured of 140 different species. The five most frequently reported species were the white grunt (Haemulon plumieri), lane snapper (Lutjanus synagris), silk snapper (Lutjanus vivanus), yellowtail snapper (Ocyurus chrysurus) and red hind (Epinephelus guttatus).

Comparisons of LFD of each of these species caught by hook and line, fish trap and gill net (including trammel nets data) were made. Data were checked and entered into IBM PC format using DBASEIII+. Data analyses were made using software Lotus 1-2-3 and Microsoft Excel. LFD data were compared statistically using the Kolmogorov-Smirnov Two Sample Test, $p <= 0.05$ (Sokal and Rohlf, 1981). No comparative analyses between gears and/or coasts were made when the number of fish measured (n) was < 50.

The north coast is defined as extending from Isabela to Luquillo, the east coast from Fajardo to Maunabo (including the islands of Vieques and Culebra), the south coast from Patillas to Lajas, and the west coast from Cabo Rojo to Aguadilla (Figure 1).

The percentage of individuals taken which fell below the estimated mean or minimum size of sexual maturation (MSSM) was determined irrespective of sex. MSSM was selected from Román (1991) for Haemulon plumieri, Boardman and Weiler (1979) for Lutjanus vivanus, Thompson and Munro (1983a) for Lutjanus synagris and Thompson and Munro (1983b) for Epinephelus guttatus.

RESULTS

LFD: By Gear

Haemulon plumieri taken by hook and line and by gill net were significantly larger than those taken by fish traps in 1988, dmax = 0.2524 and dmax= 0.1301 (Figure 2). For the same year the mean size of capture (FL), for all coasts combined was 233mm for hook and line, 228mm for gill nets and, 216mm for fish traps. This pattern was similar for 1989 and 1990.

Lutjanus synagris taken by gill nets were significantly larger than those taken by other gears studied (dmax= 0.1107 and dmax= 0.3005), and hook and line taken animals were significantly larger than those taken by fish traps. Figure 3 shows the LFD for all gears and coasts in 1989. For 1989 the mean FL of capture for all coasts was 230mm for hook and line, 265mm for gill nets and 224mm for fish traps. The pattern was similar for

1988 and 1990.

Lutjanus vivanus taken by hook and line were significantly larger than those taken by fish trap (dmax= 0.0775). Due to the fact that this species lives in deep water, no gill net captures are reported. Figure 4 shows the LFD for hook and line and fish trap, for all coasts in 1989. This year the mean FL of captured individuals for all coasts was 306mm for hook and line, and 246mm for fish trap. The pattern was similar for 1988 and 1990.

Ocyurus chrysurus taken by hook and line were significantly larger than those taken by gill nets and fish traps (dmax= 0.2954 and dmax= 0.1532). Figure 5 shows the LFD for all gears and coasts in 1990. This year the mean FL of captured individuals for all coasts was 283mm for hook and line, 237mm for gill nets and 232mm for fish traps. The pattern was similar for 1988 and 1989.

Epinephelus guttatus taken by hook and line were significantly larger than those taken by fish trap (dmax= .1474). Figure 6 shows the LFD for hook and line and fish trap for all coasts in 1990. This year the mean FL of captured individuals was 295mm for hook and line and 270mm for fish traps. The pattern was similar for 1988-1989. Due to the fact that gill nets do not usually take Epinephelus guttatus, reports for this species taken by gill net were less than 50 for all years studied.

LFD: Coast

Individuals taken from the south coast were generally smaller than those taken on other coasts. Figure 7 shows the LFD

of Haemulon plumieri taken by gill nets on the east and south coasts in 1990. South coast taken individuals were significantly smaller than those from the east coast. Figure 8 shows the LFD of Lutjanus synagris taken by fish trap on west, south and north coasts in 1990. Fish taken on the north and west coasts were significantly larger than those from the south coast. Figure 9 shows the LFD of Ocyurus chrysurus for each coast taken by hook and line in 1990. Individuals taken from the north and west coasts were significantly larger than those from the south and east coasts. Size frequency distributions for all coasts combined and separately for 1988, 1989 and 1990 are shown for Haemulon plumieri (Figure 10) and Epinephelus guttatus (Figure 11).

Individuals Taken Below the Estimated Size of Sexual Maturation

Table 1 shows the percentages of individuals taken below the approximate mean or minimum size of sexual maturation (MSSM) for each species. Fish traps generally caught relatively more sexually immature individuals for all species studied than other gears. The greatest percentage of juveniles for any one species was over 90% for Lutjanus vivanus taken by fish trap for all three years and over 90% for hook and line for 1988 and 1990. Ocyurus chrysurus and Epinephelus guttatus were taken in relatively high numbers as juveniles by all gears, particularly by fish trap. Haemulon plumieri and Lutjanus synagris had low percentages of non sexually mature fish taken by all three gear types.

DISCUSSION

Gears

Fish traps caught significantly smaller fishes than other gears for all studied species. Fish traps are the most used gear in Puerto Rico, accounting for approximately 33% of Puerto Rico's reported landings during 1988-90. In 1978 fish traps reported approximately 52% of the total Island landings. Recently, fish trappers in Puerto Rico have reported decreasing trap catches on a per haul basis and many have forced to increase the number of traps they deploy to maintain captures.

Hook and line shows a tendency to take larger fishes for all species studied. This gear reported landings of approximately 22% of the total Island landings reported during 1988-90. Fishermen have to be motivated to increase the use of hook and line and reduce the use of fish traps if reduction of the capture of immature individuals of certain key species is to be achieved.

Gill nets show a tendency to catch fishes larger than those taken by fish traps for three species that reported this gear and larger than those taken by hook and line for Lutjanus synagris.

Coasts

Smaller individuals tend to be taken on the south than on other coasts. Possible reasons for this are: a) fishermen on the south coast generally fish in shallower waters than fishermen on other coasts; b) this coast is more heavily fished by fish traps or other gears than other coasts, removing small fish before they have a chance to grow; c) there may be natural size differences

because of factors such as food availability variation among coasts. These various possible explanations need to be evaluated to understand observed differences.

Individuals Taken Below the Estimated Size of Sexual Maturation

Relatively few individuals of Haemulon plumieri and Lutjanus synagris were taken below MSSM. Lutjanus vivanus shows an alarmingly high percentage of individuals taken below MSSM during the three years for both gears reported. This species is highly valued economically in Puerto Rico and is heavily exploited. The need for action to protect sexually inmature individuals of this valuable species is recommended.

Approximately 37% of Ocyurus chrysurus taken by all gears and all years studied combined were caught before reaching MSSM. Fish traps took approximately 69% below MSSM. Currently the CFMC has a management plan in Federal waters to protect this species. The plan prohibits capture below a catch size (254mm FL in 1988, 279mm FL in 1989 and 304mm in 1990). Approximately 53% in 1988, 70% in 1989 and 26% in 1990 of individuals of this species were caught below the minimum catch size established by of the federal management plan in both state and federal waters.

Epinephelus guttatus shows a relatively high percentage of individuals taken below the MSSM. It has been proposed to protect the seasonal spawning aggregation of this species, because during this period the species is very vulnerable to heavy fishing pressure. Such protective measures and others

requiring gear modification are likely necessary to maintain or to increase yield.

ACKNOWLEDGMENT

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TE MEAN OR MINIMUM SIZE OF SEXUAL MATURATION, FORK LENGT
(*** n < 50)

Haemulon plumieri
Minimum Size of Sexual Maturity = 160mm

Gear/Year	1988	1989	1990
Hook and Line	0.80	0.70	0.14
Gill Net	2.20	6.10	0.30
Fish Trap	9.60	11.80	5.10

Lutjanus synagris
Approximate Mean Size of Sexual Maturation=180mm

Gear/Year	1988	1989	1990
Hook and Line	5.90	2.30	0.80
Gill Net	0.30	0.00	22.00
Fish Trap	3.90	4.10	15.00

Lutjanus vivanus
Approximate Minimum Size of Sexual Maturation = 380mm

Gear/Year	1988	1989	1990
Hook and Line	94.80	75.00	94.30
Gill Net	***	***	***
Fish Trap	98.60	98.60	95.60

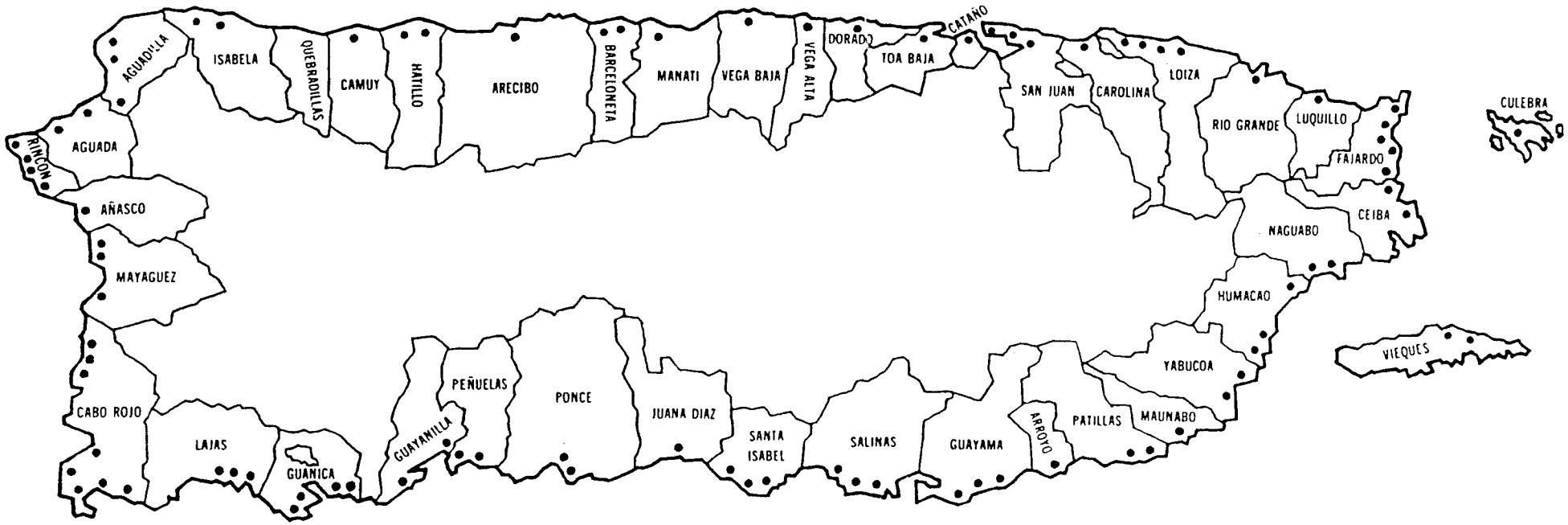
Ocyurus chrysurus
Approximate Mean Size of Sexual Maturation = 260mm

Gear/Year	1988	1989	1990
Hook and Line	39.10	35.70	38.20
Gill net	26.30	26.30	76.60
Fish Trap	58.20	71.20	77.70

Epinephelus guttatus
Approximate Minimum Size of Sexual Maturation = 250mm

Gear/Year	1988	1989	1990
Hook and Line	23.10	36.70	27.60
Gill Net	***	***	***
Fish Trap	29.50	32.90	33.60

LIST OF FIGURES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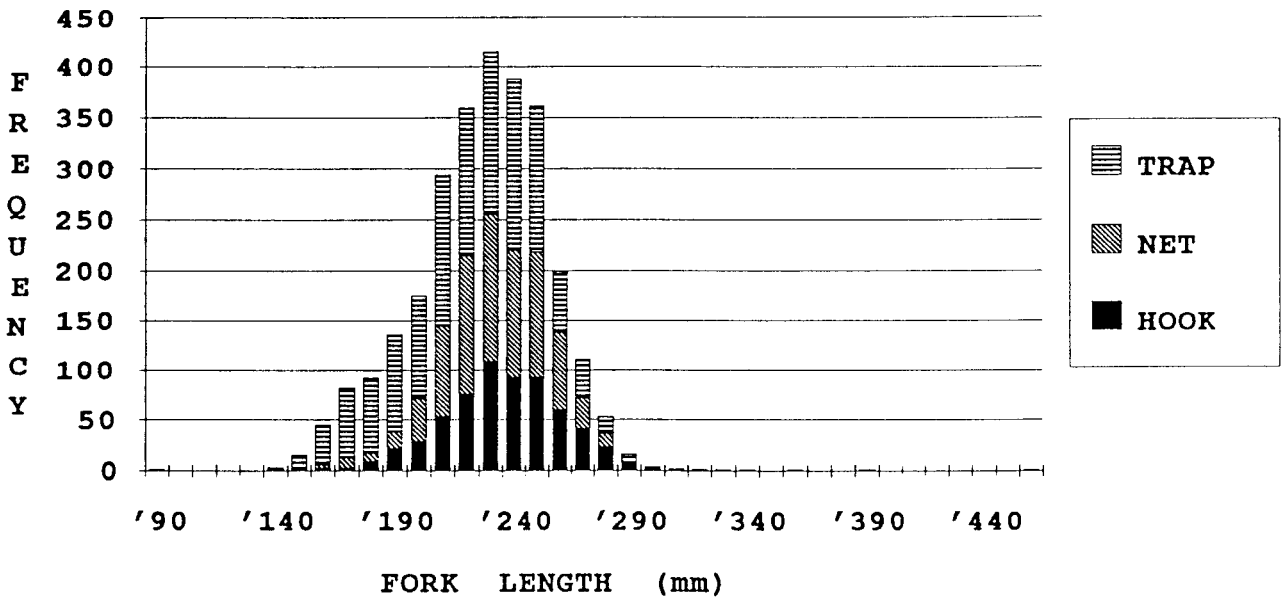
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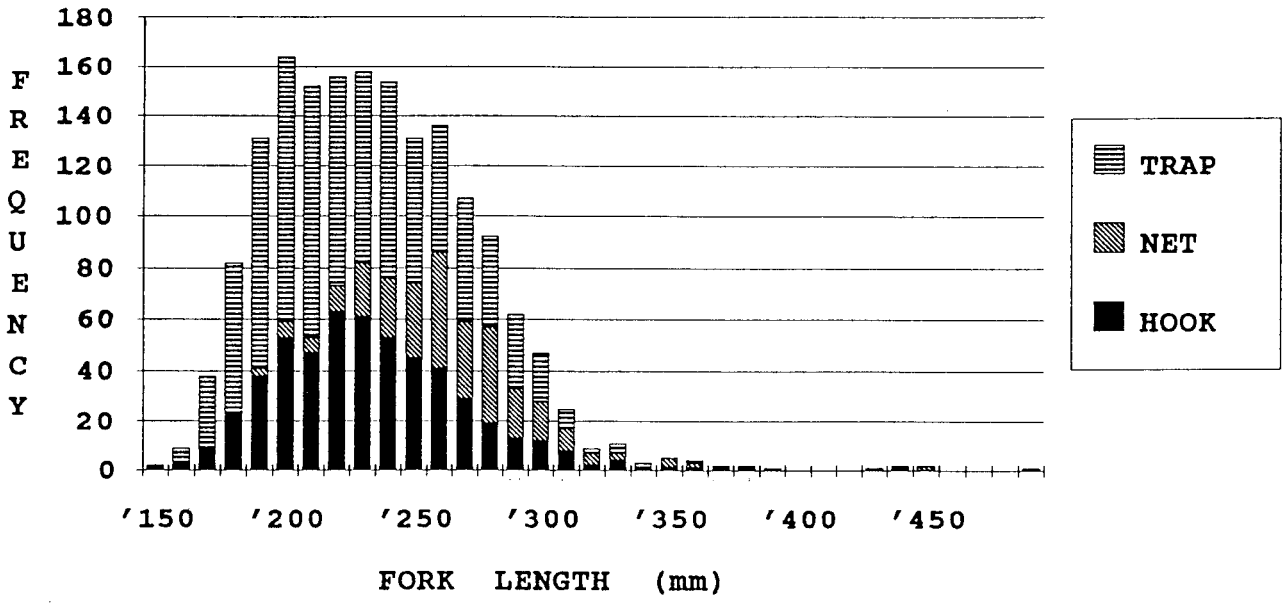
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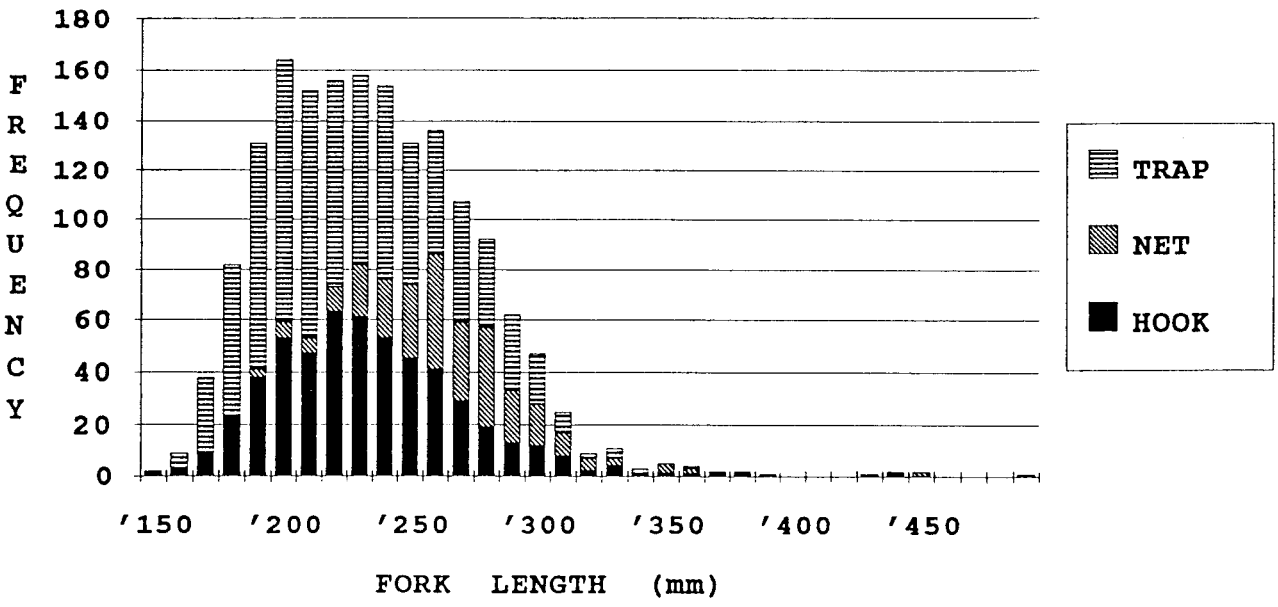
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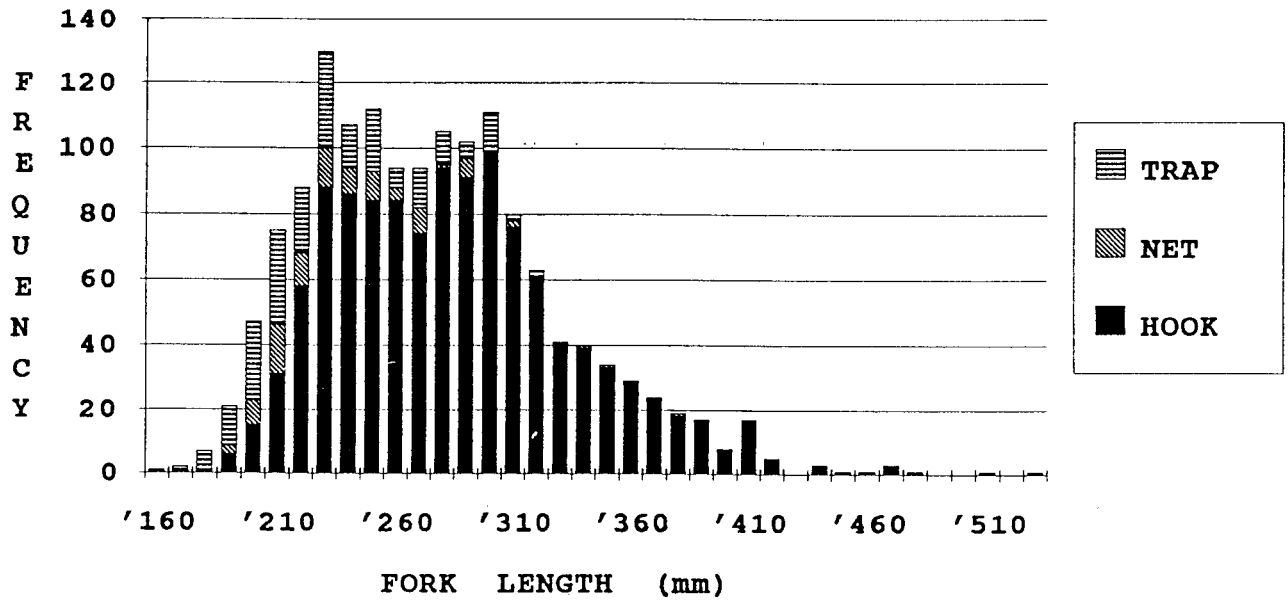
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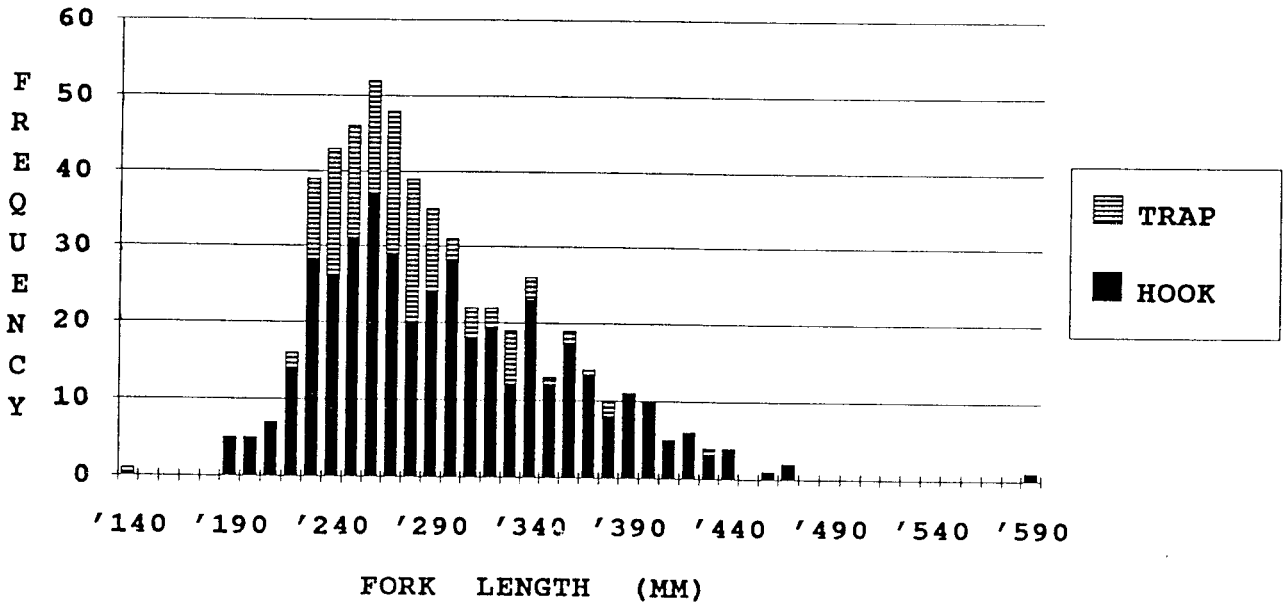
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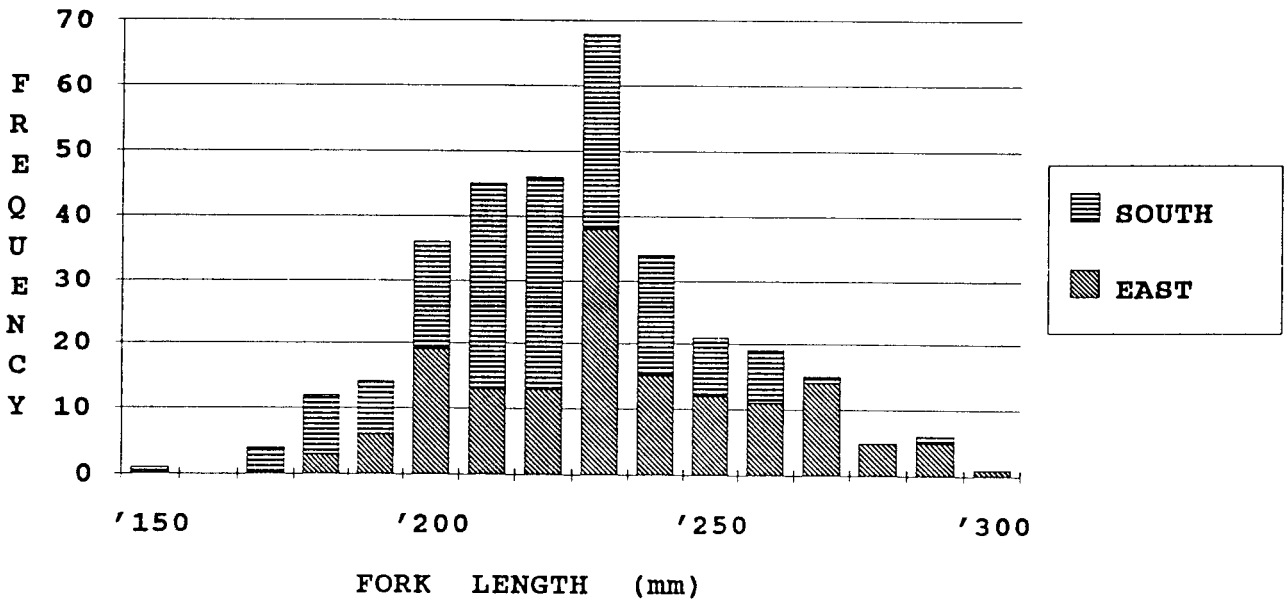
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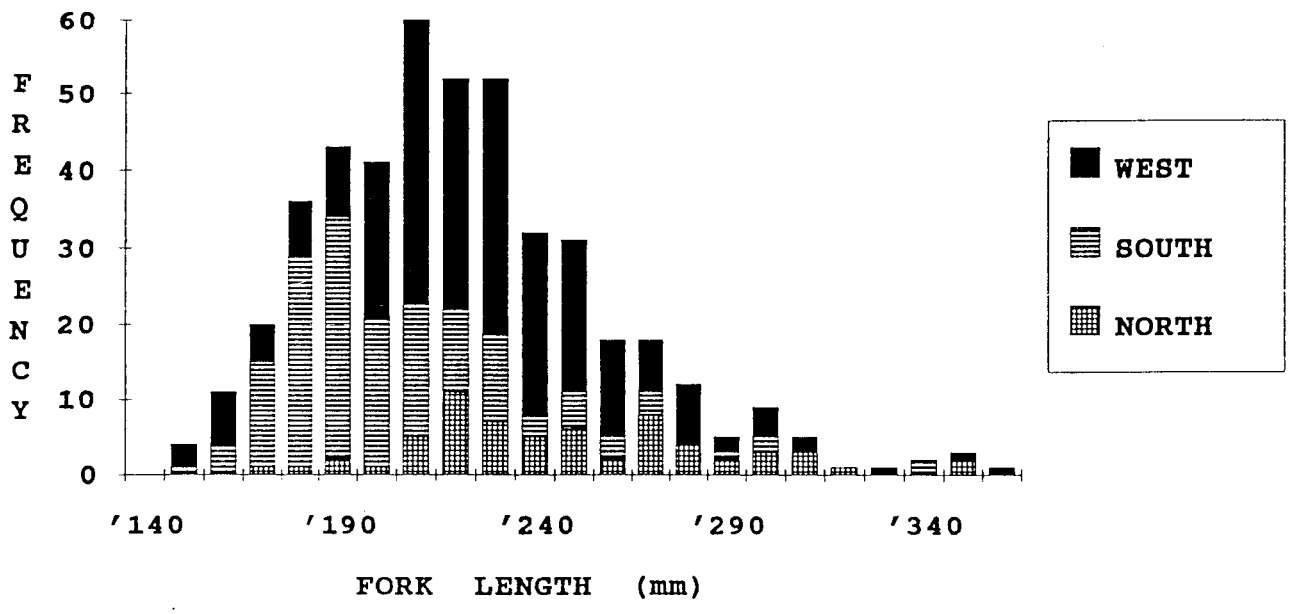
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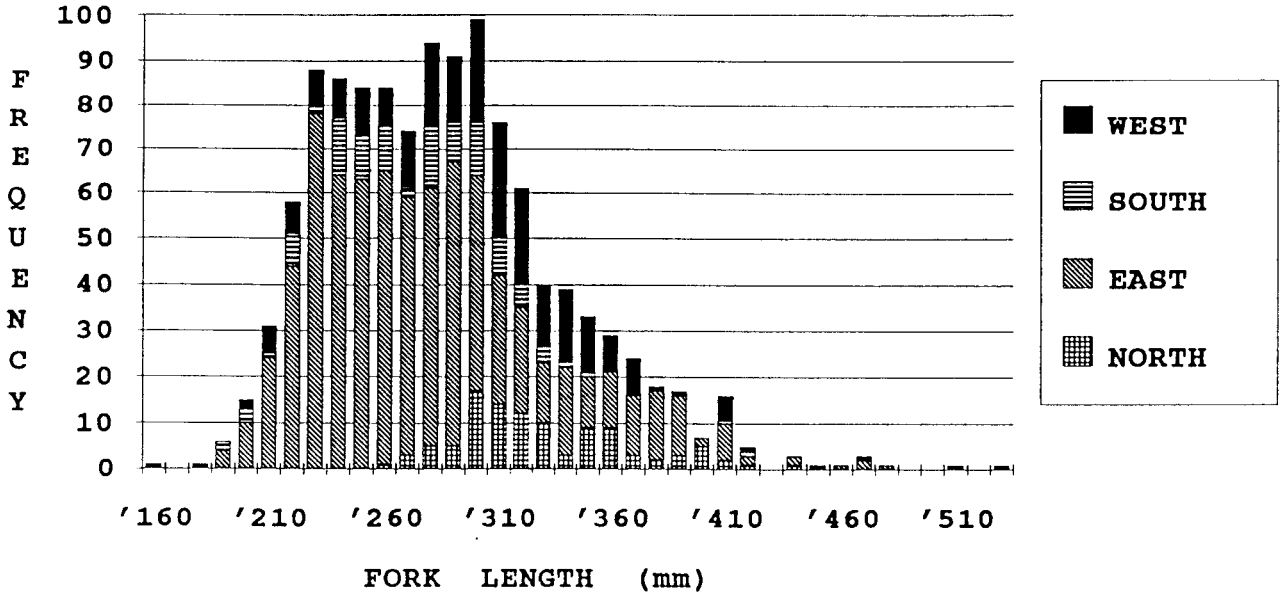
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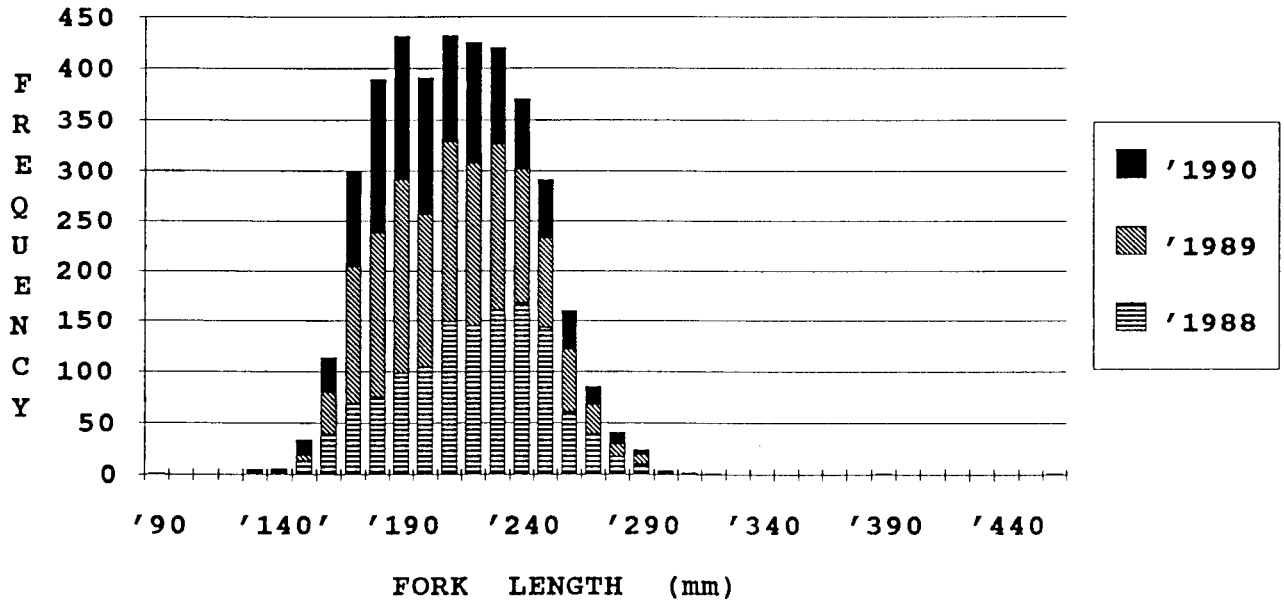
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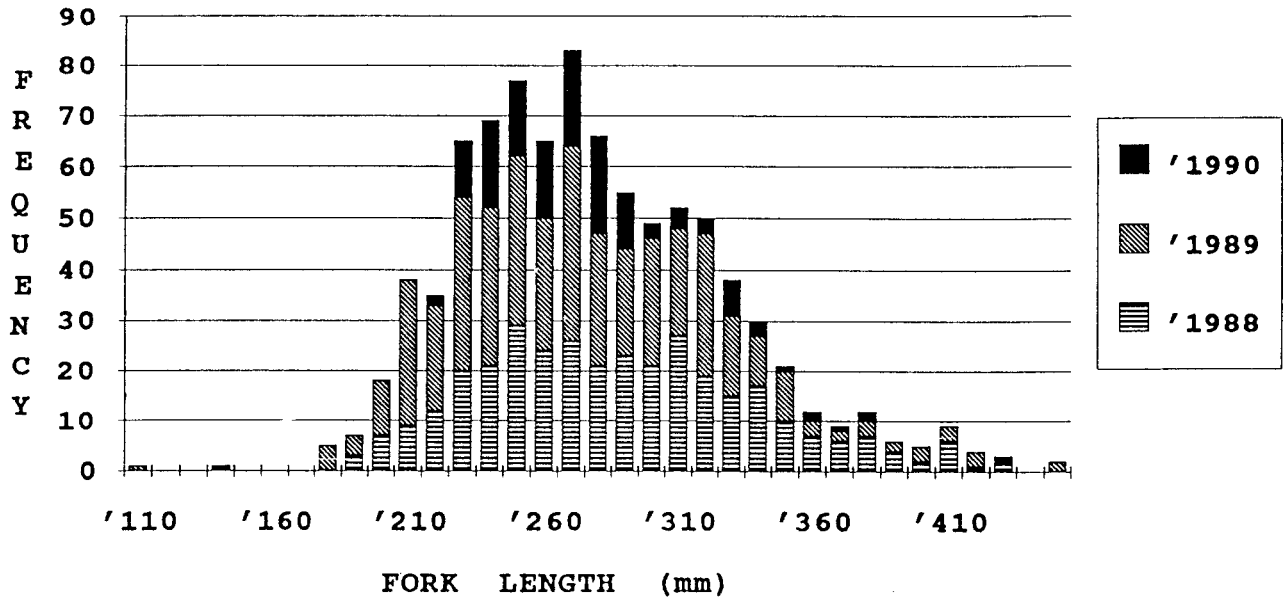
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