Indian Journal of Fisheries 41 (2): 80-6, June 1994

Observations on the biology of some sciaenid fishes from Mandapam region

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Received: 20 December 1991

ABSTRACT

Regression coefficients in the length-weight relationships in females and males in *Johneiops sina, Johnius dussumieri* and *Johnius macropterus* showed no significant difference and common equation is recommended in each case. In *Dendrophysa russelli*, separate regression equations are necessary. Relative condition factor seems to be affected by reproductive cycle. Spawning season of./, *sina, J. dussumieri* and *J. macropterus* extended from March to October. *D. russelli* seems to spawn round the year. Length at first maturity in *J. sina, D. russelli, J. dussumieri* and *J. macropterus* was 152,144,168 and 136 mm respectively. Monthly sex ratio departed significantly from 1:1 only in *J. sina,* where there was male dominance.

The present paper gives information on length-weight relationship, relative condition factor and spawning in *Johneiops sina, Dendrophysa russelli, Johnius dussumieri* and *Johnius macropterus* from Mandapam region. While the first two species occur in the trawl catches from both Palk Bay and Gulf of Mannar, the latter two are confined to the Gulf of Mannar. Though earlier works from other regions on *J. sina* (Nair 1977) and *J. dussumieri* (Devadoss 1969; Murty 1979) are available, no study has so far been made on the biology of *D. russelli* and *J. macropterus.*

MATERIALS AND METHODS

Samples were collected from the commercial trawlers operating in the Gulf of Mannar and Palk Bay off Mandapam during 1989-91. Total length (mm) and weight (to nearest 0.1 g) were recorded separately for females and males. Length-weight relationship was calculated using the formula log W = log a + b log L, and test of significance of regression coefficients was done (Snedecor and Cochran 1967). Relative condition factor, Kn (Le Cren 1951) was estimated using the equation Kn = W7w\

Seven maturity stages were recognized and the ovaries were fixed in 5% formalin. Ova were measured at a magnification where each micrometer division is equal to 0.0163 mm. The material for the study was taken from the middle portion of the right ovary in all the species. Ova less than 6 md were not taken into consideration since they are numerous in all stages of maturity.

RESULTS AND DISCUSSION

Length-weight relationship

In *Johneiops sina,* the study was based on 274 females (length 80-193 mm) and 374 males (length 73-162 mm). The equations obtained are:

Females : log W = —5.5611 + 3.3064 log L; r^2 = 0.98
Males : log W = —5.3918 + 3.2285 log L; 1^ = 0.96

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The analysis of covariance revealed no significant difference in the regression coefficients of the sexes (Table 1). The common equation for the species is:

$$\log W = -5.4601 + 3.2616 \log L; r^2 = 0.97$$

In *Dendrophysa russelli,* 266 females (length 76-181 mm) and 236 males (length 66—170 mm) were studied. The equations were:

Females : $\log W = -5.6060 + 3.3298 \log L; r^2 = 0.98$
Males : $\log W = -5.3842 + 3.2236 \log L; r^2 = 0.98$

The analysis of covariance (Table 1) revealed significant difference ($P < 0.05$) in the regression coefficients of the sexes, thus necessitating separate regression equations for females and males.

In *Johnius dussumieri,* the study was based on 232 females (length 93-204 mm) and 231 males (length 71-204 mm). The equations obtained were:

Females : $\log W = -5.1578 + 3.1293 \log L; r^2 = 0.95$
Males : $\log W = -5.1045 + 3.1028 \log L; r^2 = 0.97$

Since the analysis of covariance revealed no significant difference between regression coefficients (Table 1), a common equation was suggested:

$$\log W = -5.1411 + 3.1209 \log L; r^2 = 0.96$$

Murty (1979) also found that the regression coefficients of sexes of *J. dussumieri* from Kakinada do not significantly differ.

In *Johnius macropterus,* 106 females (length 88-158 mm) and 104 males (length 78-167 mm) were studied. The equations obtained were:

Females : $\log W = -5.3920 + 3.2175 \log L; r = 0.96$
Males : $\log W = -5.3543 + 3.1981 \log L; r^2 = 0.97$

Since analysis of covariance revealed no significant difference between regression coefficients (Table I), a common equation was suggested:

$$\log W = -5.3714 + 3.2070 \log L; r^2 = 0.97$$

Relative condition/actor

The relative condition factor (Kn) in *J. sina* was highest in July, lowest in September, and low in March, June and August compared to other months. In *D. russelli,* Kn was highest in September and lowest in October. From April to July and in November it showed low values. In *J. dussumieri* Kn decreased from January to reach minimum in June and then increased to the highest value in December. In *J. macropterus,* it remained low during May to August. The low Kn values during certain months may be attributed to the increased metabolic strain of spawning. The peak spawning months of these species coincided with low Kn values.

Variations in mean Kn values in length groups were examined. The points of inflexion for *J. sina, D. russelli, J. dussumieri* and *J. macropterus* were, respectively, 145, 135, 165 and 135 mm. The point of inflexion on the curve showing a decrease in Kn value with increasing length is a good indication of the length at which sexual maturity starts (Hart 1946). This observation agreed well in all the 4 species.

Maturation and spawning

Ova diameter frequency polygons of stages III—VI were determined. In *J. sina,* the early-maturing ova showed mode at 22-23 md and the late-maturing ova at 26-27 md in stages III—IV. In stage V, the mature opaque ova formed a mode at 30-31 md. A distinctly separate mode of large translucent ripe ova was formed at 44—45 md in^tage VI. There was also another mode at 38—39 md which were about to become ripe and be spawned. This pattern of ova development indicated that each adult female may spawn at least twice per year.

In *D. russelli,* the early-maturing ova (mode at 22—23 md) in stage IV had further advanced to 36-37 md in stage V with an

Table 1. Comparison of regression lines of females and males *oiJohneiops sina, Dendrophysa russelli. Johnius dussumieri* and *Johnius macropterus* by ANACOVA

	Deviation from regression											
	df				SS				MS			
	J. sina	*D. russelli*	*J. duss-umieri*	*J. macro-pterus*	*J. sina*	*D. russelli*	*J. dussu-mieri*	*J. macro-pterus*	*J. sina*	*D. russelli*	*J. duss-umieri*	*J. macro-pterus*
Within Female	272	264	230	104	0.363529	0.269062	0.592809	0.114907	0.001337	0.001019	0.002577	0.001105
Male	372	234	229	102	0.807269	0.240803	0.440235	0.118459	0.002170	0.001029	0.001922	0.001161
Total	644	498	459	206	1.170798	0.509865	1.033044	0.233366	0.001818	0.001024	0.002251	0.001133
Pooled W	645	499	460	207	1.175702	0.515977	1.033462	0.233429	0.001823	0.001034	0.002247	0.001128
Difference between slopes	1	1	1	1	0.004904	0.006112	0.000418	0.000063	0.004904	0.006112	0.000418	0.000063

J. sina F = 2.6975 (df 1, 644) not significant
D. russelli F = 5.9688 (df 1,498) significant at 5%
J. dussumieri F = 0.1860 (df 1,459) not significant
J. macropterus F = 0.0559 (df 1,206) not significant

adjacent mode of fully mature opaque ova which would become ripe soon. There were two modes (44-45 and 48-49 md) of ripe ova with prominent oil globules in stage VI ovary. There is a positive indication that this species may have multiple spawnings during a prolonged breeding season.

In *J. dussumieri,* the predominantly early maturing ova at 24-25 md in stage III had progressed to 28-29 md in stage IV which contained all mature opaque ova. The two distinct modes at: 22-23 and 28-29 md in stage IV had advanced to 28-29 and 34-35 md respectively in stage V. In stage VI, these modes shifted to 32-33 and 42-43 md groups. The ova mode 32-33 md were all opaque, whereas other mode consisted of translucent ripe ova with oil globules. The ova diameter frequency distribution in different stages of ovary indicated that the ova would be released in two spawning acts. Similar observations were made in the same species from Kakinada region (Murty 1979) as well as in *Atrobucca nibe* (Murty 1980) and *Nibea maculala* (Jayasankar 1989).

Pattern of ova development in./. *macropterus* seemed to be very similar to that of./. *dussumieri.* Modes at 20—21 and 26-27 md in stage IV had progressed to 36-37 and 40-41 md, respectively, in stage VI. The presence of two distinct modes in all the maturity stages suggest at least two spawning acts in the species during a protracted spawning season.

Percentage occurrence of gravid (stage V) and ripe (stage VI) females during different months in the 4 species is given in Fig. 1. Spawning season in *J. sina* extended from March to October with peak spawning in March, August and September. At Calicut, this species breeds all the year round with peak spawning during November to February andMay(Nair 1977).

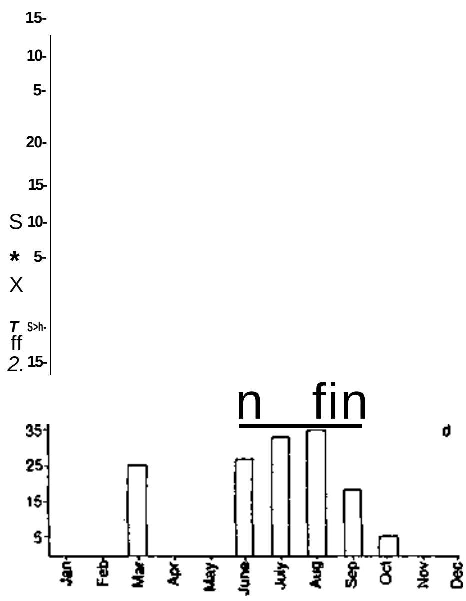
D. russelli appeared to breed almost round the year as evidenced by the presence of gravid and ripe females in all the months except in June, August and September (no data in the first two months).

Advanced maturity stages of ./. *dussumieri* occurred in March, April, June, August and September, indicating that the spawning season spans between March and September. This is in agreement with the findings of Murty (1979) for the same species from Kakinada.

Spawning season in *J. macropterus* is almost the same as that of./ *dussumieri* with peak spawning during June—August.

Length at first maturity

The percentage occurrence of 4 species of sciaenids in different stages of maturity was calculated for each 10 mm length interval. Females alone were taken into consideration and the specimens above stage 111 were treated as mature.



Kig 1 Monthly occurrence of gravid (stage V) and ripe (stage VI) females of (a) *Johneiops sina,* (b) *ilendrophysa russelli,* (c) *Johnius dussumieri* and (d) *Johnius macropterus*

In *J. sina*, all specimens below 125 mm were immature and 50% were mature at 152 mm. All fishes above 175 mm were mature. In *D. russelli* all specimens below 125 mm were immature and 50% were mature at 144 mm with all being mature above 165 mm. All females of J. *dussumieri* below 135 mm were immature and 50% were mature at 168 mm. All fishes above 185 mm were mature. In *J. macropterus,* all specimens below 125 mm were immature and 50% were mature at 136 mm with all being mature above 145 mm.

From the above observations, it may be concluded that the lengths at first maturity in *J. sina*, *D. russelli*, *J. dussumieri* and *J. macropterus* are, respectively, 152, 144, 168 and 136 mm. At Calicut, *J. sina* becomes sexually mature at a smaller length (115 mm; Nair 1977). Similarly, *J. dussumieri* attains sexual maturity at a smaller length (110 mm) at Kakinada (Murty 1979).

Sex ratio

In *J. sina*, the overall female to male ratio (0.7:1) was highly significant (P < 0.01) with males outnumbering females in most of the months. In *D. russelli*, except in July and November, the sex ratio was close to 1:1 (Table 2). In *J. dussumieri,* except in 2 months, the sex ratio did not depart significantly from 1:1 in any other months, and in *J. macropterus,* the overall sex ratio (1.02:1) did not depart significantly from 1:1 (Table 3). At Calicut, the overall sex ratio of *J. sina* was in favour of females (Nair 1977) contrary to the present observation. Females of *J. dussumieri* dominated in most of the months at Kakinada (Murty 1979). However, the present study indicated equal distribution of sexes in the commercial catches almost throughout the year.

Length-related sex ratio in *J. sina*, *D. russelli* and *J. dussumieri* (Tables 4, 5)

Table 2 Month-wise sex ratio of.*lohneiops* a and *Dendrophysa russelli*

Month	*J. sina*				*D. russelli*			
	Number offish	Female	Male	Chi-square	Number of fish	Female	Male	Chi-square
Jan	33	19	14	0.76	148	71	77	0.24
Feb	73	27	46	4.95'	32	16	16	0.00
Mar	138	52	86	8.38'	81	39	42	0.11
Apr	50	29	21	1.28	30	17	13	0.53
May	20	11	9	0.20	10	5	5	0.00
June	31	6	25	11.65'	No data			
July	20	9	11	20	5	5	—	5.00*
Aug	57	30	27	0.16	No data			
Sep	6	2	4	0.67	18	II	7	0.89
Oct	86	37	49	1.67	43	23	20	0.21
Nov	93	30	63	11.71'	93	60	33	7.84**
Dec	41	22	19	0.22	42	19	23	0.38

Significant at 5% level; Significant at 1% level.

Table 3 Month-wise sex ratio of *Johnius dussumieri* and *Johnius macropterus*

Month	*J. dussumieri*				*J. macropterus*			
	Number offish	Female	Male	Chi-square	Number offish	Female	Male	Chi-square
Jan	25	17	8	3.24	3	2	1	0.17
Feb	31	14	17	0.15	4	2	2	0.00
Mar	24	12	12	0.00	18	9	9	0.00
Apr	33	17	16	0.03	No data			
May	2	1	1	0.00	II	6	5	0.05
June	25	7	18	4.84*	30	15	15	0.00
July	8	1	7	4.50*	7	3	4	0.07
Aug	32	20	12	2.00	35	20	15	0.36
Sep	31	15	16	0.03	16	11	5	1.13
Oct	88	49	39	0.93	36	19	17	0.06
Nov	112	55	57	0.04	48	18	30	1.50
Dec	52	24	28	0.31	2	1	1	0.00

'Significant at <% level.

Table 4 Sex ratio in different length groups *ofjohneiops sina* and *Dendrophysa russelli*

Length groups (mm)	*J. sina*				*D. rus. elli*			
	Number of fish	Female	Male	Chi-square	Number offish	Female	Male	Chi-square
6fr *9			-		1	—•	1	1.00
70-79	4	—	4	4.00*	6	3	3	0.00
80-«9	31	4	27	17.06**	4	1	3	1.00
90-99	35	9	26	8.26**	21	11	10	0.05
100 109	55	19	36	5.25*	11	4	7	0.82
110 119	61	16	45	13.79**	17	8	9	0.06
120 129	127	43	84	13.24**	47	25	22	0.19
130-139	129	55	74	2.80	136	70	66	0.12
140-149	96	52	44	0.67	129	64	65	0.01
150 159	59	32	27	0.42	69	36	33	0.13
160 169	38	31	7	13.56**	45	27	18	1.80
170 179	9	9	•-—	9.00**	14	13	1	10.29*
180 189	1	I		1.00	2	2		2.00
190 199	3	3		3.00			•—	

Significant at 5% level; Significant at 1 % level.

showed that males dominate in smaller length groups and females start outnumbering males at a length close to that at first maturity. In./. *macropterus*, except in size groups 110-119

Table 5 Sex ratios in different length groups of *Johnius dussumieri* and *Johnius macropterus*

Length groups (mm)	*J. dussumieri*				*J. macropterus*			
	Number offish	Female	Male	Chi-square	Number of fish	Female	Male	Chi-square
70 79	4	—	4	4.00*	1	— •	1	1.00
80-89	6	—	6	6.00*	3	1	2	0.33
90-99	13	3	10	3.77	8	4	4	0.00
100-109	23	9	14	1.09	23	7	16	3.52
110-119	50	18	32	3.92*	42	24	18	0.86
120-129	67	24	43	5.39**	50	31	19	2.88
130-139	82	40	42	0.05	44	21	23	0.09
140-149	88	42	46	0.18	25	II	14	0.36
150-159	52	20	32	2.77	13	7	6	0.08
160-169	33	29	4	18.94**	1	–	1	1.00
170-179	27	18	9	3.00	—	—	—	—
180-189	11	9	2	4.45*	—	—	—	
190-199	2	2	—	2.00	—	–	—	--
200-209	4	3	1	1.00	—		—	
210-219	1	1	—	1.00	—		—	—

Significant at 5% level; Signi ficant at I % level.

and 120-129 mm, males outnumbered females in other groups (Table 5).

ACKNOWLEDGEMENTS

I thank Dr P S B R James, Ex-Director, Central Marine Fisheries Research Institute, Cochin, for encouragement and Dr P Bensam, Principal Scientist, for critically going through the manuscript.

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