

ECOLOGY AND BIOLOGY OF *ABUDEFDUF GLAUCUS* (CUVIER) (POMACENTRIDAE, PISCES) FROM MINICOY ATOLL, LAKSHADWEEP

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ABSTRACT

Abudefduf glaucus forms a very conspicuous component of the upper reef flat ichthyofaunal assemblage throughout Lakshadweep. It is found living under crevices of reef rocks and under the dead boulders and often swimming out in small shoals. The fish is sluggish. Juveniles settle at first in small upper littoral rock pools. The dispersal takes place when it attains a total length of 30 to 40 mm.

The species is essentially a herbivore, feeding on small encrusting and filamentous algae found attached to reef rocks, though sometimes copepods and calcareous material are found in the gut. The fish is active during the day time.

A common formula for both the males and females to establish the length-weight relationship is given as follows :

$$\text{Log } W = -3.773507 + 2.534044 \text{ Log } L.$$

Size at first maturity at 50% level is 60 mm T. L. This indicates that dispersal of the species after settlement in rock pools takes place before attaining sexual maturity. The species breeds throughout the year, perhaps with peaks in September to December and February to March. Females show a higher ratio than males in the population indicating that the species could be a colonial breeder, a male spawning with more than one female at a time. The total number of matured eggs in an ovary ranges from 8,789 to 23,655 when the total length of the fish varied from 74 to 92 mm.

The population is always multimodal due to continual recruitment. The individual fish attains a T. L. of 77 mm by the first year with an average monthly growth of 6.41 mm and theoretically 113 mm by the end of the second year. However, the largest fish in the samples studied was only 98 mm in T. L.

INTRODUCTION

Studies on the ecology and biology of some reef fishes from Lakshadweep were initiated by the present authors during 1981-'83. Part of the information thus gathered was already made available to the scientific community (Pillai *et al.*, 1983; Pillai *et al.*, 1986; Pillai and Madan Mohan, 1988; Pillai *et al.*, 1988; Madan Mohan and Pillai, 1987). The present paper deals with a short account of the ecology and biology of the

pomacentrid *Abudefduf glaucus* which constitute a dominant element of the fish assemblage of the upper reef flat throughout Lakshadweep. The fish is usually not eaten in Minicoy, though it is reported that in some of the northern islands it is caught during monsoon when other fishes are not available for food.

ECOLOGY

Abudefduf glaucus is found at the upper littoral water marks under boulders and

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small rock pools in small shoals. They often swim out of the crevices and from under the boulders and return to the dwelling places at the sign of the least disturbance. Post-larvae settle in the tide pools throughout the year and remain there until they attain a size of 30 to 40 mm in total length. Dispersal of the juveniles from the site of first settlement occurs just before they attain sexual maturity. Whether the species has an early pelagic life like most of the reef fishes is not ascertained during the present study. The species is diurnal in activity. It must be assumed that the species should form an important link in the food chain of many larger carnivorous fishes of the reef.

MATERIAL AND METHODS

Samples during the present study was collected from the leeward side of Minicoy Atoll during July, 1981 to June, 1983 with the help of a cast net covering the loose dead boulders and thus hand picking the fishes that entangled. Biweekly samples were analysed in fresh condition. Total length of the fish was recorded in mm and weight in g. For maturity studies ova counts were made with the help of a plankton counting chamber. In all ova diameter measurements 80 μ m is equal to 1 mm. Comparison of the present results is rendered difficult due to lack of earlier studies on the species.

Length-Weight Relationship

Four hundred and fifty specimens; 210 males and 240 females, were analysed to establish the length-weight relationship of this species. The length-weight relationship for male and female was found to be as follows:

Males : $\text{Log } W = -3.793824 + 2.533923 \text{ Log } L$.

Females : $\text{Log } W = -3.962517 + 2.645178 \text{ Log } L$.

Analysis of covariance indicated no significant difference in the regression lines for males and females, hence a common equation to establish the length-weight relationship of the species is given as follows :

$\text{Log } W = -3.773507 + 2.534044 \text{ Log } L$.

Food And Feeding

With a view to ascertaining the nature of food and condition of the feed, the gut contents of 486 specimens were analysed during the study. The samples were collected during day generally between 0900 and 1700 hrs depending on the tide. The gut contents formed mainly encrusting and filamentous algae were commonly found on dead coral boulders of the reef flat. However, in a few cases copepods and calcareous matters were also observed. It is likely that these entered into the stomach along with the algae. There was no appreciable difference in the gut contents of the adults and the newly settled post-larvae. We have made no attempt to analyse the guts of early larval forms and at this stage it is difficult to say whether the larvae feeds on planktonic organisms and then switch on to algal food after settlement.

Fishes with half-full, three-fourth full and full stomachs are pooled together as fully fed and details of condition of feed on monthly basis is presented in Table 1. Majority of the fish throughout the year is fully fed indicating active feeding during day time. Any correlation between feeding and spawning activity could not be established.

Reproduction

Stages of maturity

Stage I : Gonads visible under a lens. Ovary occupies about 1/4th of the body cavity. Ova transparent, elongated with a centrally placed large nucleus. Ova measure

TABLE 1. Feeding condition of *Abudefduf glaucus* at Minicoy based on day time collection. Data for July, 1981 to June, 1983 pooled together for monthly average

Month	No. of fish examined	Empty (%)	Fully fed (%)
July	28	17.86	82.14
August	34	14.71	85.29
September	42	45.24	54.76
October	60	10.00	90.00
November	78	37.18	62.82
December	22	4.55	95.45
January	36	5.56	94.44
February	21	23.81	76.19
March	114	22.81	77.19
April	124	45.16	54.84
May	74	40.54	59.46
June	54	31.48	68.52

1 to 8 md with a mode at 4 md. Testis very thin, narrow and white in colour.

Stage II : Gonads occupy about 1/3rd of the body cavity. Ovary starts thickening. Ova of different sizes from 1 to 24 md with mode at 12md. Testis also starts thickening than the stage I. Spent and recovering stages also show the same mode of ova.

Stage III (Maturing) : Gonads occupy about half the length of the body cavity. Three distinct modes of ova viz., immature with a mode at 4 md, intermediate with a mode at 12 md and maturing ones with a mode at 24 md. Deposition of yolk visible in larger eggs. Testis becomes prominent.

Stage IV (Mature) : Ovary shows yellow colour with enlarged blood vessels on the wall. Mature ova between 36 and 56 md, mode 44 and 52 md. Testis thick and cream coloured.

Stage V (Ripe) : Ovary yellow with prominent blood vessels. Ova becomes opaque with a size of 44 to 64 md, mode 52 md. Testis well formed.

Stage VI (Spawning) : Ovary deep yellow. Wall becomes thin and ova is visible. Larger ova that are ready for spawning remain free from the ovarian wall. Larger ova still grow and reaches 68 md with a mode at 60 md. Testis cream coloured with an oily appearance.

Stage VII (Spent) : Ovary shrunk, narrow and crumbled. Wall with blood vessels. Ova 1 to 16 md with mode at 12 md.

Progression of ova to maturity (Fig.1). In the 1st stage, ova proliferate from the ovarian wall and vary from 1 to 8 md with a mode of 4 md. In the 2nd stage the larger ova advances to 12 md though proliferation of ovarian wall continues as is seen in all stages of maturity. Three distinct modes of ova are recognisable in the 3rd stage viz., 4 md, 12 md and 24 md. As the 4th stage is reached the large mode in lower stage soon advances to 44 md and 52 md which are destined to spawn soon. In the 5th stage matured ova attain a mode of 52 md with a thick deposition of yolk. At the spawning stage the larger ova are at a mode of 60 md. The occurrence of different modes and continuous proliferation of the ovarian wall indicates that an individual sheds the eggs in batches during a spawning season and the fish may spawn for more than a day at a time.

Sex ratio

The percentages of males and females in the natural population for the various months during the period of study is presented in Table 2. During July, 1981 to June, '82 male: female was 1 : 1.70 and during July '82 to June, 1983 it was 1 : 1.14. A predominance of female is indicated in nature which may suggest that a male will spawn with more than one female at a time.

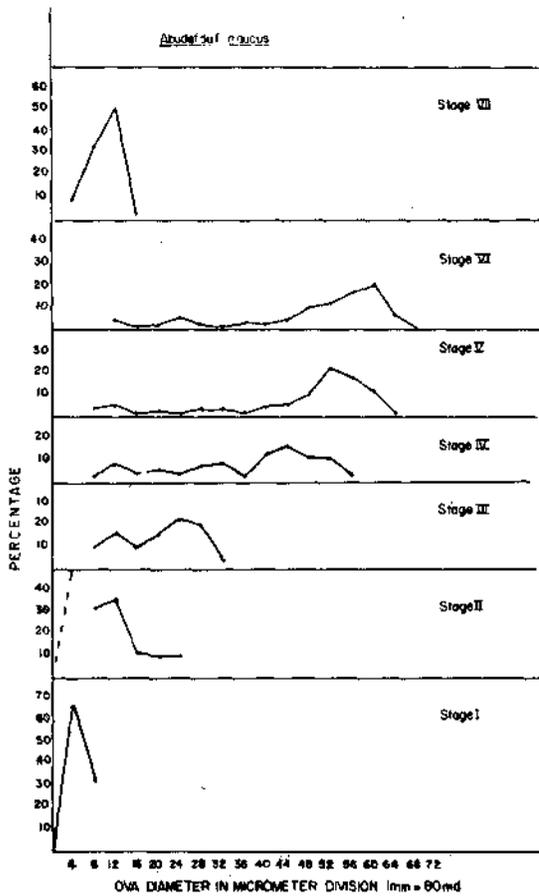


Fig. 1. Ova diameter polygons at different stages of maturity *Abudedefduf glaucus*.

Size at first maturity

A total of 427 specimens was analysed that belong to different maturity stages, to determine the size at first maturity of the species. Stages I and II are treated as immature and stages III to VII as mature. The percentages of fishes at 4 mm length frequency intervals are given in figure 2. As shown in figure (2) the size at first maturity at 50% level is 60 mm T. L.

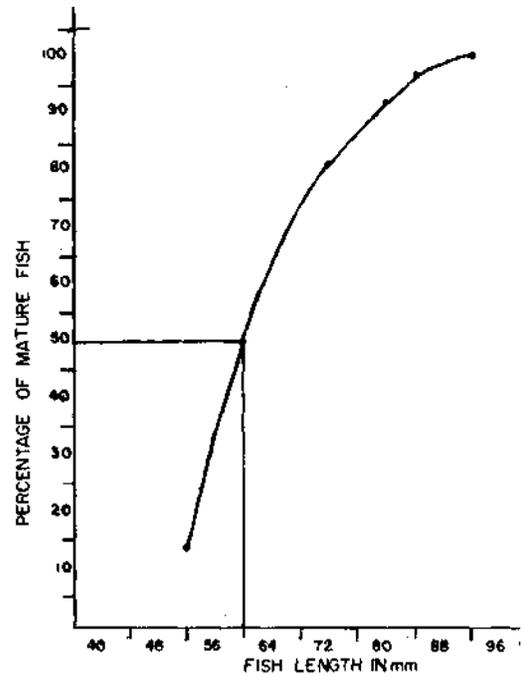


Fig. 2. Length at First maturity at 50% level in *Abudedefduf glaucus*.

Spawning season

The percentages of different stages of maturity in various months are presented in Table 3. The data is based on the analysis of 619 specimens. As indicated in the Table 3 mature and spent fishes are present throughout the year showing that the species spawns throughout the year at Minicoy. However, September to December and February to March seem to be the active period of breeding. Though post-larvae get recruited to the tidal and rock pools throughout the year there is a profusion of them during November-December period.

Fecundity

We have not ascertained the number of spawning by an individual in a year. An individual is likely to spawn more than once in a year as is evident from the maturity

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TABLE 2. Percentage occurrence of males and females in *Abudefduf glaucus* from July, 1981 to June, 1983 at Minicoy

Months	1981 - 1982			1982-1983		
	Total No.	Males (%)	Females (%)	Total No.	Males (%)	Females (%)
July	27	37.04	62.96	—	—	—
August	24	25.00	75.00	10	60.00	40.00
September	17	35.30	64.70	25	40.00	60.00
October	13	30.77	69.23	47	29.79	70.21
November	24	25.00	75.00	54	53.70	46.30
December	—	—	—	22	45.45	54.55
January	—	—	—	32	37.50	62.50
February	—	—	—	21	33.33	66.67
March	57	12.28	87.72	27	51.85	48.15
April	34	14.71	85.29	63	46.03	53.97
May	52	42.31	57.69	21	23.81	76.19
June	22	36.36	63.64	28	35.71	64.29

studies already given. However, total number of eggs present in a mature ovary based on 14 samples (stages V and VI) varied from 8,789 to 23,655 (Table 4). The T.L of samples ranged from 74 mm to 92 mm. The data presented in Table 4 almost indicates a relative increase in the number of matured ova as the length of the fish increased.

Age and growth

To figure out the pattern of length-frequency in the population, a total of 710 specimens were utilised. The T. L ranged from 25 mm to 98 mm. The gathered information is consolidated in Figures 3 and 4. The population is multimodal in all the

TABLE 3. Monthly percentages of different stages of maturity in *Abudefduf glaucus* from Minicoy during July, 1981 to June, 1983

Months	No. of fish	Percentage of different stages of maturity						
		I	II	III	IV	V	VI	VII
July	27	11.11	59.26	22.22	3.70	-	3.70	-
August	34	2.94	14.71	17.65	2.94	5.88	23.53	32.35
September	42	-	4.76	7.14	9.52	21.43	35.71	19.05
October	60	8.33	8.33	16.67	6.67	43.33	8.33	8.33
November	78	-	1.28	25.64	35.90	12.82	17.95	6.41
December	21	-	-	-	4.76	23.81	61.90	9.52
January	32	12.50	34.37	18.75	25.00	3.12	6.25	-
February	21	-	-	-	19.05	23.81	38.09	19.05
March	84	-	1.19	8.33	10.71	17.86	48.81	13.09
April	97	-	10.31	16.50	11.34	30.91	16.50	14.43
May	73	5.48	24.66	9.58	12.33	6.85	32.87	8.22
June	50	-	8.00	20.00	22.00	34.00	8.00	8.00

TABLE 4. Number of ova per ovary in *Abudefduf glaucus*. Stage of maturity V or VI

Length of fish (mm)	Wt. of fish (g)	Wt. of ovary (mg)	Total no. of matured ova
74	10.5	705	8789
75	9.0	690	9939
76	11.0	720	11356
77	11.0	752	12664
78	11.0	745	12813
79	9.5	1222	21684
82	14.5	800	11685
82	11.5	830	16680
83	11.0	825	14883
85	14.5	942	14383
86	15.5	960	15634
87	14.5	976	16566
90	16.0	1144	23655
92	18.0	1200	22300

months due to protracted breeding and continual recruitment of post-larvae. The rate of growth was traced by Peterson's method of modal progression. Out of the many modes seen in Figure 5 only a few could be traced for growth rate for a reasonable time. Mode A with an initial length of 32 mm attained a length of 72 mm in 7 months. Mode B registered a growth of 72 mm in 8 months from 28 mm. Mode C to start with 44 mm reached 76 mm in 8 months. Averages for these three modes show a monthly growth rate of 5.22 mm in the first year of growth. Field observations have shown that the smallest fish in rock pools during settlement was about 10 mm in T. L. This post-larvae or juveniles increase by an average of 10 mm during the first 2 months. The smallest mode represented in (B) is of 28 mm T. L which should be about 3 months old.

Allowing a monthly average for the rest of the year (9 months) of 5.22 mm, the total length that may attain by the end of the

first year is 77 mm. The growth rate shows a retardation after the first year or soon after attaining sexual maturity. As shown in figure 5, mode D starting with 60 mm has reached 92 mm in a period of 10 months. Mode E has an initial growth of 76 mm and has grown to 88 mm in 4 months. Mode F increased to 88 mm in three months from 80 mm while mode G showed an increase of 8 mm in three months (76 to 84 mm T. L). Averages of D to G is 3 mm per month for the second year. Interpreting from these data a T. L of 113 mm should be the size of a fish by the end of the second year. However, the largest fish in our samples were only 92 mm in T. L. which should be the maximum size it may attain at Minicoy. This also indicates that the life span of the individual fish is more or less only two years.

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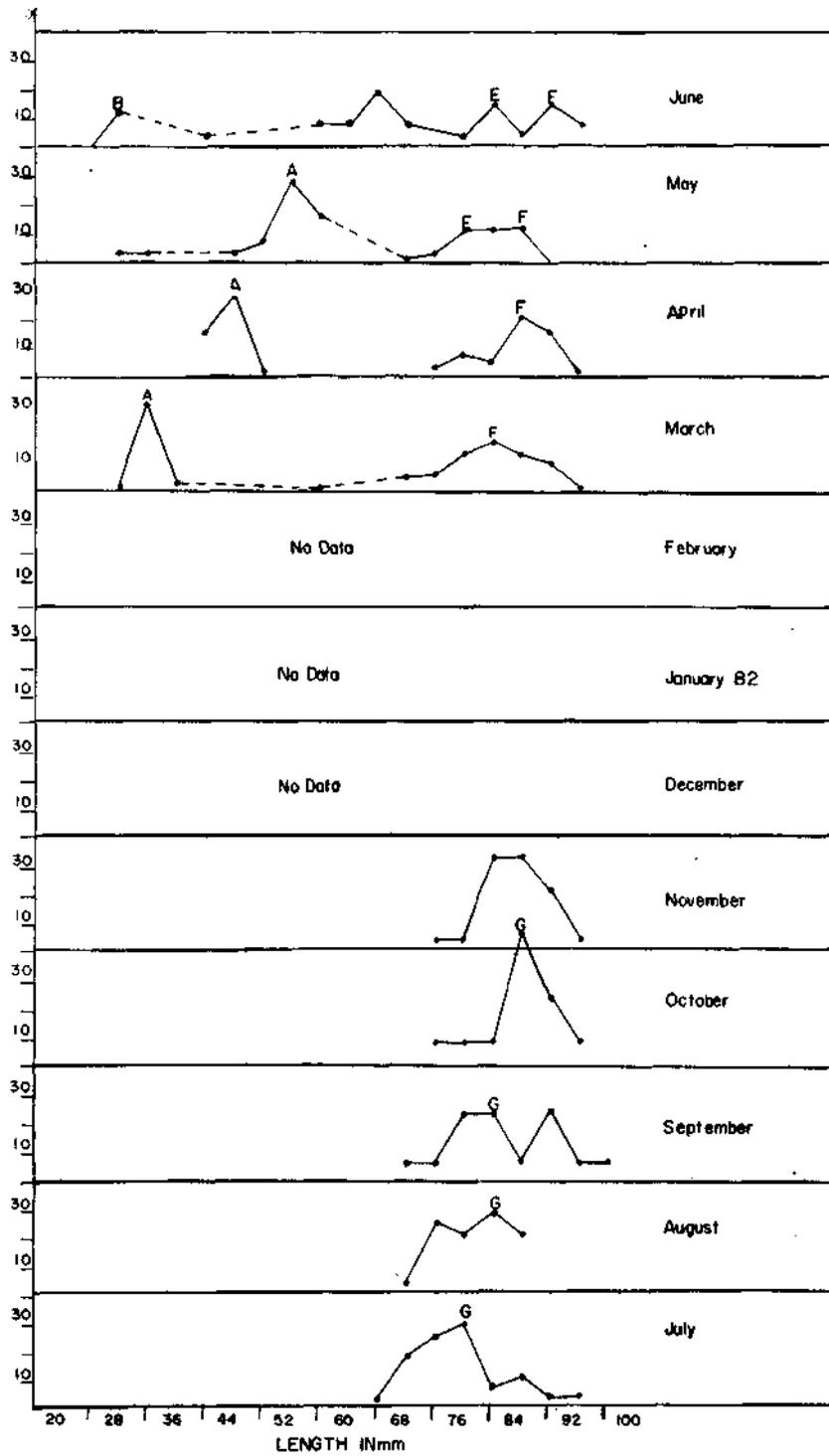


Fig. 3. Length-frequency distribution of *Abudedefduf glaucus* during July, 1981 to June, 1982.

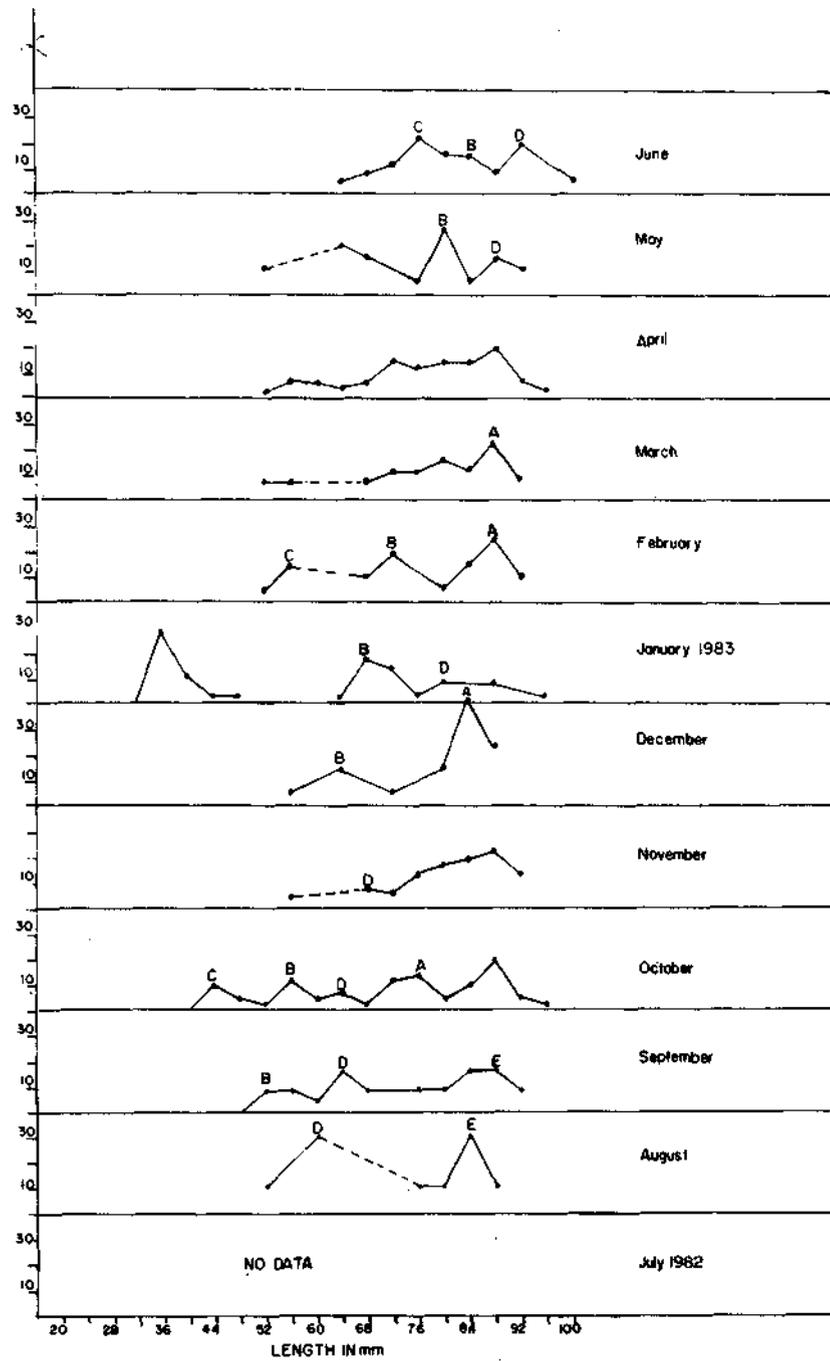


Fig. 4. Length-frequency distribution of *Abudedefduf glaucus* at Minicoy during July, 1982 to June, 1983.

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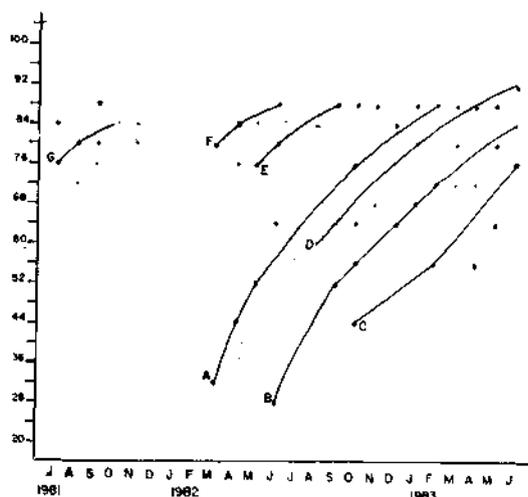


Fig. 5. Progression of length frequency modes in *Abudedefduf glaucus* at Minicoy Atoll.

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