

OPTIMIZATION OF MESH SIZE OF GILLNETS TO CAPTURE THE BARRACUDAS, *Sphyraena picuta* IN THOOTHUKUDI WATERS

P. Karthiga Priya, B. Sundaramoorthy, N. Neethiselvan, D. Sukumar and K. Masilan*

Tamil Nadu Fisheries University,

Nagapattinam -611001, Tamil Nadu, India

E-mail: masilanakmsara@gmail.com (*Corresponding Author)

Abstract: *Sphyraena picuta*, a coastal barracuda locally called as “Neduva”, forms a commercial fishery in Thoothukudi Coast for throughout the year. Fishing season is started from November to June on gillnets with mesh size ranging from 50 mm to 128 mm. The fishery is mainly constituted by length group ranging from 61 – 134 cm. The study deals with optimization of mesh size to capture the commercially significant size group 83 – 85 cm, The optimum mesh size for commercial exploitation of *S. picuta* in Thoothukudi is estimated as 8.87 cm. Gillnets with 8.87 cm mesh size would capture length groups which have crossed length at first maturity and hence would pave way for the sustained fishery of *S. picuta* in this coast.

Keywords: Optimum mesh size, *Sphyraena picuta*, gillnet selectivity, Thoothukudi coast.

Introduction

Barracudas have been the second dominant species next to lethrinids in Thoothukudi Coast. Gillnets, Trawl net and Long lines are the main gears, employed to capture the barracuda in Thoothukudi waters. However, gillnets and longlines are mainly used to exploit barracuda resources of Thoothukudi coast. *Sphyraena picuta* form commercial fishery in Thoothukudi from November to June at a depth ranging from 50 – 100 m. No attempt has been so far made to optimize the mesh size of the gillnets to capture *S. picuta* which are indiscriminately fished by gillnets. Selection factors of *S. picuta* so as to optimize the mesh size for the capture of this species. The gillnet selectivity studies in Indian waters are mainly concerned with the optimization of mesh size for the commercial exploitation of important marine and freshwater fishes (Sree Krishna *et al.*, 1972; Sulochanan *et al.*, 1975 ; Luther *et al.*, 1994; Neethiselvan *et al.*, 2000 and 2001).

Sphyraena picuta is a common species in the shore waters of Thoothukudi coast. The selectivity estimates for this important fishery has not been done so far but for a preliminary study (Catch and effort, biological factors) by Mohammad and Balasubramanian, (1990); Premalatha and Manojkumar, (1990). The main objective of this study was to determine of

the optimize mesh size, selection factor, commercially significant length group and catch and effort of this species.

Materials and Methods

The study was carried out for one year from April 2012 to March 2013 at Threspuram, Inigonagar and Tharuvaikulam landing centers for traditional crafts of Thoothukudi Coast (Tamil Nadu, Southeast Coast, India) (Fig 1). Nets with the mesh size of 50 mm, 52 mm and 128 mm were sampled from the gillnets operated from the commercial fishing boats of Thoothukudi origin, (Popularly called “Vallam”). The nets with the mesh size of 50, 52 and 128 mm were named as net ‘A’, ‘B’ and ‘C’ respectively. The features of the net A, B and C are given in Table 1.

The webbings were maintained to head rope, maintaining a uniform horizontal hanging co-efficient of 0.5. The total length of individual fish was measured to the nearest cm. The mesh size determined by measuring the stretched meshes with a centimeter scale (FAO, 1978).

The selectivity was estimated by using the indirect method of Sparrae and Venema (1992). According to him, for gilling and wedging, the selection curves are bell shaped and can be described by the following relation $S(L) = \exp[-(L-L_c)^2 / 2S^2]$ where $S(L)$ is the length based gear selectivity, L is the mid length of the size/length group, L_c is the mean selection length per being caught and S is the standard deviation of the normal distribution.

The procedure for estimation of selection curve involved the following steps:

(i) CB = Number of fish caught in net with larger mesh size (m_2)

CA = number if fish caught in A net with smaller mesh size (m_1).

(ii) Calculations for log ratios for successive fish lengths

$$Y = \ln (CB/CA)$$

Linear Regression analysis was made against the mid value of each of the length group as follows

$$\ln (CB/CA) = a_1 + b_1L$$

Where, a_1 =Intercept for BA combination

b_1 = slope value for BA combination

$$\ln (CC/CB) = a_2 + b_2L$$

Where, a_2 =Intercept for CB combination

b_2 = slope value for CB combination

L = mid length of a length group

CA, CB and CC refers to catch in number in net with the mesh size A, B and C corresponding to the mid value of length group, L.

(iii) Regression analysis of the log ratios against the interval midpoint and expressed as,

$$Y = a + bL$$

Where, Y is the natural logarithm of ratio of catches, L is the midpoint of the length class and a and b are constants.

The common selection factors (SF) for three mesh combination viz. A, B and C was derived using the equation.

$$SF = \frac{-2x[(A+B)xa_1/b_1] + [(B+C)xa_2/b_2]}{(A+B)^2 + (B+C)^2}$$

(iv) The common standard deviation(s) for three combinations A, B and C was derived using the equation

$$S = \sqrt{\frac{1}{3-1} \times \left(\frac{-2xa_1 \times (B-A)}{b_1^2 \times (A+B)} \right) \times \left(\frac{-2xa_2 \times (C-B)}{b_2^2 \times (B+C)} \right)}$$

(v) The mean selection length (L_c) of each net was estimated from the common selection factor (SF) as follow

$$L_{ci} = SF \times mi$$

Where, ' L_{ci} ' refers to mean selection length of different nets

'mi' refers to different mesh size

(vi) The optimum mesh size for the commercial exploitation of each species of barracuda were worked out based on the following formula,

$$m = \frac{L_{opt}}{SF}$$

Where 'm' is the stretched measure of mesh in cm and ' L_{opt} ' is either the mid-length of the commercially significant length group or mean length at first maturity of the respective species in cm. SF is the mean value of selection factors derived based on different mesh combinations.

(vii) Monthly Average catch and effort of barracudas are calculated as, the mean daily catch for a month was worked out by taking the mean total catch estimated during different sampling days of months. The average daily catch was multiplied by the number of fishing days of the month for estimated the monthly catch. The effort was expressed in terms of boat days and the catch was expressed in terms of kilograms and also in tonnes.

Results and Discussion

Fishing season of barracuda was found to be from November to June as reported by Mohammed and Balasubramanian, (1990) and Premalatha and Manojkumar (1990). However, a slight deviation in peak season from that reported by Mohammad and Balasubramanian (1990). Among the two peaks of fishing season of barracuda in the gillnet fishery, one was found to fall on the months of November and May against the November and March as observed by Mohammed and Balasubramanian (1990). The reason may be attributed to the gear selected for the study. As 15th April to 30th May being closed season for trawl net along the coast of Tamil Nadu, One of the peak seasons has been recorded as March instead of May. The comprehensive study involving catches from all fishing gear such as gillnets, longlines and trawl nets is required to find out the exact fishing of barracuda along Thoothukudi coast. The peak fishing season found to be from November Premalatha and Manojkumar, (1990) who study was based on the catches from commercial trawl nets. The reason may be attributed the fact that the fisherman of Thoothukudi used to switch over to long lining from July to September due to rough weather conditions, though barracudas are reported to migrate and available for fishing in shallow water during south-west monsoon (June to August). Catch and effort particulars of *Sphyraena obtustata* is given in Table (2).

Length frequently distribution of *S.picuta* in gillnets of mesh sizes 50, 52 and 128 mm is given in Table (3). The total length of *S. picuta* caught ranged from 61 to 134 cm. The nets A, B and C does not catch any immature animals of *Sphyraena picuta*.

Selectivity parameters viz, L_b , L_c and L_d increased with the increase in mesh size irrespective of species, indicating clear cut selectivity by the gillnets (Ag). This is an accordance with the findings of Reis and Pawson (1992) who reported the gillnets are rather than species specific. Increase in L_c and SF of *Amblygaster sirm* with the increase in mesh size have also been documented by many workers (Dayartane 1988; Jude 2000; Ravikumar 2003; Manojkumar 2006 and Parivallal 2008). L_b , L_c and L_d values for *S. obtustata* were given in Table 4 and Fig-2.

Selection factor for this species is 9.47 this is an accordance with the findings of Andreev (1962) who reported that the selection factors generally ranges between 5 and 10.

Optimum mesh size for the *S. picuta* is 8.87 cm. Net A, B and C does not pose any threats to the *Sphyraena picuta*. The present study recommended to encourage the nets A (50mm), B (52mm), and C(128mm) to enhance the catch of *Sphyraena picuta* fishery in Thoothukudi coast.

Conclusion

The fishing season of barracuda by small and big meshed gillnets in Thoothukudi coast was found to be throughout the year. However, peak fishing season was from November and June. Among the big meshed gillnets, the net 'D' with mesh size 12.8 cm may be encouraged as it captured only maturing animals of *S. picuta*.

Acknowledgement

The Tamil Nadu Fisheries University merit fellowship awarded to the first author to undertake the research as part of her master's degree programme is hereby acknowledged.

References

- [1] Andreev, N.N., 1962. Handbook of fishing gear and its rigging. Published by Moscow, Jerusalem. 454p.
- [2] Dananjanie, K.A.T., M.D.S.T. DeCroos and D.C.T. Dissanayake, 2009. Gillnet selectivity and food and feeding habits of *Sphyraena obtustata* and *Sphyraena jello* in the coastal waters off Negombo, Srilanka, *J. Natl. Aquat. Resour. Agency (Srilanka)*.39p.
- [3] Dayarante, P., 1988. Gillnet Selectivity for *Amblygaster sirm (Sardinella Sirm)* *Fish. Res.*, 2:71-82.
- [4] FAO, 1978. FAO Catalogue of fishing gear Designs fishing News books Ltd., Farnham, Surrey.
- [5] Jude, D., 2000. Optimization of mesh size for the commercial exploitation of Tuna (Family: Scombridae) in Thoothukudi waters. M.F.Sc., Thesis, Tamilnadu Veterinary and Animal Sciences University, India.72p.
- [6] Luther, G., P.P. Pillai, A.A. Jayaprakash, G. Gopakumar, T.V. Sathinanandan, R. Molly Varghese, Sathiadhas and S. Sivagami, 1994. Gill net Fisheries of India.*Mar.Fish. Infor. Serv., T and E ser.*, 150: 1-25.
- [7] Manoj Kumar, 2006. Analysis of gill net selectivity on the carangids fishery of Thoothukudi Coast. M.F.Sc., Thesis, Tamilnadu Veterinary and Animal Sciences University, India. 73p.
- [8] Mohammed, K and Balasubramanian, 1990. Fishery, Growth, Yield Per recruit and Stock assessment of *Sphyraena obtustata* cuvier Off Tuticorin, Gulf of mannar. *Indian. J. Fish.*, 37(4): 281-288.
- [9] Neethiselvan, N., D. Jude, B. Sundaramoorthy and P. Gopalakrishnan 2000. Optimization of mesh size of gillnets to capture *Amblygaster sirm* (Walbaum) in Thoothukudi coastal waters, south east coast of India, *Fish. Technol.*,37(2):73-76.

- [10] Neethiselvan, N., T. Vaitheswaran and D. Jude, 2001. Optimization of mesh size of gillnet for *Sardinella gibbosa* (Bleeker). *Fish.Technol.*, 38(2): 84-86.
- [11] Parivallal, P., 2008. Analysis on the gillnet selectivity of Alliyar reservoir. M.F.Sc Thesis, TANUVAS, India. 73p.
- [12] Premalatha and Manojkumar (1990). Some Biological Aspects of Two Species of Barracudas from The South west Coast Of India, *Indian J. Fish.*, 37(4): 289-295.
- [13] Ravikumar, (2003). Analysis of gillnet selectivity and fishing pressure on the lesser sardine fishery of Thoothukudi. M.F.Sc. Thesis, Tamilnadu Veterinary and Animal Sciences University, India. 72p
- [14] Reis, E.G. and M.G., Pawson, (1992). Determination of gillnet selectivity for bass (*Dicentrarchus labrax L.*) using commercial catch data. *Fish. Res.*, 13:173-187.
- [15] Sparrae, P and S.C. Venema (1992). Introduction to tropical fish stock assessment part I. Manual FAO *Fisheries Technical paper*, No.306, Rev., Rome.172-199.
- [16] Sreekrishna, Y., J.S. Rao, P. Dawson, T.J. Mathai and P. Sulochunan, (1972a). Mesh selectivity for spotted seer *Scomberomorous commersoni*. *Fish. Technol.*, 9(2):133-138.
- [17] Sulochunan, P.K.A. Sandhanandam, T. Joseph Mathai and M.S. Abbas, (1975). Selectivity of gillnets for *scomberomorouscommersoni*. *Fish. Tech.*, 12(1):52 -59.

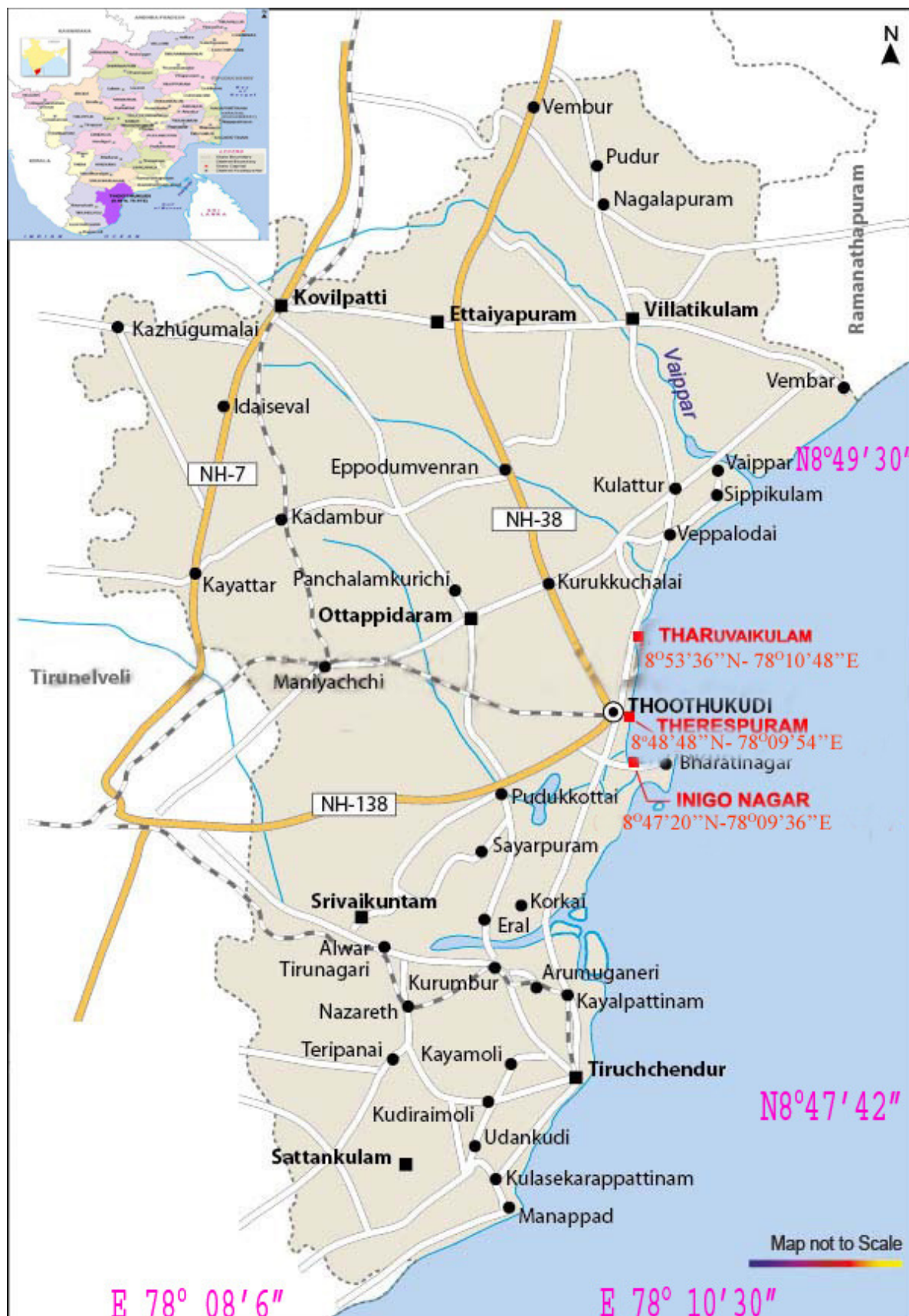


Fig 1. Location of Fishing Ground in Thoothukudi coast, India

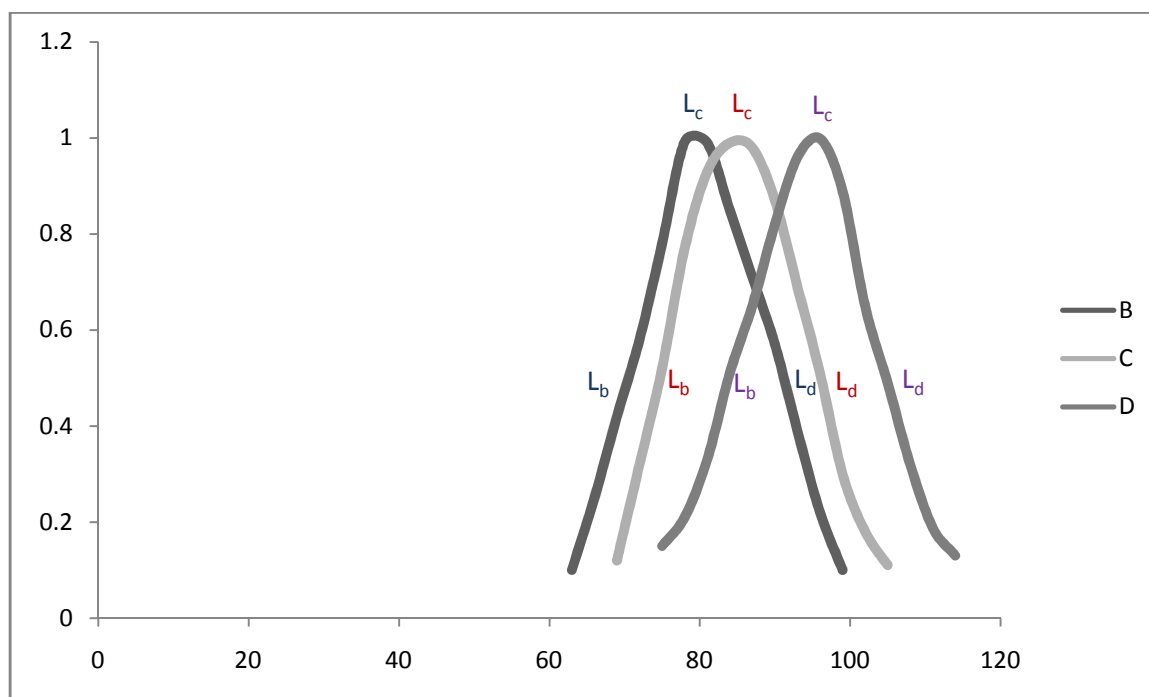


Fig - 2: Selection curves of *Sphyraena picuta* for gill net types A, B and C

Table 1: Description of the gillnets operated for fishing barracuda along Thoothukudi coast

S. No	Parameters	Types of gillnets		
		A	B	C
1	Webbing material	Polyethylene	Polyethylene	Polyethylene
2	Mesh size	50mm	52mm	52mm
3	No. of meshes in length	2,640	2,640	2,640
4	No. of meshes in depth	110	110	110
5	Twine Specification	0.5mm ϕ	0.5mm ϕ	0.5mm ϕ
6	Horizontal hanging co-efficient	0.5	0.5	0.5
7	Type of float	PVC	HDPE	HDPE
8	No. of floats/Net	20	20	20
9	No. of Sinkers/Net	10	10	10
10	Type of sinkers	Stone	Stone	Stone
11	Head rope material	PP	PP	PP
12	Thickness of head rope			
13	Length of head rope	20.5m	22.8m	22.8m
14	Foot Rope material	-	-	-
15	Size of foot rope	-	-	-
16	Thickness of foot rope	-	-	-

Table 2: Monthly Catch and effort particulars of *Sphyraena picuta* in gillnet for the period from April 2012- March 2013 in Thoothukudi Coast

Sl. No	Month	Average No of crafts operated/day	Boat Days	Number of barracuda landed/boat	Total weight of barracudas landed/boat (in kg)	Total no. of barracudas landed	Total. wt. of barracuda landed (kg)	CPUE
1	Apr.'12	200	24	15	75	1,800	9000	3.13
2	May.'12	180	24	20	100	2,400	12000	4.17
3	Jun.'12	180	26	10	30	780	2,340	1.15
4	Jul.'12	190	24	10	30	720	2,160	1.25
5	Aug.'12	180	22	10	30	660	1,980	1.36
6	Sep.'12	180	22	5	15	330	990	0.68
7	Oct.'12	180	24	5	15	360	1,080	0.63
8	Nov.'12	180	24	8	24	576	1,728	1.00
9	Dec.'12	180	24	10	50	1,200	6,000	2.08
10	Jan.'13	180	23	10	50	1,150	5750	2.17
11	Feb.'13	150	23	10	50	1,150	5750	2.17
12	Mar.'13	150	23	12	60	1,380	6900	2.61

Table 3: Length frequency distribution and the ratios of natural logarithms of number caught under different length group of *Sphyraena picuta* in different gillnet combinations

Midlength	Net A	Net B	Net C
	50mm	52mm	128mm
63	2	-	-
66	3	2	-
69	8	4	-
72	14	8	-
75	26	12	1
78	28	16	2
81	22	26	3
84	20	29	4
87	18	14	5
90	14	12	8
93	12	10	11
96	8	9	14
99	4	5	18
102	2	3	23
105	-	4	18
108	-	2	12

111	-	1	11
114	-	-	3
117	-	-	2
120	-	-	1
123	-	-	1
126	-	-	1
129	-	-	1
132	-	-	1

Table: 4 Selectivity parameters of *Sphyraena picuta* with respect to different gillnets

Net	Selectivity Parameters (in cm)		
	L_b	L_c	L_d
B	69	79	99
C	72	85	100
D	94	98	102