PRELIMINARY RESULTS OF THE SIZE-MATURITY SURVEY OF COMMERCIALLY IMPORTANT FISHES OF HONDA BAY

By

ROBERT E. SCHROEDER
U.S. Peace Corps Volunteer

ABSTRACT

Overfishing is suspected at Honda Bay, Palawan. Four commercially important species were analyzed for size and maturity to determine whether the suspicion is true. Preliminary results indicate *Sardinella melanura* to be predominantly mature. Less than 1% are juveniles. All are also above the FAO listed average size. A dominant proportion, 36% of *Leiognathus daura*, 84% of *Caranx ignobilis*, and 60% of *Nemipterus hexodon*, removed by fishermen are juveniles. *Leiognathus daura* and *Nemipterus hexodon* are not undersized, *Caranx ignobilis* is. These results represent the first quarter of an on-going annual survey.

INTRODUCTION

Honda Bay is a land indentation embayment, partially isolated from the open Sulu Sea by offshore islands and wide intertidal zones. Environmental topography includes estuarine, mangrove, coral reef, seagrass, and pelagic fishing grounds. Its center lies at approximately 9°50'N latitude and 118°50'E longitude. It lies on the central east coast of Palawan, bordering Puerto Princesa. Honda Bay covers approximately 25,000 hectares, with depths from wide shallow intertidal zones to 23 fathoms, and has approximately 100 kilometers of coastline. It has traditionally been known as a very productive Palawan fishing ground. Based on preliminary surveys it is evident that this area is an excellent breeding and juvenile nursery ground for commercially important species.

Fishermen interviewed say that quantity of fish and average size for individual species have been decreasing in recent years at Honda

Bay. By removing more juvenile than mature fishes the chance for stock replenishment is greatly reduced. If this trend continues, it may reasonably be assumed that reproducing stocks may be eliminated from Honda Bay.

The objectives of this study are as follows:

1) To determine the maturity stage (juvenile, maturing, or mature) of species removed by fishermen. The fishes studied are limited to those defined as commercially important by the Philippine Council for Agriculture and Resources Research (PCARR, 1976). For the Honda Bay area these include species of the families Clupeidae, Carangidae, Leiognathidae, and Nemipteridae (PCARR, 1977).

2) To determine the average size (standard length and weight) of each species taken. This will be compared to the standard adult size set by the Food and Agriculture Organization (FAO) for the Western Central Pacific, including the Philippines (FAO, 1974).

PROCEDURE

Thirty random fish collections of the four commercially important families were taken on 24 days. The collections were made from 13 different fish landing sites around Honda Bay. To insure random sampling, fishermen were met on the beach before they could separate any fish. Most of the fish were taken from the nets while still alive. At each collection, all individuals landed of each commercially important family were taken, regardless of size or numbers. Fishing methods, exact location, and date of catch were recorded for each individual. The fishing methods include fish corral, trawl, gill net, stationary bagnet, and hook and line. These data represent collections from the first quarter of sampling, from September through November, 1977.

Fishes were identified as to species (FAO, 1974; Fowler, 1928; Gosline and Brock, 1960; and Weber and De Beaufort, 1936) and standard length and standard weight taken. Sex and maturity stages were determined using the standard eight stage maturity scale.

Data were tabulated for each month, and pertinent relationships were graphed.

RESULTS

A total of 1,486 fishes were identified and classified into four families and 39 species. All eight maturity stages are represented. Species are as follows:

CLUPEIDAE

Species	No.	
Sardinella melanura	167	individuals
S. fimbriata	121	"
S. albella	86	"
S. longiceps	4	"
Total	378	"

LEIOGNATHIDAE

Species	No.	
Leiognathus daura	150	individuals
L. equulus	104	"
Gazza minuta	89	"
Leiognathus brevirostris	14	"
L. fasciatus	11	"
L. elongatus	3	"
L. splendens	3	"
L. sp.	2	"
Total	376	individuals

CARANGIDAE

Species	No.	
Caranx ignobilis	114	individuals
Selaroides leptolepis	77	"
Gnathanodon speciosus	61	"
Atule sp.	24	"
Caranx melampygus	22	"
Uraspis reversa	21	"

Carangoides malabaricus	15	"
Selar boops	9	"
Caranx sexfasciatus	8	"
Elegatis bipinnulatus	8	"
Caranx ajax	5	"
Alepes sp.	4	"
Ulua mentalis	3	"
Caranx sp.	3	"
Carangoides gymnostethoides	3	"
Megalaspis cordyla	2	"
Alectis ciliaris	2	"
Scomberoides lysan	1	individual
Carangoides equula	1	"
Caranx armatus	1	"
Total	384	individuals

NEMIPTERIDAE

Species	No.	
Nemipterus hexodon	226	individuals
N. tulo	79	"
N. marginatus	22	"
Scolopsis taeniopterus	8	"
Nemipterus tambuloides	6	"
N. metopias	5	"
Scolopsis sp.	2	"
Total	348	individuals

Graphed relationships represent data for the most dominant species collected for each of the four commercially important families. They are *Sardinella melanura* (Clupeidae), *Leiognathus daura* (Leiognathidae), *Caranx ignobilis* (Carangidae), and *Nemipterus hexodon* (Nemipteridae). Graphs for each species include (FAO, 1968):

(a) Length-Frequency-Histogram
(b) Length-Cumulative-Frequency Polygon
(c) Weight-Frequency Histogram
(d) Weight-Cumulative-Frequency Polygon
(e) Maturity-Frequency Histogram

(f) Maturity-Cumulative-Frequency Polygon
(g) Length-Weight Stereogram
(h) Length-Maturity Stereogram
(i) Weight-Maturity Stereogram

Clupeidae

For the family Clupeidae, 167 *Sardinella melanura* (Cuvier) "black-tip sardine" (FAO, 1974) represent the dominant species collected. From the length-frequency relationship (Fig. 1a), the mode (the variate with maximum frequency) (FAO, 1968) is 17.8 cm in standard length. The median (the variate with the total average frequency) (FAO, 1968) is 17.6 cm in standard length (Fig. 1b). For *Sardinella melanura* the range for standard length is 13.0 to 19.3 cm (Fig. 1a).

The weight mode of *S. melanura* is 100 gm in standard weight (Fig. 2a). The median is 94 gm and range for standard weight is 39.5 gm to 135.0 gm (Fig. 2b).

The mode for *S melanura* occurs at maturity stage III (Preparation) and the median at maturity stage V (Stretching) (Figs. 3a and b). Less than 1% of *S. melanura* are juvenile (stage I maturity). Approximately 40% are undergoing the maturation process (stages II-V) and 60% at the stage of mature or past (VI-VIII).

For *S. melanura*, the length-weight combination in maximum occurrence is 18.3 cm in length and 105 gm in weight (Fig. 4). This is a bivariate normal bell-shaped distribution (FAO, 1968). This indicates that as length increases, the frequency of individuals of higher weight also increases, roughly, to this maximum combination and then decreases, similarly, with further increases in both variates.

The Length-Maturity Stereogram (Fig. 5) was drawn to see if larger (higher standard length) individuals of *S. melanura* are also more mature (higher maturity stage). Subjective analysis of this indicates that the majority of individuals occur between the range of 16-19 cm ($\pm$ 9% of the median length). No predominant relationship is apparent that would indicate maturity increases with length. For example, almost as many individuals in the higher length range, 18-19 cm, are of stage III, as are of stage VIII maturity. Similarly,

but to a lesser extent, this is apparent in some of the lower length groupings.

S. melanura individuals of higher weight intervals show approximately equal frequencies in both extremes of high and low maturity stages (Fig. 6). This is similar to the preceding length-maturity relationship.

Leiognathidae

The dominant species collected of the family Leiognathidae is *Leiognathus daura* (Cuvier) "goldstripe ponyfish" (FAO, 1974) totalling 150 individuals for the first quarter of sampling. The mode is 9.8 cm and the median 8.8 cm in standard length (Figs. 7a and b). The range for standard length of *L. daura* is 6.0 to 13.0 cm (Fig. 7a).

The mode for standard weight is 27.5 gm (Fig. 8a). The median weight for L. daura is 24.0 gm, with the range from 7.3 to 77.3 gm (Fig. 8b).

L. daura indicates a mode at maturity stage I (Juvenile) (Fig. 9a). The median occurs at maturity stage II (Quiet) (Fig. 9b). Thirty six percent of all *L. daura* sampled from Honda Bay are stage I juveniles. Approximately 64% are undergoing the maturation process (Stages II-V) and none of the individuals have yet reached the mature stage of VI.

The length-weight relationship of *L. daura* (Fig. 10) also indicates a bivariate normal distribution. Individuals 9.3 cm in length and 27.5 gm in weight are the combination in maximum occurrence. At lesser and greater length-weight combinations is a lesser frequency of individuals.

Subjective analysis of Fig. 11, the Length-Maturity Stereogram, indicates length increases with no major increase or decrease in maturity stage. Lower maturity stages remain relatively dominant throughout the length range.

The weight-maturity and length-maturity relationships are similar (Figs. 12 and 11). This is as expected for *L. daura* has a bivariate normal distribution for length-weight.

Carangidae

A total of 114 individuals of *Caranx ignobilis* (Forskal) "yellowfin jack" (FAO, 1974) represent the dominant species for the first quarter sampling of Carangidae. Both the mode and median for length frequency of *C. ignobilis* occur at 7.8 cm in standard length (Figs. 13a and b). The range for standard length is 6.1 to 51.8 cm (Fig. 13a).

The Weight-Frequency and Length-Frequency graphs are similar (Figs. 13a and 14a). The mode and the median both occur at 50 gm (Figs. 14a and b). Standard weight for *C. ignobilis* ranges from 5.6 to 3,700 gm (Fig. 14a).

The maturity mode and median for *C. ignobilis* both occur at stage I (Juvenile) (Figs. 15a and b). A dominant proportion of juveniles, 84%, are removed by fishermen from Honda Bay, as indicated by this sample. Only 2.6% have reached maturity.

Most of the *C. ignobilis* individuals collected are less than 10 cm and 100 gm in weight-length combination (Fig. 16). Increasing correspondingly from these values, both in length and weight, few individuals occur.

For *C. ignobilis* the Length-Maturity and Weight-Maturity Stereograms are similar (Figs. 17 and 18). The vast majority fall within maturity stage I in both the lowest length and weight category.

Nemipteridae

For the family Nemipteridae, *Nemipterus hexodon* (Quoy and Gaimard) "ornate threadfin bream" (FAO, 1974) is dominant with 226 individuals per first quarter sampling. The length frequency relationship shows a normal continuous and symmetrical bell-shaped distribution (Fig. 19a). The mode occurs at 13.5 cm and the median at 14.0 cm (Figs. 19a and b). The standard length range for *N. hexodon* is 7.6 to 19.8 cm (Fig. 19a).

For weight frequency *N. hexodon* also has a normal bell-shaped distribution (Fig. 20a). The mode for standard weight is 50.0 gm and the median is 69.0 gm (Figs. 20a and b). *N. hexodon* has a standard weight range of 16.6 to 195.8 gm (Fig. 20a).

Most *N. hexodon* from the Honda Bay samples are juvenile. This is apparent from the maturity frequency relationship (Fig. 21a). Specifically, 60.4% are of stage I maturity (Fig. 21b). Maturing individuals represent 38% of the total sampled. Less than 2% are mature.

The bivariate length-weight relationship of *N. hexodon* (Fig. 22) is a normal bell-shaped distribution. The bivariate value of maximum frequency is 13.5 cm in length and 60 gm in weight. Roughly, frequency decreases for weight-length combinations with increasing distance from this maximum.

Most *N. hexodon* individuals less than 13 cm are of stage I, and those greater than 13 cm dominate stages III and IV (Fig. 23). A positive correlation is shown here between larger individuals and higher maturity stages for the first five stages of maturity. Beyond stage V no other correlation exists.

The weight-maturity relationship (Fig. 24) does not demonstrate a positive size-maturity correlation as well. Throughout the weight range the majority appear to be mostly stage I.

DISCUSSION AND CONCLUSIONS

Clupeidae

Preliminary results indicate fishermen are not overfishing undersized *Sardinella melanura.* The median length for *S. melanura* collected from Honda Bay is two cm longer than the maximum FAO sample of 15 cm and over five cm (or 45%) longer than the common 12 cm recorded by FAO (Figs. 1a and b) (FAO, 1974). All *S. melanura* sampled from Honda Bay are longer than the common FAO sample for this species. No FAO maximum or common standard weight is available for comparison with *S. melanura* (Figs. 2a and b). Preliminary results also indicate *S. melanura* to be predominantly mature (Figs. 3a and b). There is no problem of exploitation due to depletion of its juveniles. Maturity of *S. melanura* did not increase or decrease with increasing length (Fig. 5). Possibly, however, since the approximate deviation is only 9% from the median length, this change in length may be too small to warrant a substantial variance

in maturity for this sample of Honda Bay *S. melanura.* Apparently, there is no present danger of stock elimination of *S. melanura* from Honda Bay.

Leiognathidae

For *Leiognathus daura* the maximum standard length listed by FAO is 11 cm, with 7 to 11 cm common (FAO, 1974). Most of the *L. daura* sampled from Honda Bay fall within this common range (Figs. 7a and b). One individual is above the FAO maximum, larger by about 18% of this maximum length, with less than 5% of those sampled falling below this common range. No FAO weight listings are available for comparison with *L. daura* (Figs. 8a and b). Removal of undersized individuals does not appear to be a problem. A dominant proportion of *L. daura* are found to be in the juvenile stage (Figs. 9a and b). These preliminary results indicate fishermen may be depleting the breeding stocks, since juveniles are more dominant. Maturity of *L. daura* remains relatively constant, with lower stages dominant as length increases (Fig. 11). Maturity may be more a function of the dominant population included in the sample rather than length variance here.

Carangidae

Most individuals sampled of *Caranx ignobilis* are greatly undersized (Figs. 13a and b). FAO (1974) lists 115 cm as maximum and 60 cm as a common standard length for *C. ignobilis.* All of the individuals sampled from Honda Bay are far below this common size. In fact almost 75% of those sampled are less than 10 cm (Fig. 13b). There are no FAO weight standards for *C. ignobilis* (Figs. 14a and b). These preliminary data indicate that predominantly undersized fishes are being removed by Honda Bay fishermen. Most individuals of *C. ignobilis* are also juveniles (Figs. 15a and b). Due to the large percentage of small and immature individuals no size-maturity relationship is apparent (Figs. 17 and 18). As with *L. daura,* the predominantly small size and juvenile composition of *C. ignobilis* may be more related to the local dominant population contained within the sample rather than being indicative of the true population. Being only preliminary results the data for *C. ignobilis* represent only 114 individuals. Statistical significance is lowest for this species of the four species analyzed.

Nemipteridae

Removal of undersized individuals of *Nemipterus hexodon* does not appear to be a problem (Fig. 19a). The common length for this species is 15-25 cm and maximum 30 cm, as listed by FAO (1974). Almost half of the *N. hexodon* collected from Honda Bay are within this common length, with the rest falling short of the standard (Fig. 19b). An individual of maximum standard length, by FAO definition, has not been collected from Honda Bay. FAO weight listings are not available for a relative discussion (Figs. 20a and b). Preliminary results show this Honda Bay species to be predominantly immature (Figs. 21a and b). It appears that Honda Bay fishermen are removing a dominant proportion of *N. hexodon* juveniles. Possibly stock depletion may be occuring for *N. hexodon* in Honda Bay. Within specific intervals, maturity increases with length (Fig. 23). Data for this species are represented by the highest numbers, and thus most statistically significant of the four.

The data contained in this preliminary report represent only the first quarter of sampling (the first three months of a twelve month survey). Due to low sample sizes, a statistical analysis has not been conducted on these data. At the end of the twelve month survey, all data, including that contained in this report, will be subjected to a complete and detailed statistical analysis. A full report will then be submitted.

It is recommended that no action be taken based on the results contained here. A full year of sampling is first necessary to detect any seasonality in conditions and for statistically more reliable results. By that time, specific recommendations will be made to conserve Honda Bay's fish resources.

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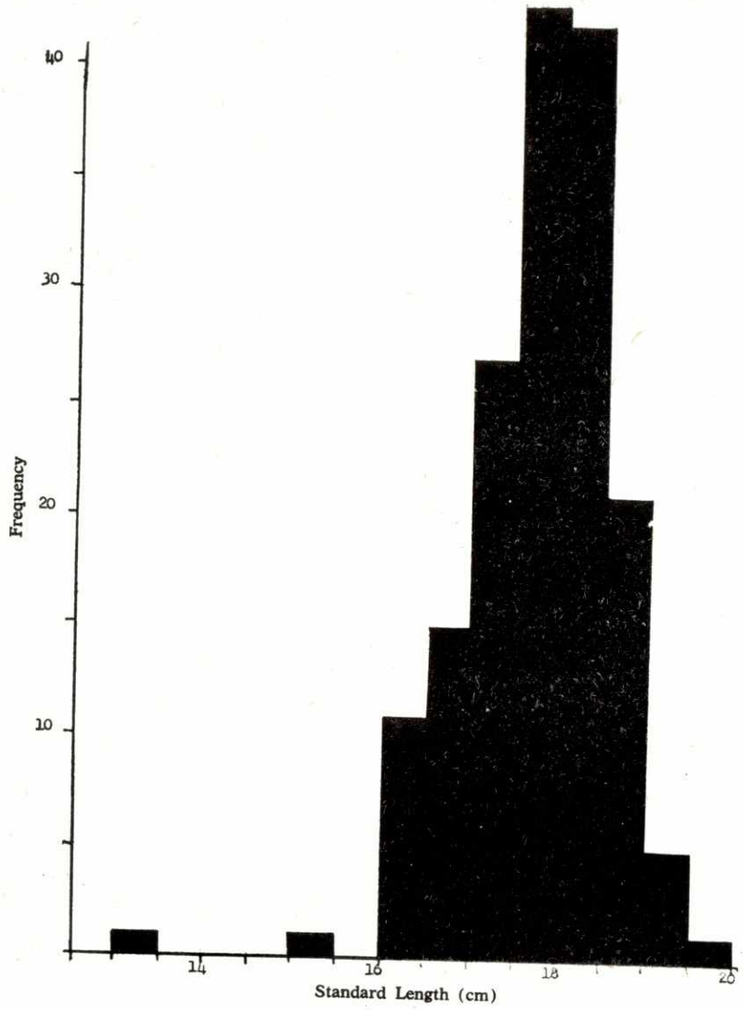


Fig. 1a Length-Frequency Histogram of *Sardinella melanura*

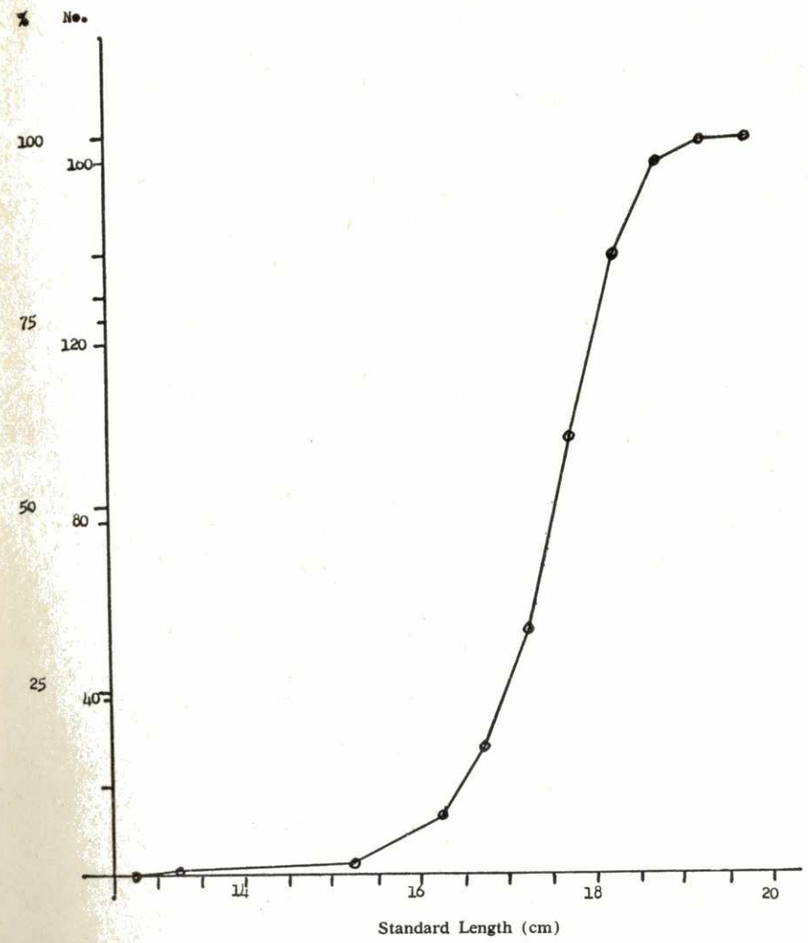


Fig. 1b Length-Cumulative-Frequency Polygon of *Sardinella melanura*

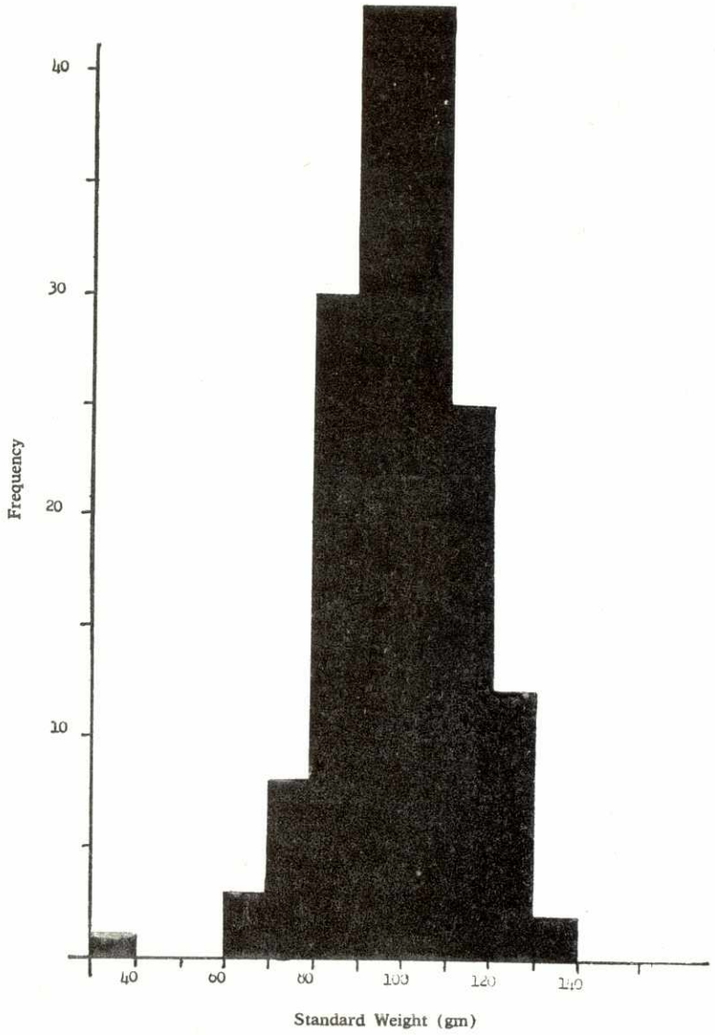


Fig. 2a Weight-Frequency Histogram of *Sardinella melanura*

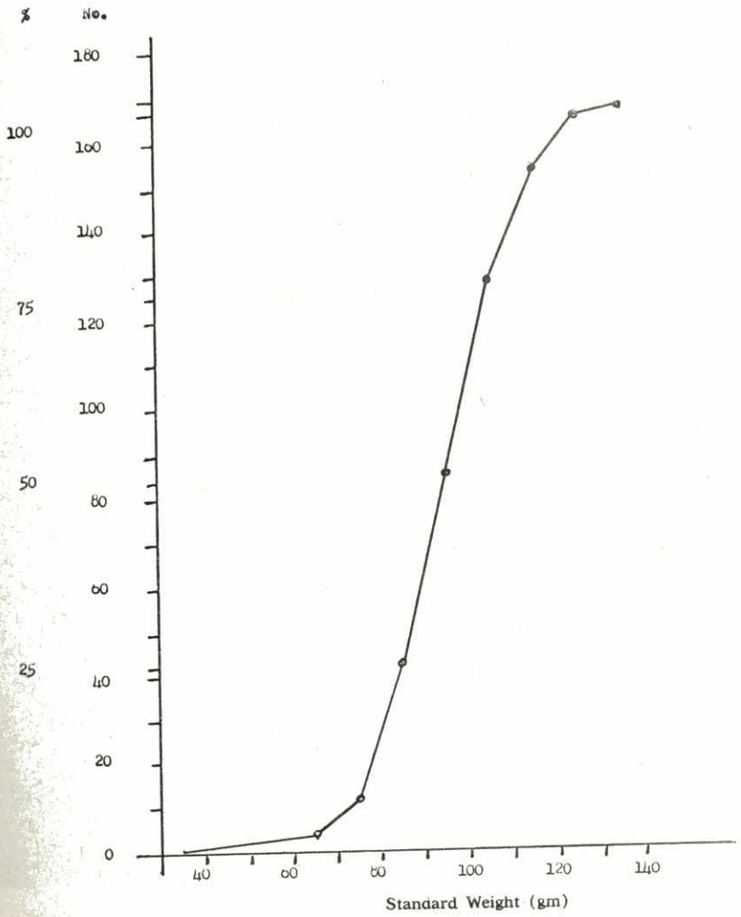


Fig. 2b Weight-Cumulative-Frequency Polygon of *Sardinella melanura*

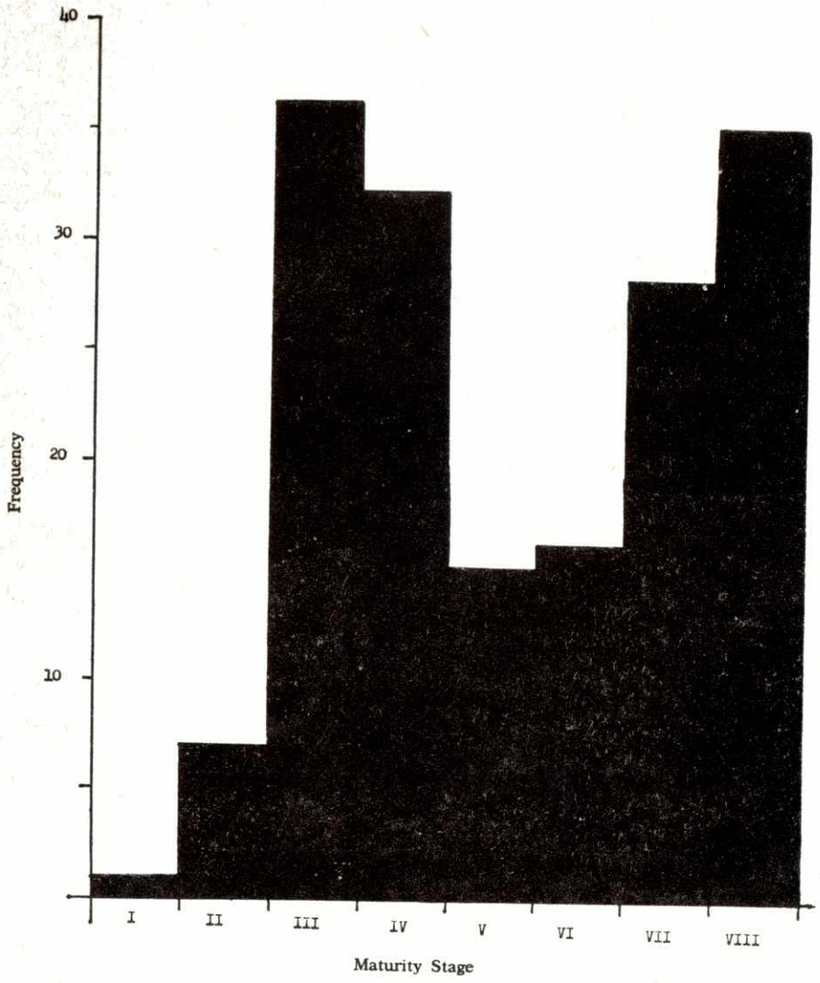


Fig. 3a Maturity-Frequency Histogram of *Sardinella melanura*

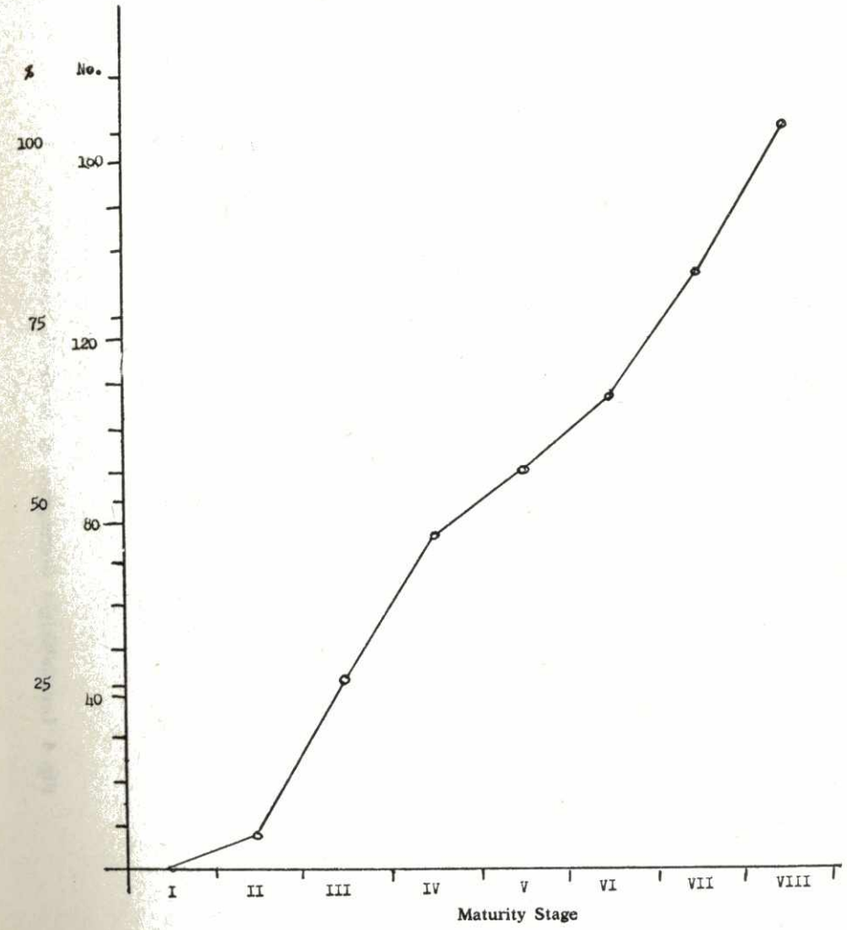


Fig. 3b Maturity-Cumulative-Frequency Polygon of *Sardinella melanura*

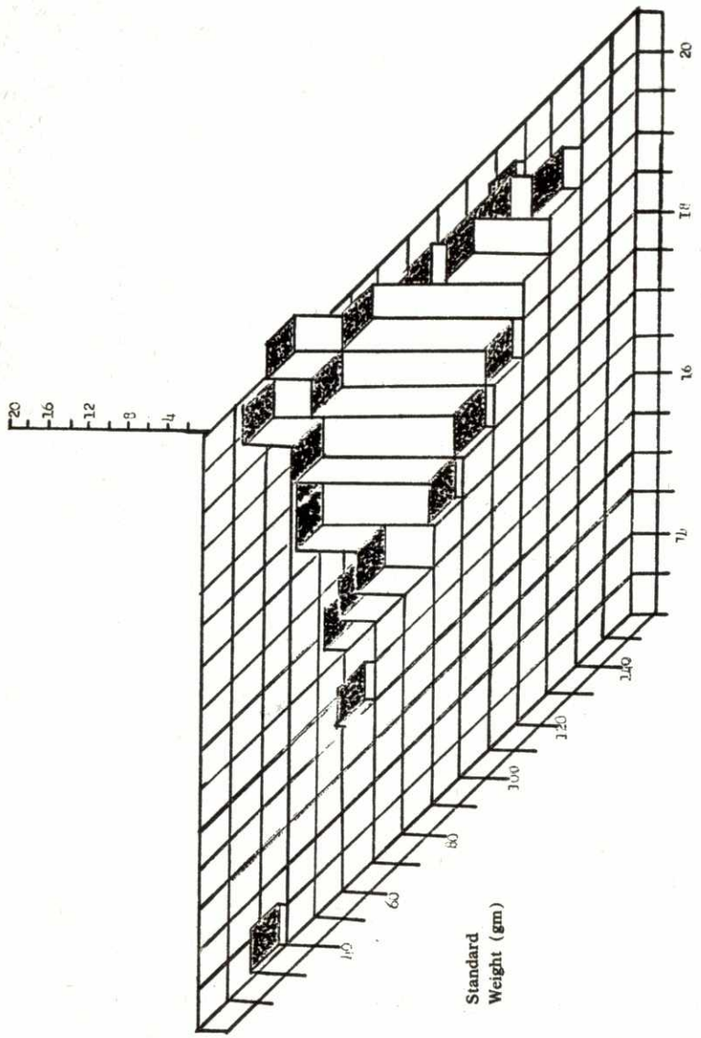


Fig. 4 Length-Weight Stereogram of *Sardinella melanura*

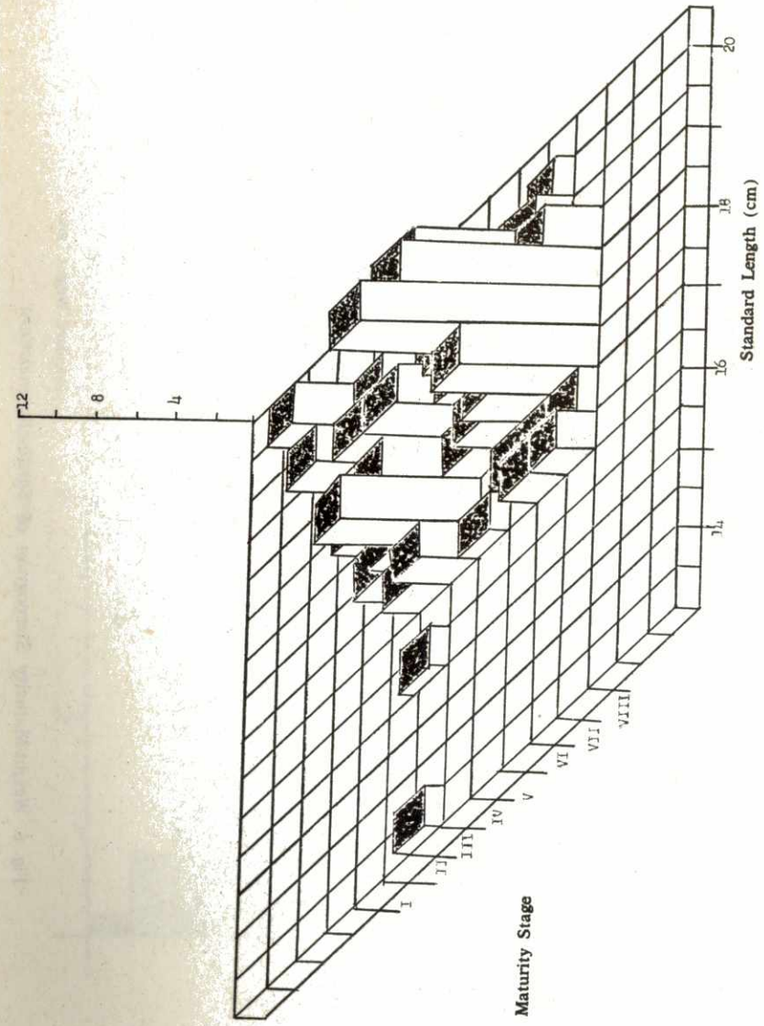


Fig. 5 Length-Maturity Stereogram of *Sardinella melanura*

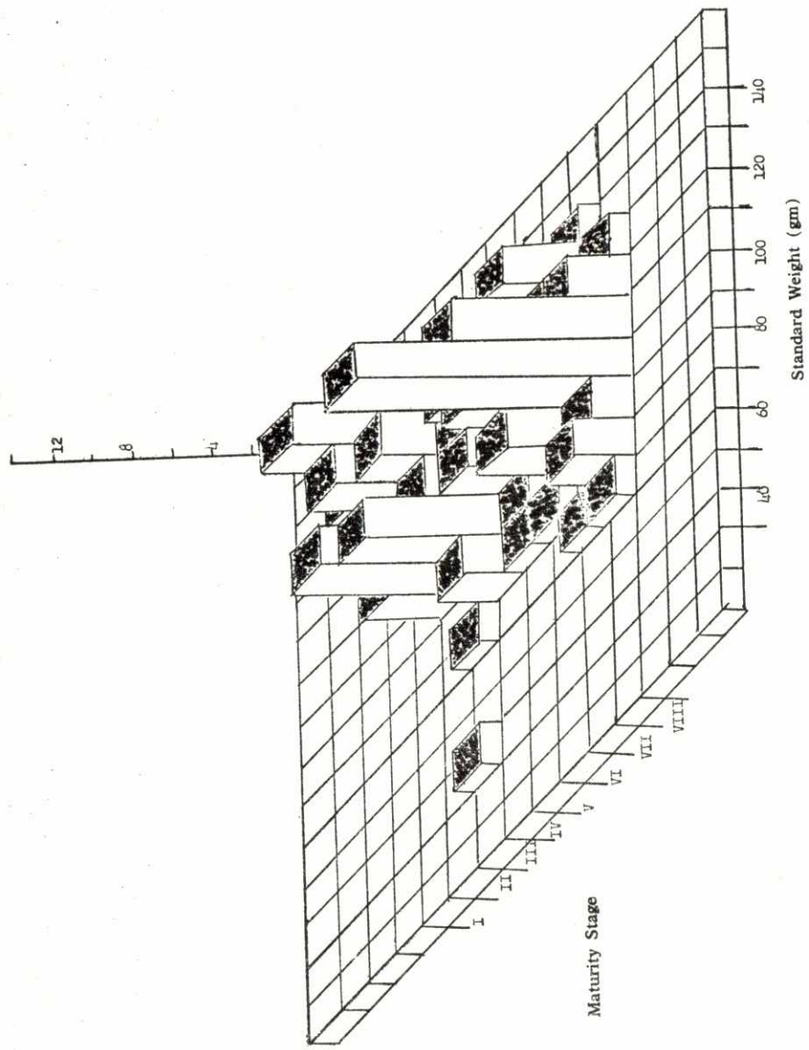


Fig. 6 Weight-Maturity Stereogram of *Sardinella melanura*

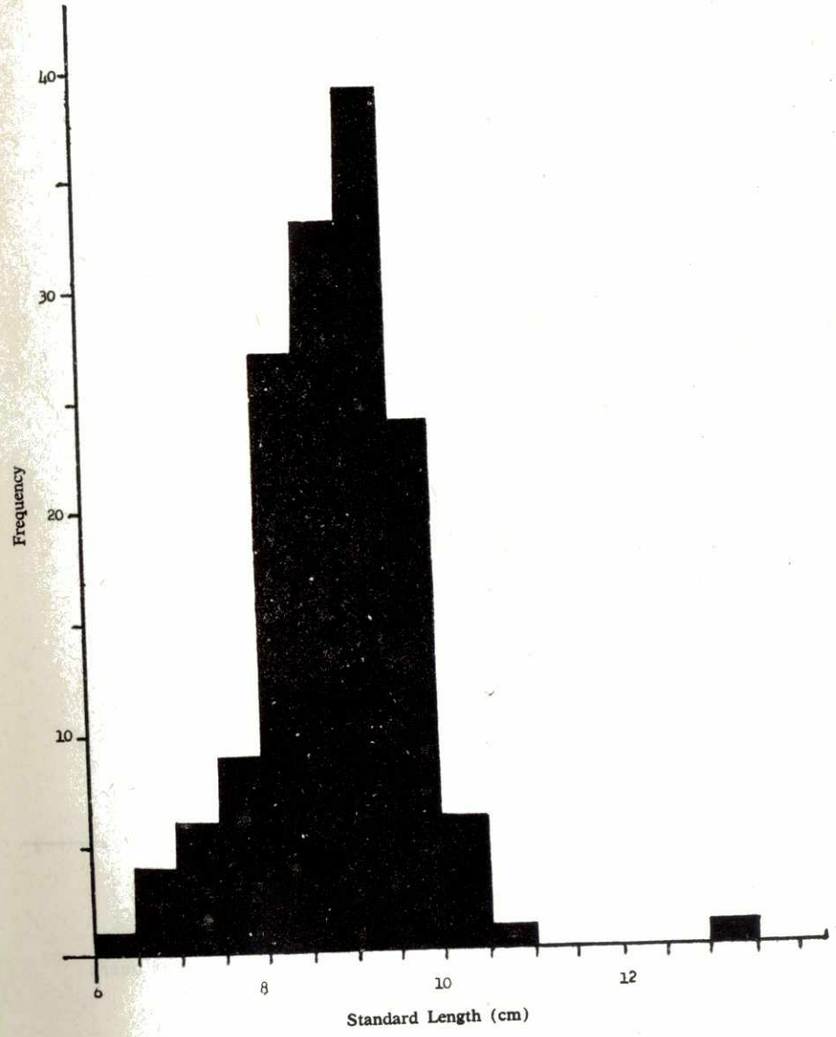


Fig. 7a Length-Frequency Histogram of *Leiognathus daura*

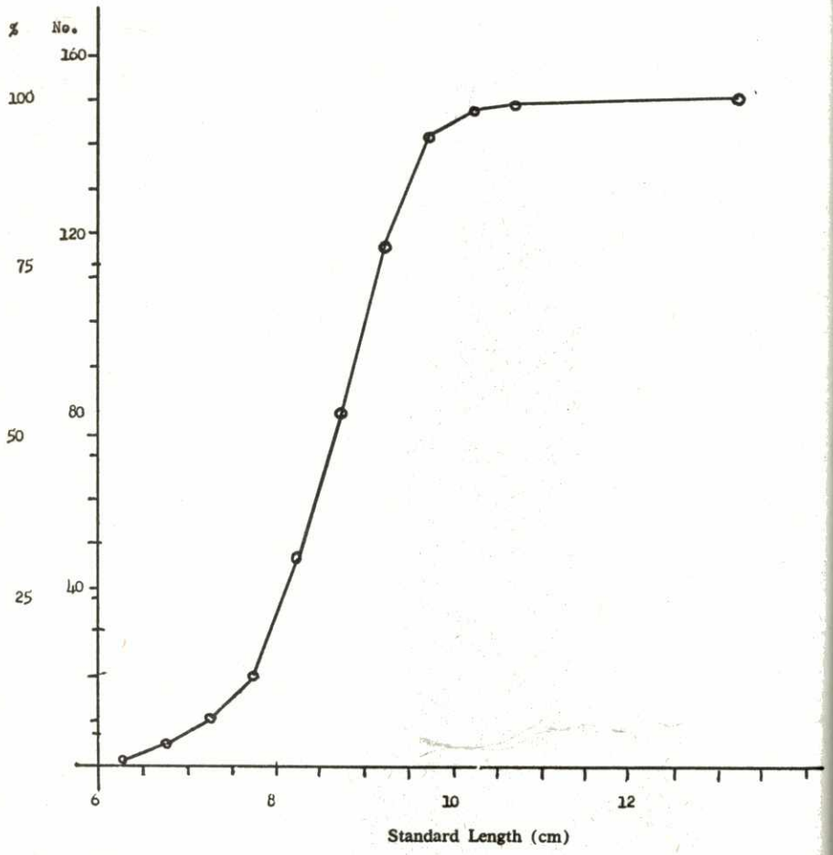


Fig. 7b Length-Cumulative-Frequency Polygon of *Leiognathus daura*

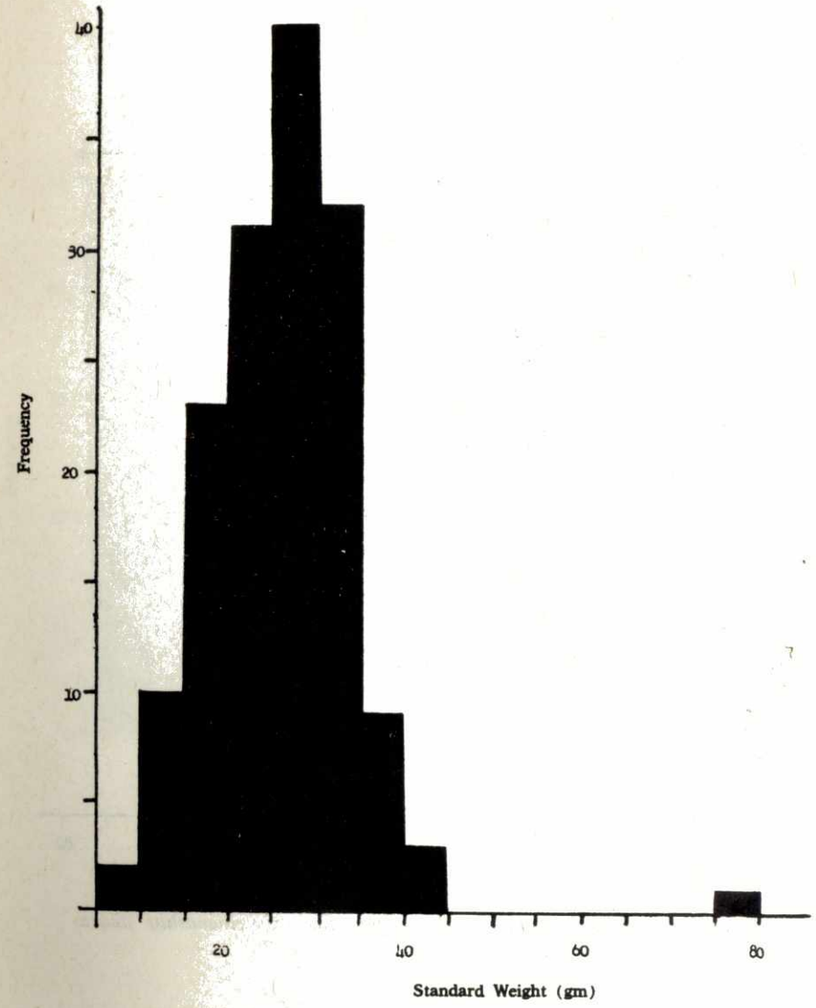


Fig. 8a Weight-Frequency Histogram of *Leiognathus daura*

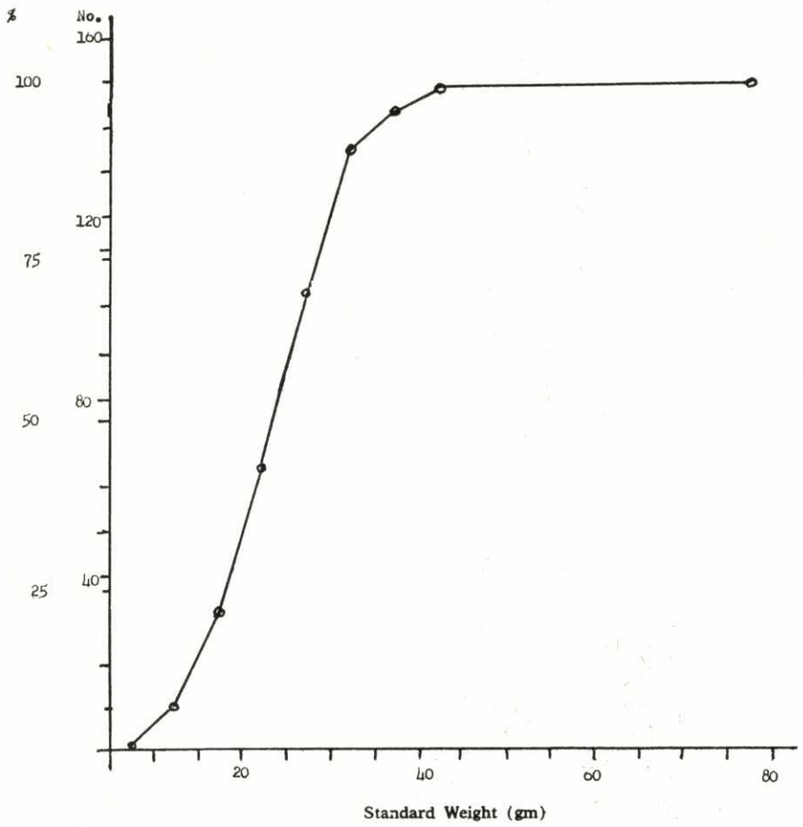


Fig. 8b Weight-Cumulative-Frequency Polygon of *Leiognathus daura*

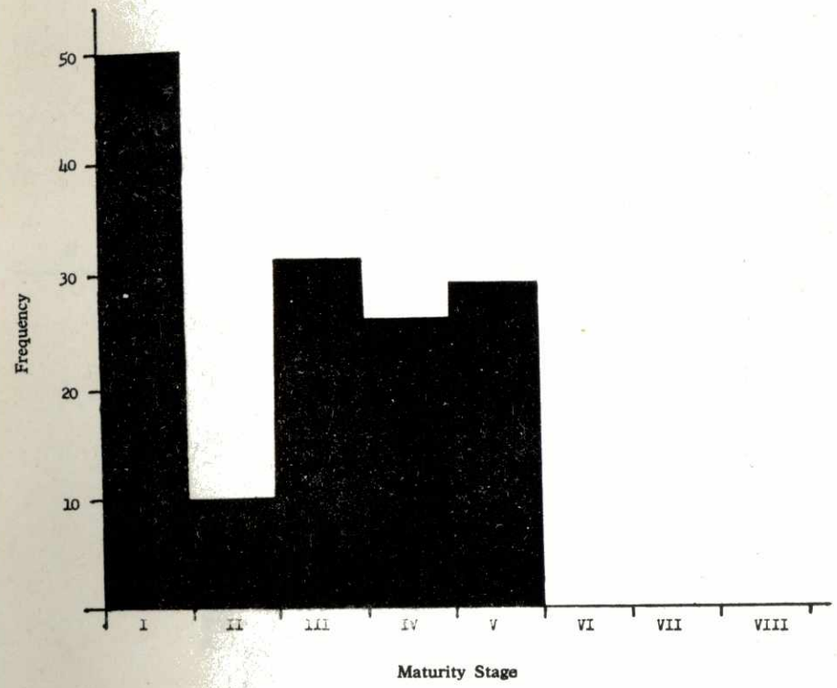


Fig. 9a Maturity-Frequency Histogram of *Leiognathus daura*

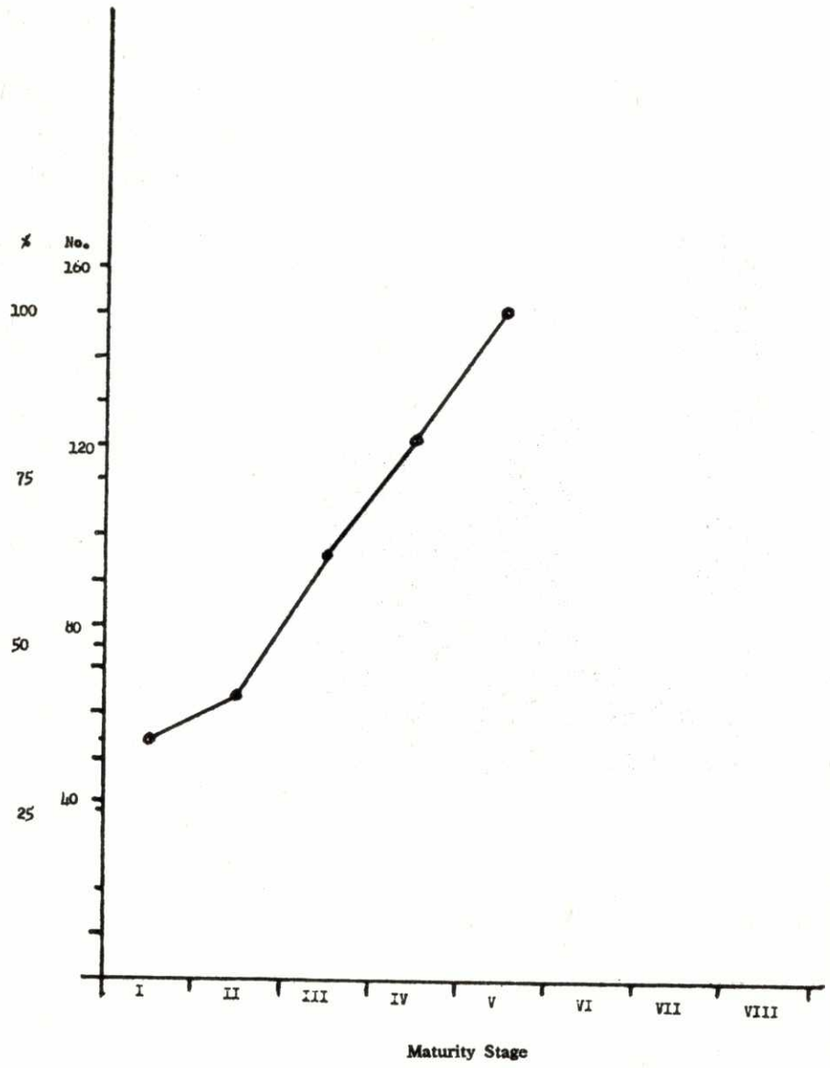


Fig. 9b Maturity-Cumulative-Frequency Polygon of *Leiognathus daura*

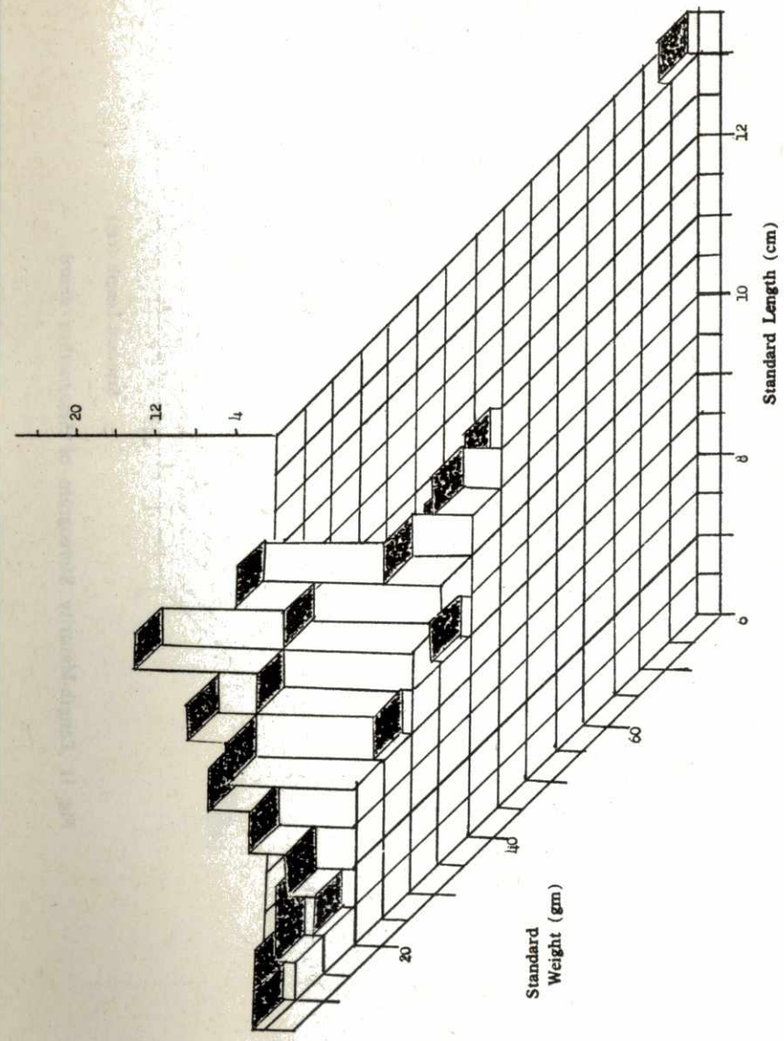


Fig. 10 Length-Weight Stereogram of *Leiognathus daura*

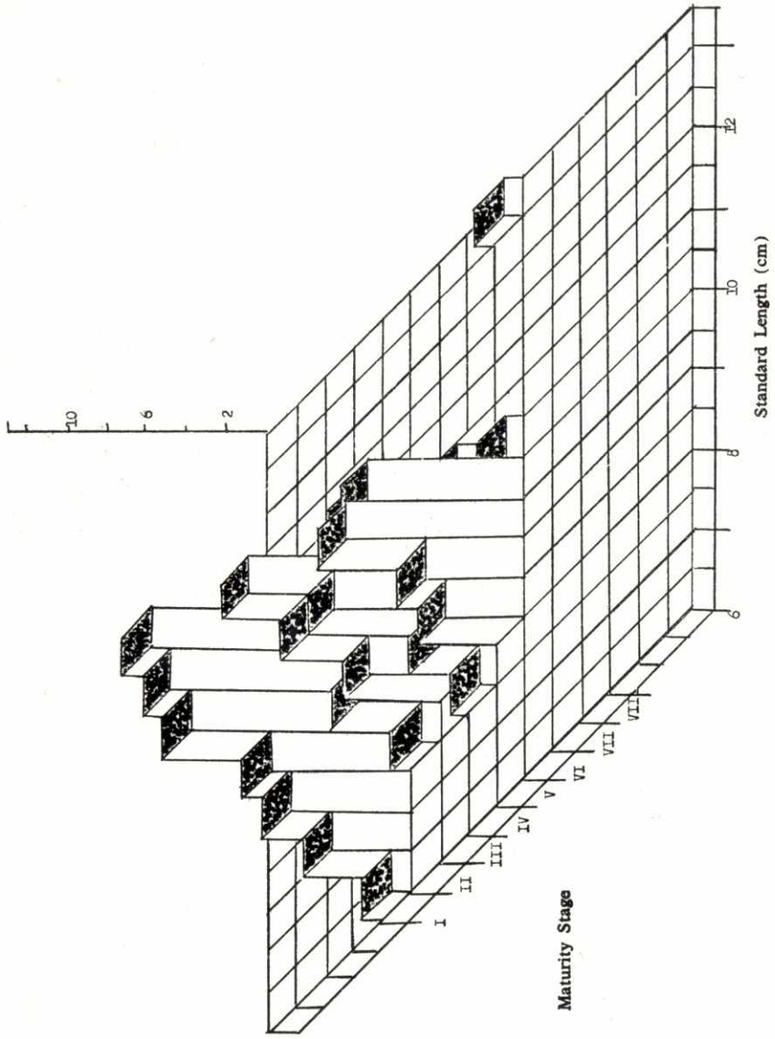


Fig. 11 Length-Maturity Stereogram of *Leiognathus daura*

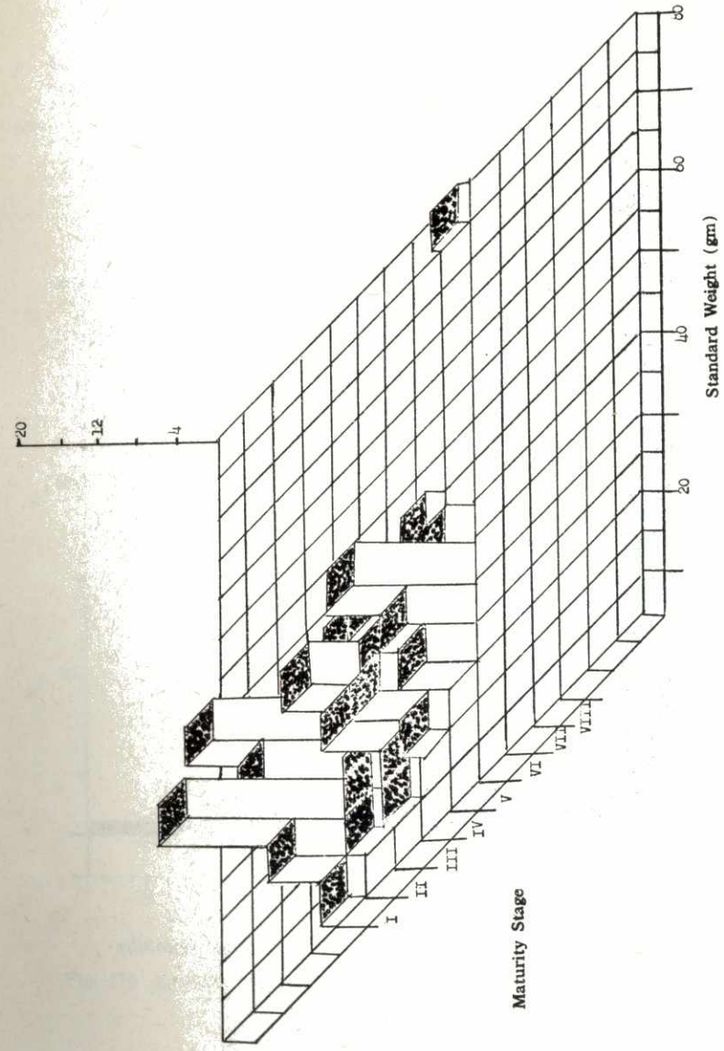


Fig. 12 Weight-Maturity Stereogram of *Leiognathus daura*

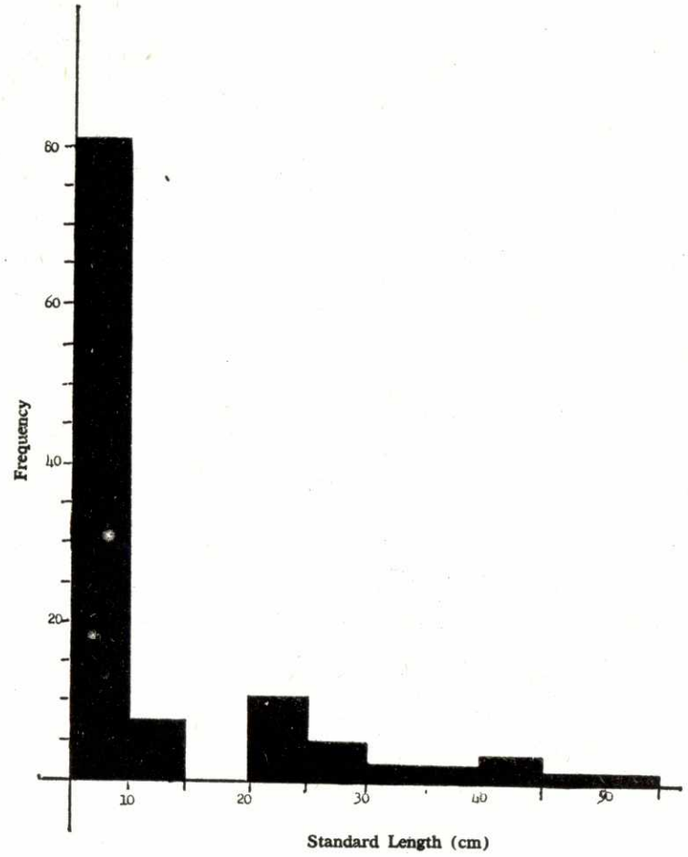


Fig. 13a Length-Frequency Histogram of *Caranx ignobilis*

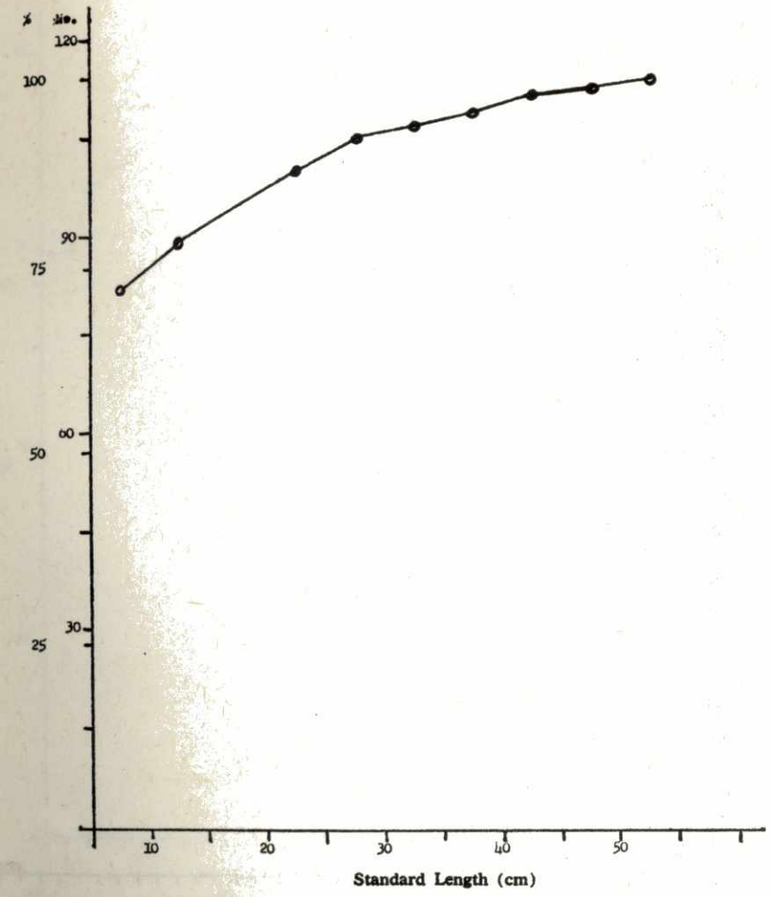


Fig. 13b Length-Cumulative-Frequency Polygon of *Caranx ignobilis*

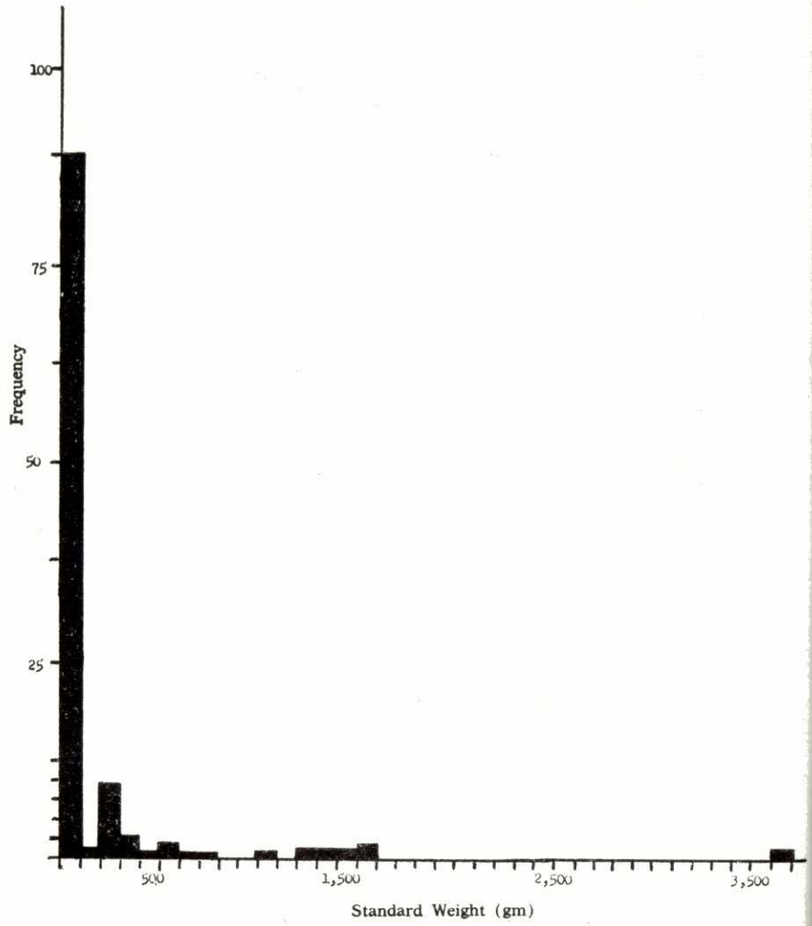


Fig. 14a Weight-Frequency Histogram of *Caranx ignobilis*

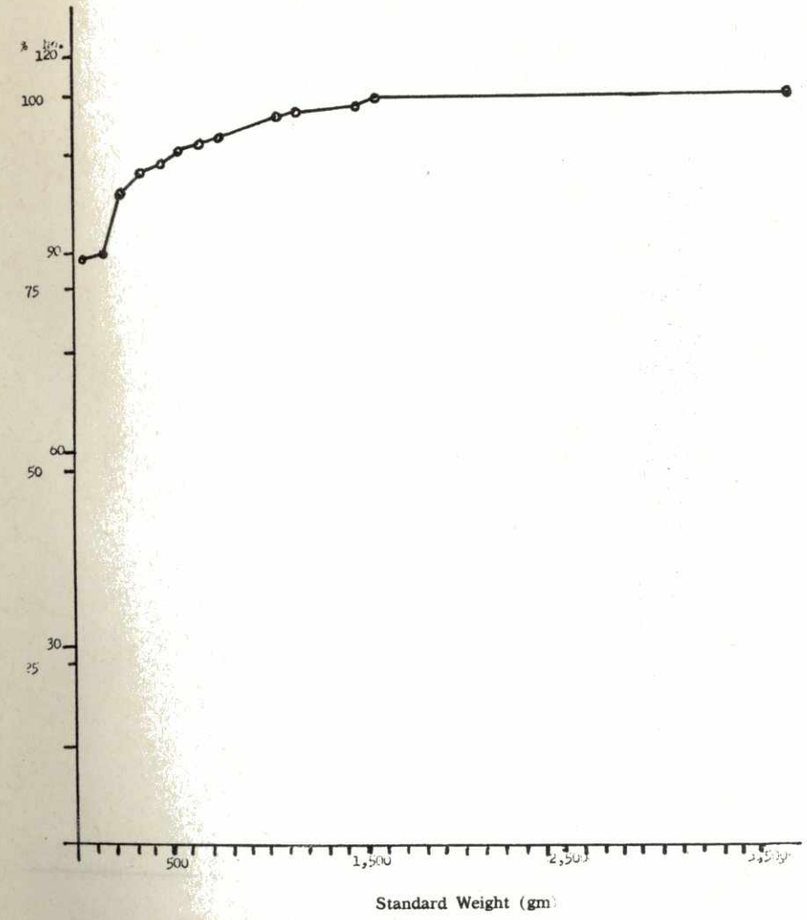


Fig. 14b Weight-Cumulative-Frequency Polygon of *Caranx ignobilis*

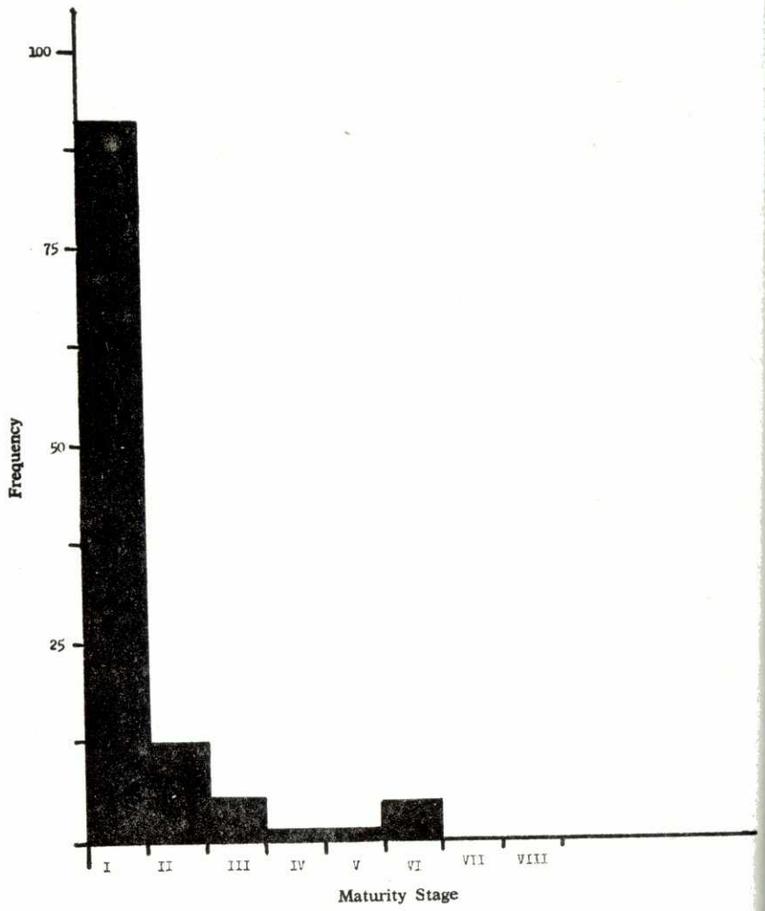


Fig. 15a Maturity-Frequency Histogram of *Caranx ignobilis*

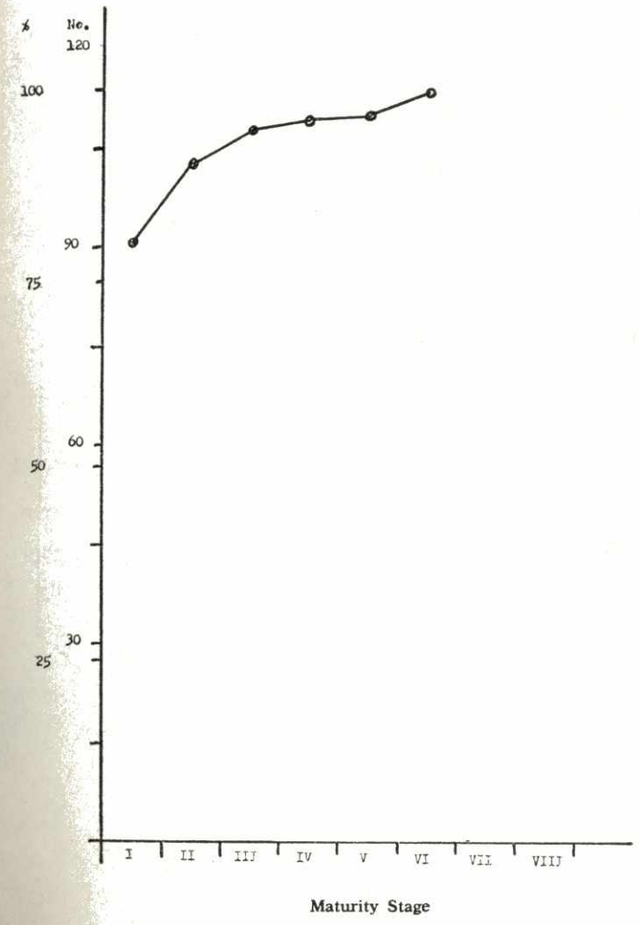
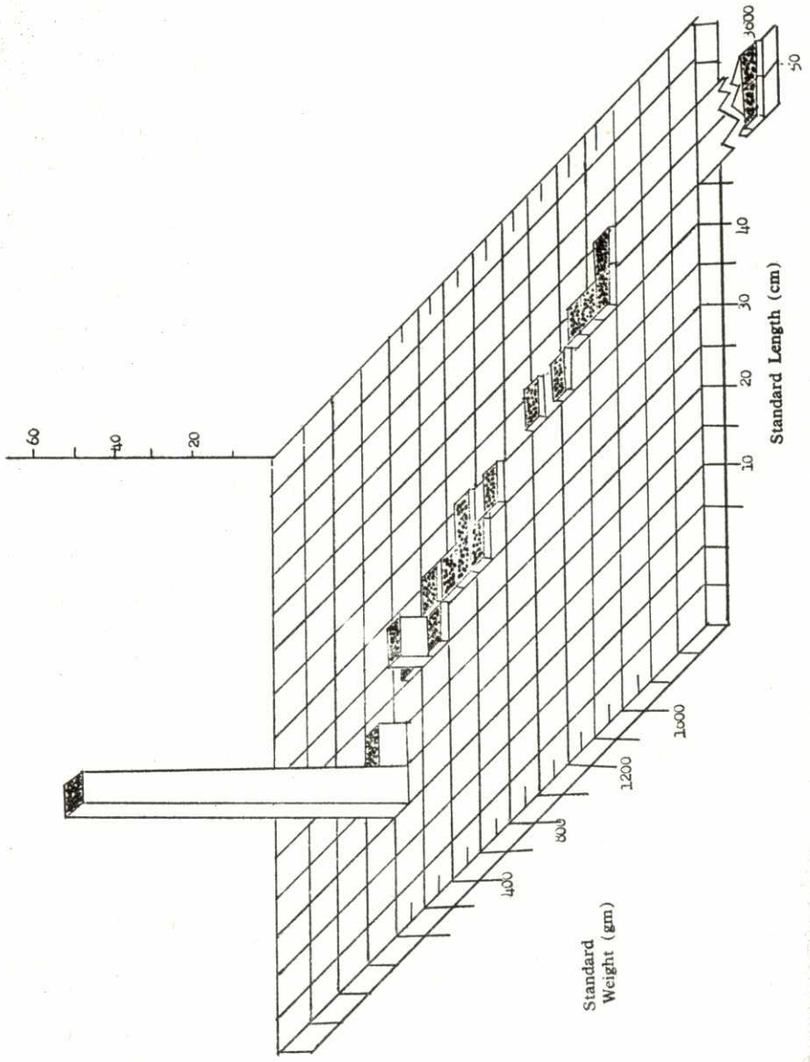


Fig. 15b Maturity-Cumulative-Frequency Polygon of *Caranx ignobilis*



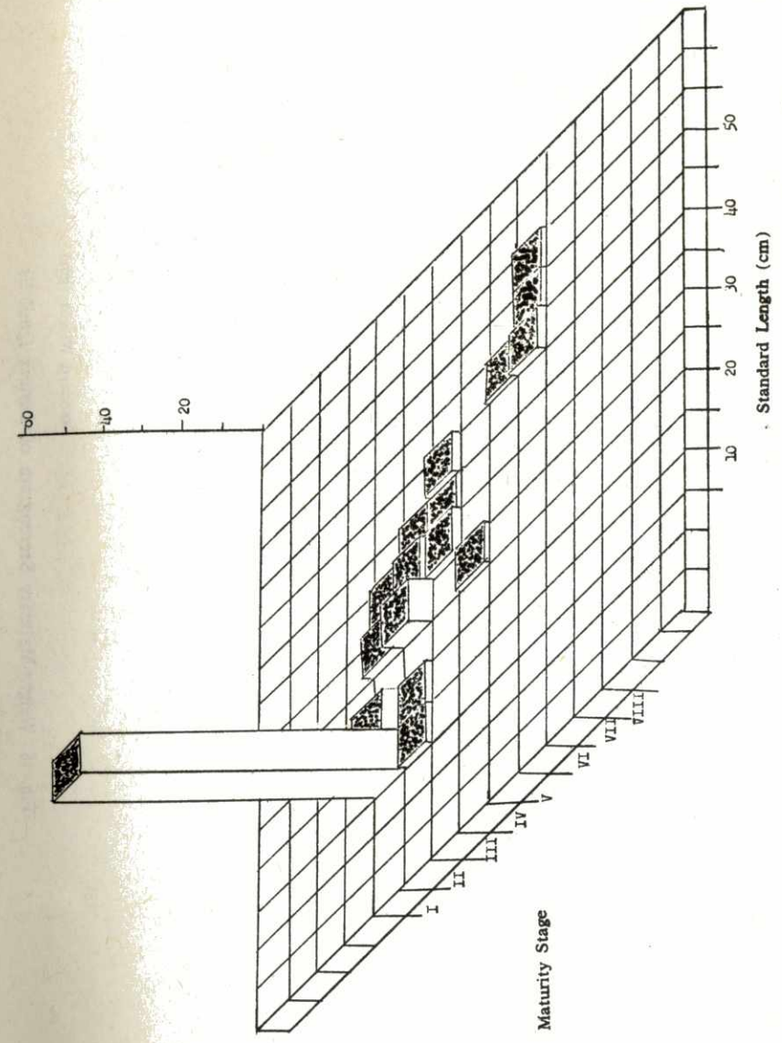


Fig. 17 Length-Maturity Stereogram of *Caranx ignobilis*

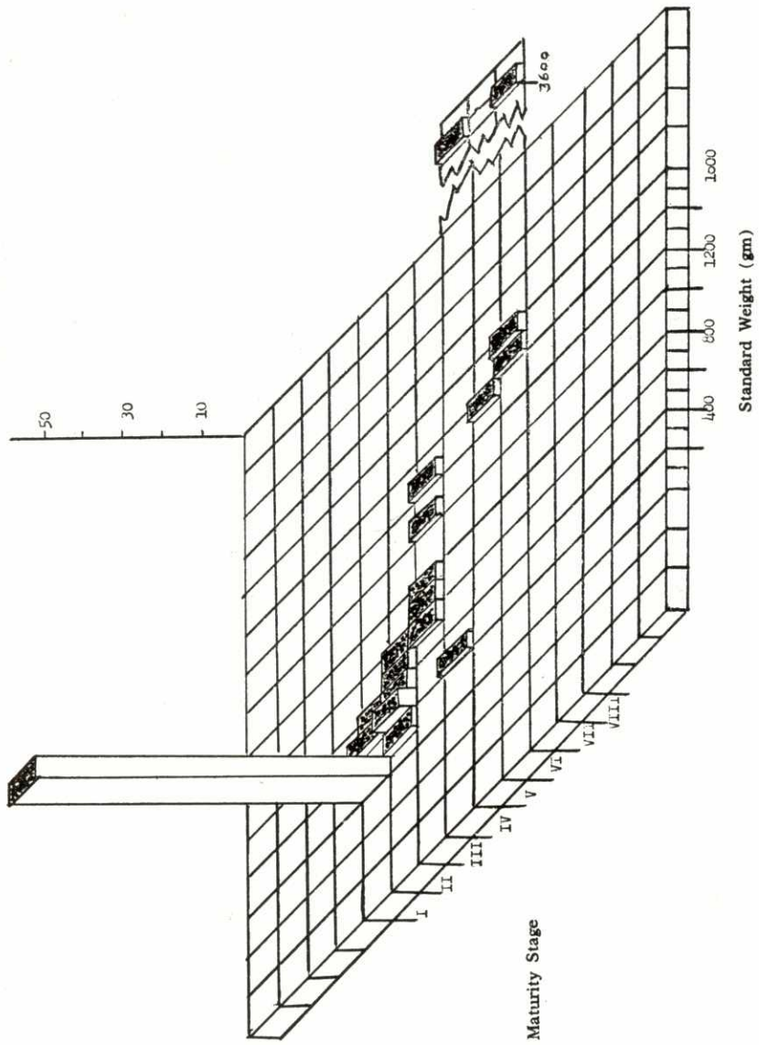


Fig. 18 Weight-Maturity Stereogram of *Caranx ignobilis*

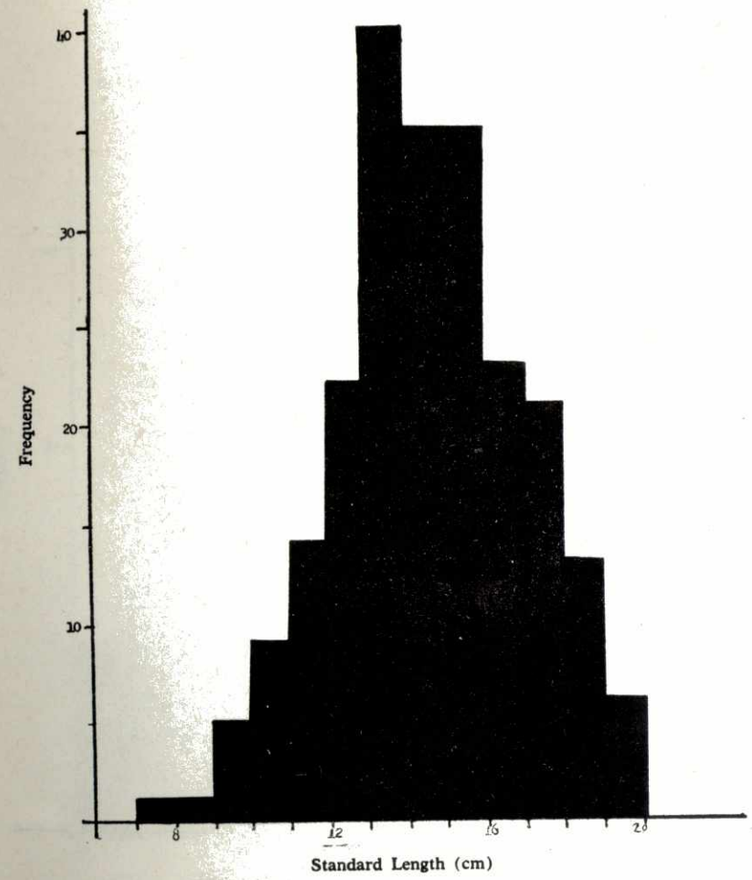


Fig. 19a Length-Frequency Histogram of *Nemipterus hexodon*

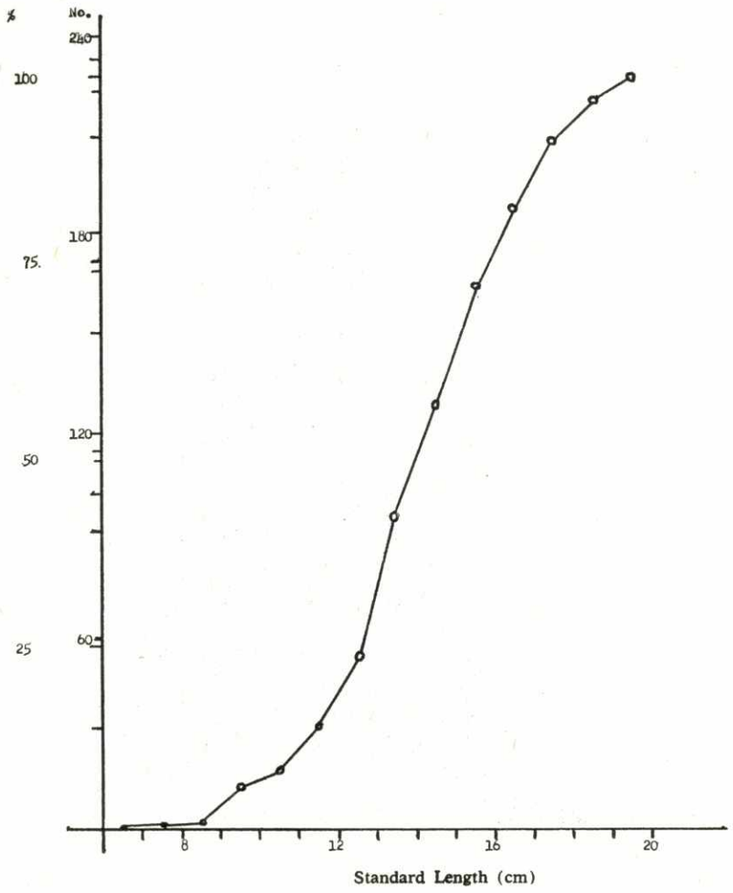


Fig. 19b Length-Cumulative-Frequency Polygon of *Nemipterus hexodon*

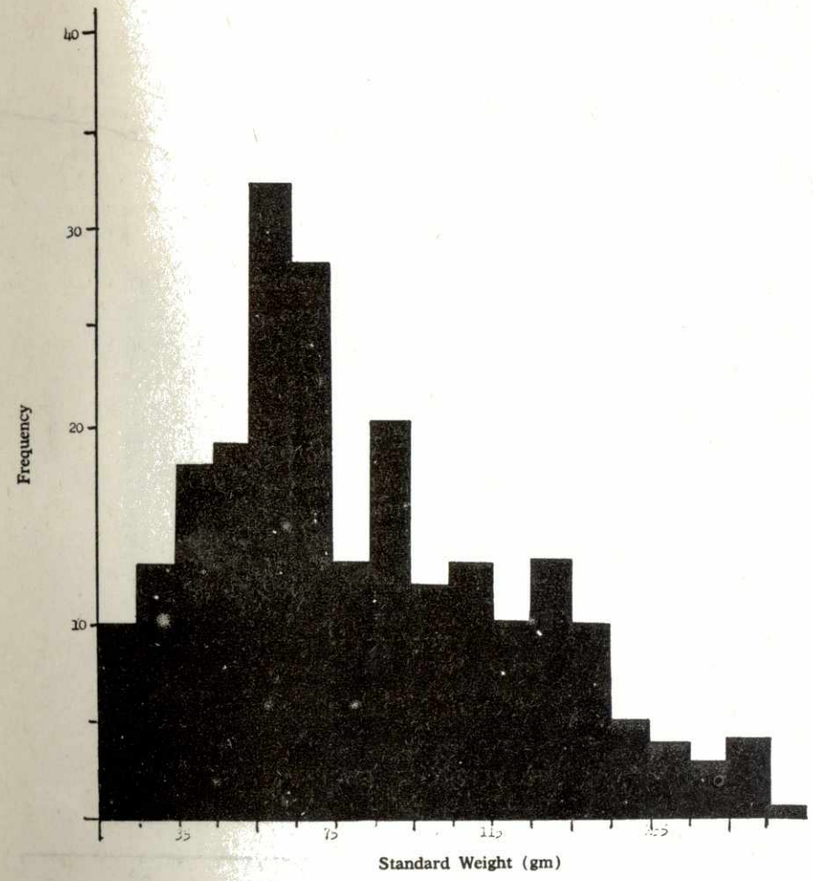


Fig.20a Weight-Frequency Histogram of *Nemipterus hexodon*

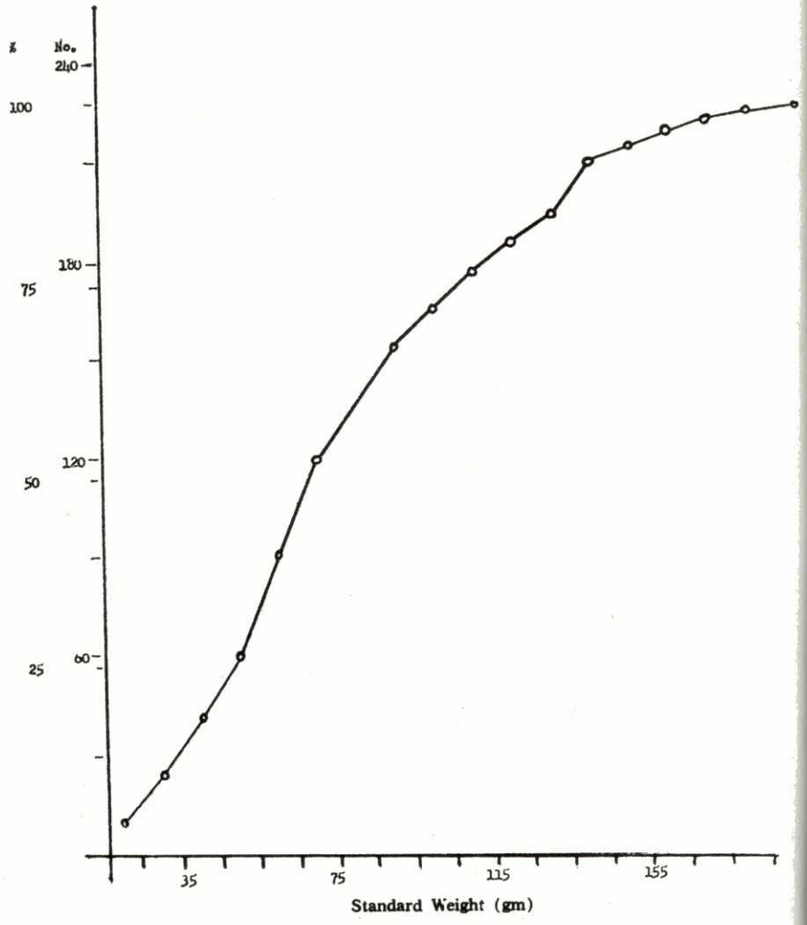


Fig. 20b Weight-Cumulative-Frequency Polygon of *Nemipterus hexodon*

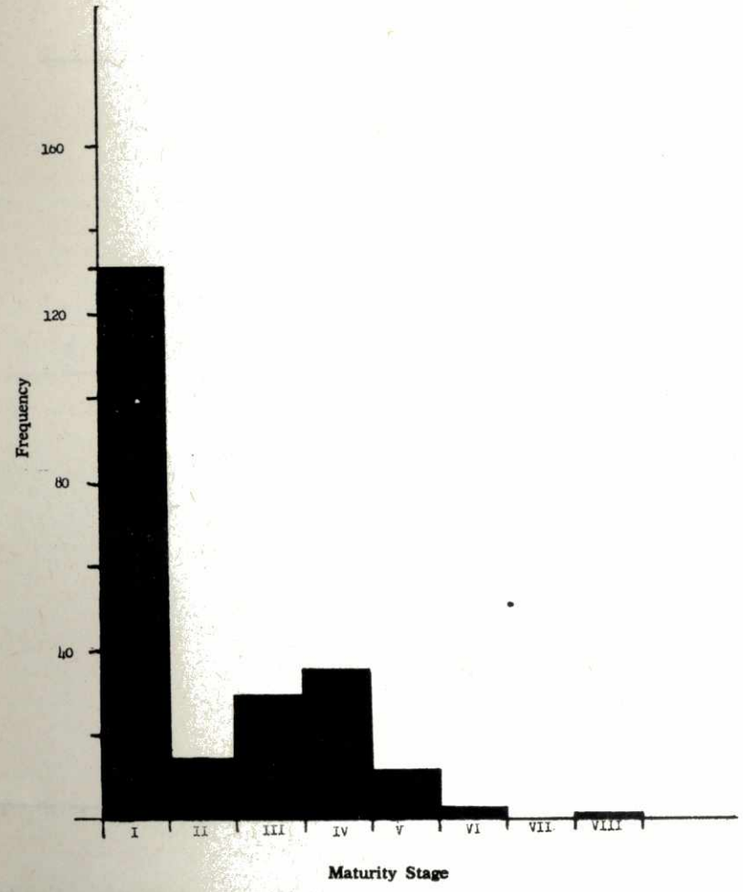


Fig. 21a Maturity-Frequency Histogram of *Nemipterus hexodon*

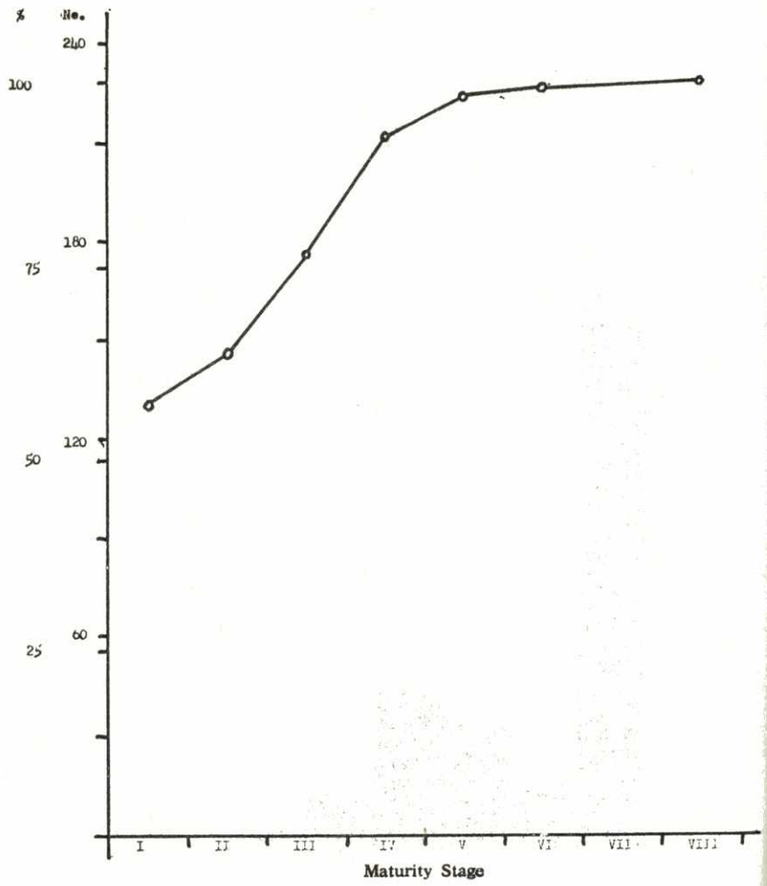


Fig. 21b Maturity-Cumulative-Frequency Polygon for *Nemipterus hexodon*

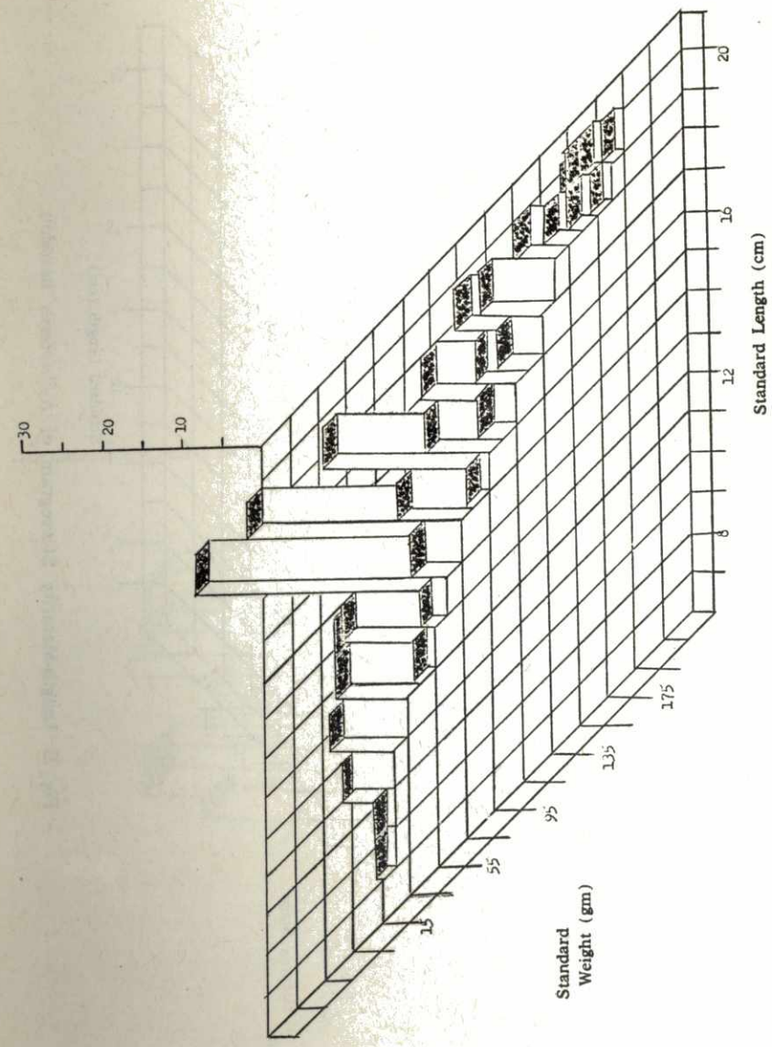


Fig. 22 Length-Weight Stereogram of *Nemipterus hexodon*

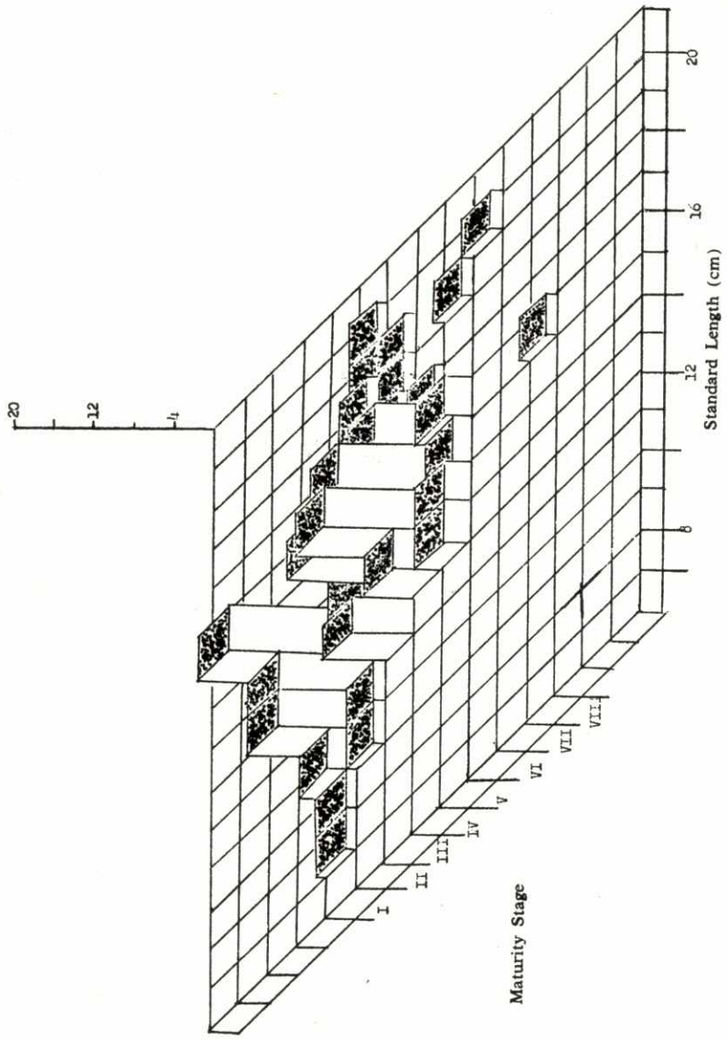


Fig. 23 Length-Maturity Stereogram of *Nemipterus hexodon*

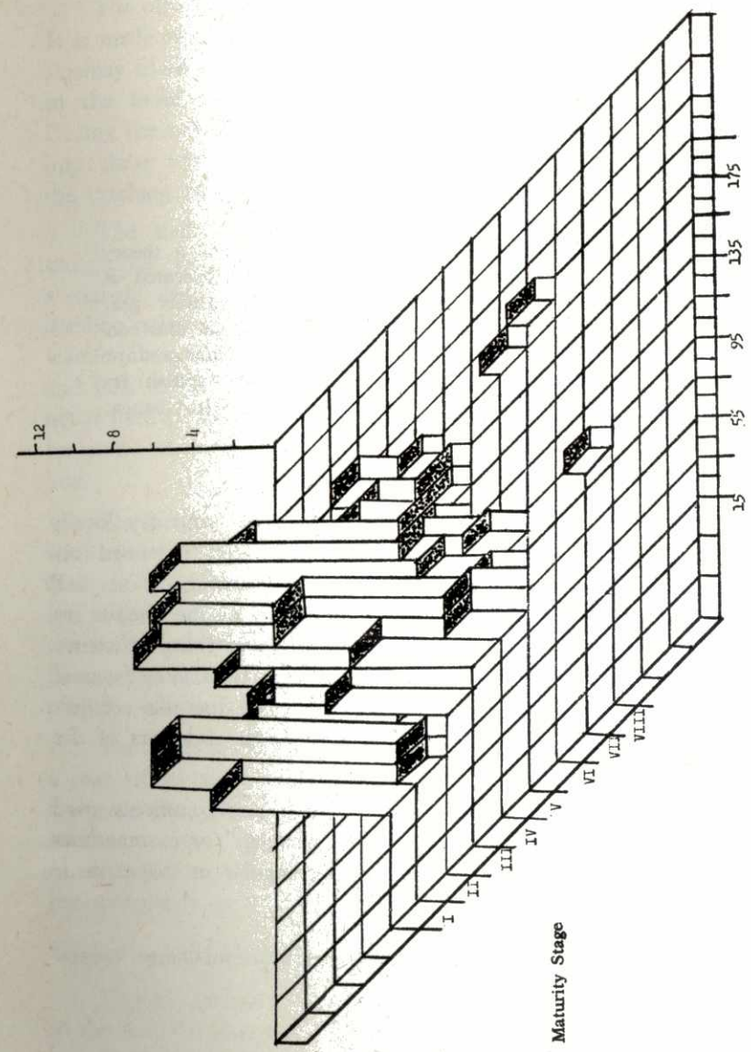


Fig. 24 Weight-Maturity Stereogram of *Nemipterus hexodon*