

## Size, food and age of commercially exploited *Trichiurus lepturus* linnaeus caught off negombo and beruwala, in sri lanka

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Received on : 11/15/2006

Accepted after revision on : 04/03/2007

### Abstract

Six species of Family: Trichuridae are essential shore line fish in Sri Lanka, which is highly popular as dry salted or fresh fish consumption. *Trichurus lepturus* is the most common species in catches out of the about six, the purpose of present study was to find the size, food habit and age of *T. lepturus*.

Food habit and the age of *T. lepturus* was studied from August 2005 to January 2006. Samples were to ice boxes from Negombo and Beruwala fishing area. Beach seines at other landing sites were visited twice a month.

*T. lepturus* of about 20% of randomly selected fish was measured for total length. About 10-15% fish of the above sample was taken to the laboratory after injecting 5% formalin through anus. Gut content were identified to nearest taxon and their number were recorded.

The result indicated that the main food of *T. lepturus* consist of *Sardinella* sp., *Leiognathus* sp., *Polynemus* sp., *Secutor* sp., *Anchovelia* sp., *Mugil* sp. and shrimps. The type of food varied with the age. Small fish consumed shrimps and *Anchovelia* sp., where as relatively large fish consumed *Sardinella* sp. The amount of fish consumption increased linearly with the size.

The mean length of fish at age I, II, III, IV, V, VI, VII, VIII, IX and X was 28.27cm, 48.27cm, 63.01cm, 73.49cm, 81.02cm, 86.44cm, 90.33cm, 93.12cm, 95.13cm and 96.18cm respectively; and the  $L_{\infty}$ , K and  $t_0$  were 100.28cm, 0.33 and 0.00 years respectively for Negombo. The mean length of fish at the age I, II, III, IV, V, VI, VII, VIII, IX and X was 30.31cm, 51.46cm, 66.22cm, 76.52cm, 83.70cm, 88.71cm, 92.21cm, 94.65cm, 96.35cm and 97.53cm respectively; and the  $L_{\infty}$ , K and  $t_0$  were 100.28cm, 0.36 and 0.00 years respectively for Beruwala.

**Keywords : Ribbon fish, Commercial catch**

## 1. Introduction

Ribbon fish, also called hair tails, belonging to the order Perciformes, Family Trichiuridae are represented in the western Indian Ocean by 8 genera; *Aphanopus*, *Benthodesmus*, *Lepidopus*, *Evoxymetopon*, *Lepturacanthus*, *Trichiurus*, *Eupleurogrammus* and *Tentoriceps* (Fischer and Biandi, 1984).

Only three genera are found in coastal area of Sri Lanka (*Eupleurogrammus*, *Lepturocanthus*, *Trichiurus*). The above three genera are represented by the following six species of ribbon fish; *Eupleurogrammus glossodon*, *E. muticus*, *Lepturocanthus pantuli*, *L. savala*, *Trichiurus gangeticus* and *T. lepturus* (Fischer and Biandi, 1984).

Out of the above six, only *E. glossodon*, *E. muticus*, *L. savala*, and *T. lepturus* are found in Negombo and Beruwala fishing areas. *L. pantuli*, and *T. gangeticus* are only recorded from Northern coastal area of Sri Lanka. Among them *T. lepturus* is the most dominant species, abundant seasonally from September to November and feeds on prawns and other small fish (Fischer and Biandi, 1984).

*Trichiurus lepturus* is the most dominant species in Sri Lankan coastal areas. Its fishing season lasts from August to January and are most abundant from November to December. The ribbon fish are caught using two different gears in Sri Lanka, normally Surface gill nets and beach seines, these are used from Beruwala to Negombo.

The natural food of fishes comes from the many groups of plants and animals that inhabit waters. Certain chemical elements, such as Calcium in addition, are absorbed from the water itself. Food relationships do at least in part determine population levels, rates of growth and condition of fish. They serve as a partial basis for determining the status of various predatory or competing forms (Gupta, 1967).

For most species, food habits change with the seasons, with life history stages, and with the kinds of food available. According to Fischer and Biandi, 1967 the diet of *T. lepturus* mostly consists of small fish; such as species of *Dussumieria*, *Sardinella*, *Stylophorus*, *Excualosa*, *Hemiramphus*, *Mugil*, *Leiognathus*, *Caranx*, *Sciaena* and *Crustaceans*. Understanding of the food habits of *T. lepturus*, which is a carnivorous fish, use to understand the distribution of its prey. These are popular food fish in Sri Lanka.

Knowledge of the age and rate of growth of a fish is extremely useful in management and of great biological interest. In the absence of clear growth rings on the otoliths to be of use in age the determination of ribbon fish, normally the length-frequency method has been used (Narasimhan, 1976).

None of the above information on *T. lepturus* is available in Sri Lanka. Therefore, the purpose of the present study is to study the diet of *T. lepturus*, size and age structure of the exploited stock.

## 2. Materials And Methods

*Trichiurus lepturus* was taken to the ice boxes from Negombo and Beruwala fishing area and immediately 5% formalin solution was injected through anus. In the laboratory their length and weight were measured and grouped according to the lengths. Stomachs were cut open ventrally and the numbers of undigested animal content were counted species wise. Percentage occurrence of food items for size groups was calculated and also percentage frequency was determined.

Random samples, consisting of 20% of fish were measured twice a month for total length, 859 from the commercial catches at Negombo and 1585 fish from Beruwala. The length frequency method was followed for the age determination (Narasimhan, 1976).

The length frequency data for age determination was analyzed according to the (Narasimhan, 1976). The estimation of Von Bertalanffy parameters were obtained by Walford and Elefant methods using the FISAT software programme.

The Von Bertalanffy relationship was shown in equation is used for analysis,

$$L_t = L_\infty [1 - e^{-k(t-t_0)}]$$

Where  $L_t$  = length of fish at time  $t$ ,  $L_\infty$  = length of fish at which the rate of growth is zero (maximum length),  $k$  = rate at which length approaches the maximum length, and  $t_0$  = the hypothetical time (age) at which a fish would have been zero length or arbitrary growth origin of growth curve.

Length frequencies of the different sizes of the exploited population of *Trichiurus lepturus* were calculated and data were plotted. The length frequencies of *T. lepturus* caught from beach seines and gill nets were plotted to study the size ranges of the fish caught from different gears.

## 3. Result

The diet of *T. lepturus* consist of *Sardinella* sp., *Leiognathus* sp., *Polynemus* sp., *Secutor* sp., *Anchovelia* sp., *Mugil* sp. and Shrimps and it varied with size of fish. Fish less than 45cm consumed more Shrimps and *Anchovelia* sp. The large fish consumed mostly small pelagic fish, *Sardinella* sp. and *Mugil* sp. (Table I)

Table I: Percentage composition of food items of *T. lepturus* according to size groups.

Size Groups	36-45 cm	46-55 cm	56-65 cm	66-75 cm	76-85 cm	86-95 cm
*No of fish examined	20	74	68	70	39	12
* % of fish with empty stomach	25	36.5	14.7	38.5	27.2	25
* % of partially digested food materials	20	27	47	21.4	23	16.6
* Food Items Percentage composition						
F1 ( <i>Sardinella sp.</i> )	0	16.2	25	21.4	30.7	39.3
F2 ( <i>Leiognathus sp.</i> )	0	0	2.9	4.2	7.6	0
F3 ( <i>Polynemus sp.</i> )	0	0	0	0	5.1	8.3
F4 ( <i>Secutor sp.</i> )	0	0	0	4.2	0	0
F5 ( <i>Anchoveia sp.</i> )	35	16.2	10.2	5.7	5.1	0
F6 ( <i>Mugil sp.</i> )	0	4.0	0	4.2	0	8.3
F7 (Shrimps)	20	0	0	0	0	0

The diet of *T. lepturus* consist of *Sardinella sp.*, *Leiognathus sp.*, *Polynemus sp.*, *Secutor sp.*, *Leiognathus sp.*, *Polynemus sp.*, *Secutor sp.*, *Anchovelia sp.*, *Mugil sp.* and Shrimps and it varied with size of fish. Fish less than 45cm consumed more Shrimps and *Anchovelia sp.* The large fish consumed mostly small pelagic fish, *Sardinella sp.* and *Mugil sp.* (Table I)

Table II: Percentage frequency of occurrence of food items of *T. lepturus*

Food Habits	% Frequency
Empty stomach	29.16
Partially digested food materials	28.91
<i>Sardinella sp.</i>	21.43
<i>Leiognathus sp.</i>	2.79
<i>Polynemus sp.</i>	1.57
<i>Secutor sp.</i>	1.03
<i>Anchovelia sp.</i>	11.26
<i>Mugil sp.</i>	2.44
Shrimps	1.41

Table II showed modified percentage i.e. frequency of stomach with particular diets. This will tell you the major diet of *T. lepturus*. The *Sardinella sp.* ranked first followed by *Leiognathus sp.*, *Polynemus sp.*, *Secutor sp.*, *Anchovelia sp.*, *Mugil sp.* and Shrimps. The above results indicated 29.16% of stomach are empty and 28.91% consists partially digested food materials.

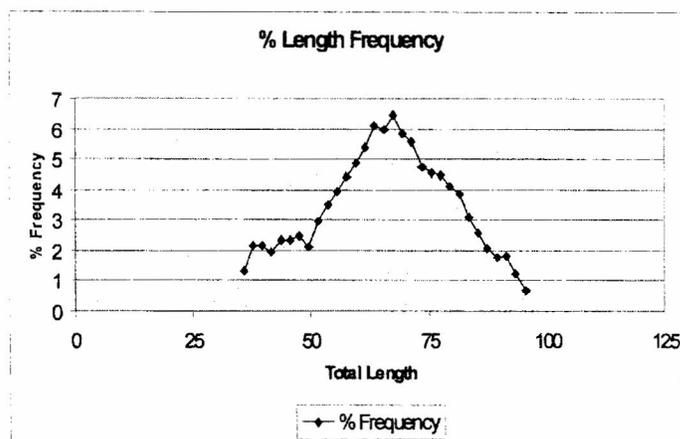


Fig1. Length frequency distribution of *T. lepturus*.

The length of the fish in the commercial catch ranged from 35.5cm to 95.5cm is shown in Figure 1 and mode length was 70cm

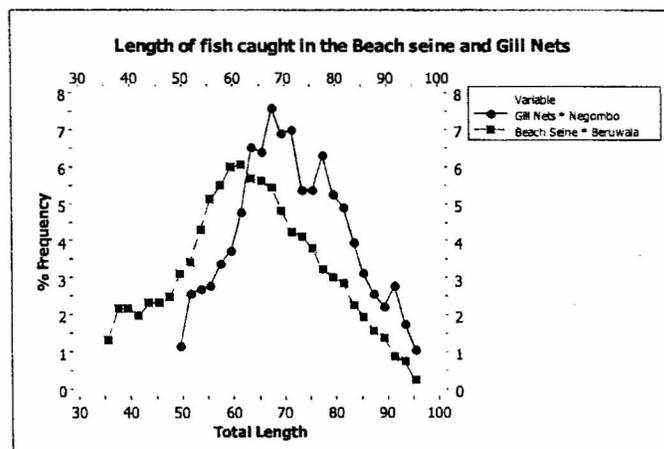


Fig2. Length of *T. lepturus* caught in Beach Seine and Gill nets.

The length of fish caught in the beach seine range from 35.5cm to 95.5cm with a mode at 60cm, where as at the gill net from 49.5cm to 95.5cm with the mode 70cm (Figure 2). The above results indicated that beach seine caught relatively more small fish than gill nets.

Table III: Occurrence of *T. lepturus* in Negombo fishing area

Date	July 2005	Aug. 2005	Sep. 2005	Oct. 2005	Nov. 2005	Dec. 2005	Jan. 2006	Feb. 2006	Mar. 2006	Total
Length/cm										
31-40	0	0	0	0	0	0	0	0	0	0
41-55	0	10	0	0	0	0	0	0	0	10
51-60	0	71	34	10	0	1	15	0	0	131
61-70	0	45	79	33	19	44	53	0	0	273
71-80	0	9	25	54	50	85	30	0	0	253
81-90	0	0	12	46	37	37	12	0	0	144
91-100	0	0	4	15	19	9	1	0	0	48
Total No.	0	135	154	158	125	176	111	0	0	859
Minimum Size/cm	0	49.5	51.5	55.5	63.5	59.5	53.5	0	0	
Maximum Size/cm	0	77.5	95.5	95.5	95.5	95.5	91.5	0	0	

Table IV: Occurrence of *T. lepturus* in Beruwala fishing area

Date	July 2005	Aug. 2005	Sep. 2005	Oct. 2005	Nov. 2005	Dec. 2005	Jan. 2006	Feb. 2006	Mar. 2006	Total
Length/cm										
31-40	0	3	15	12	15	25	20	0	0	90
41-50	0	24	37	35	31	33	33	0	0	193
51-60	0	79	83	78	59	40	47	0	0	386
61-70	0	64	50	70	87	84	82	0	0	437
71-80	0	18	20	32	73	75	72	0	0	290
81-90	0	4	10	17	34	75	49	0	0	189
91-100	0	0	0	2	8	9	11	0	0	30
Total No.	0	192	215	246	307	341	314	0	0	1615
Minimum size/cm	0	45.5	35.5	35.5	37.5	35.5	35.5	0	0	
Maximum size/cm	0	85.5	89.5	93.5	95.5	95.5	95.5	0	0	

The monthly length-frequency distributions of the *T. lepturus* are shown in Table III and IV. They were available for nine months from August to January. Its fishing season last from August to January and are most abundant from November to January in Beruwala and the most dominant size group 61-70cm, and September to December for Negombo fishing areas where the most dominant size group 61-70cm.

Table V: Length of *T. lepturus* at different age groups in Negombo and Beruwala fishing areas.

AGE / years	LENGTH / cm									
	1	2	3	4	5	6	7	8	9	10
NEGOMBO	28.27	48.27	63.01	73.49	81.02	86.44	90.33	93.12	95.13	96.18
BERUWALA	30.31	51.46	66.22	76.52	83.70	88.71	92.21	94.65	96.35	97.53

The length at the age data obtained in present study was shown in Table V. The mean length of fish at age I, II, III, IV, V, VI, VII, VIII, IX and X was 28.27cm, 48.27cm, 63.01cm, 73.49cm, 81.02cm, 86.44cm, 90.33cm, 93.12cm, 95.13cm and 96.18cm.

respectively; and the  $L_{\infty}$ ,  $K$  and  $t_0$  were 100.28cm, 0.33 and 0.00 years respectively for Negombo. The mean length of fish at age I, II, III, IV, V, VI, VII, VIII, IX and X was 30.31cm, 51.46cm, 66.22cm, 76.52cm, 83.70cm, 88.71cm, 92.21cm, 94.65cm, 96.35cm and 97.53cm respectively; and the  $L_{\infty}$ ,  $K$  and  $t_0$  were 100.28cm, 0.36 and 0.00 years respectively for Beruwala. According to that data the growth rate of *T.lepturus* is similar at both sites.

Table VI: Age comparison of fish caught in the two gears.

	Age/years								
	I	II	III	IV	V	VI	VII	VIII	IX
Gill Nets	0	183	293	191	103	41	24	15	9
Beach Seines	283	666	353	179	49	39	12	4	0
Total	283	849	646	370	152	80	36	19	9

The above results indicated that beach seines caught relatively more small age groups than gill nets. The age of the fish in the commercial catch ranged from year I to year IX was showed in Table VI.

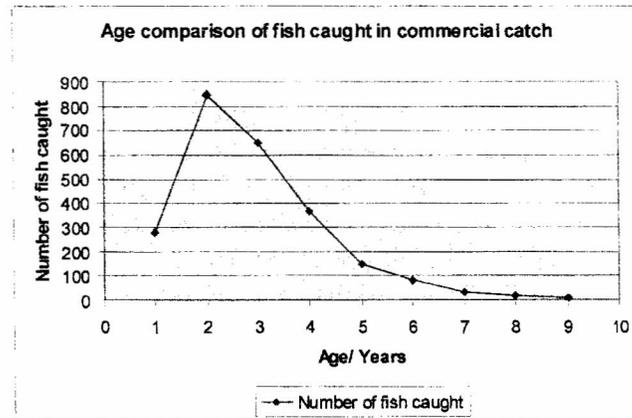


Fig 3. Age of fish caught in the commercial catch

Age of fish caught in the commercial catch in present study was shown in Figure 3. The age of the fish in the commercial catch ranged from year I to year IX. The age two group of *T. lepturus* was most abundant throughout the study period.

## 5. Discussion

The body of the ribbon fish is (Family : Trichiuridae ), extremely elongate, compressed and ribbon like, mouth large, lower jaw projecting and strong canine teeth in jaws(Fischer and Biandi,1984). According to the FAO fish identification , 6 species of ribbon fish are found in coastal area of Sri Lanka. Out of 6 species

*Trichiurus lepturus* is the most dominant species, abundant seasonally from September to November and are found in western coastal area of Sri Lanka. My study showed that *T. lepturus* formed 98% the total catch and is the most dominant species.

#### **Food habits of *T. lepturus***

Commonly *T. lepturus* feeds on wide varieties of small fish such as *Excualosa*, *Hemiramphus*, *Dussumieria*, *Sardinella*, *Stylephorus*, *Mugil*, *Leiognathus*, *Caranx* and *Sciaena* and shrimps according to the FAO (Fischer and Biandi, 1984).

Present study showed the diet of *T. lepturus* consisted of *Sardinella sp.*, *Leiognathus sp.*, *Polynemus sp.*, *Secutor sp.*, *Anchovelia sp.*, *Mugil sp.* and shrimps and its varied with size of fish.

From food analysis of 153 juveniles, Narasiman (1972), revealed that in the smaller juveniles of *T. lepturus* preferred copepods, while large juveniles preferred small fish, prawns and variety of crustaceans. According to above findings the copepods rank first followed by other crustaceans, prawn larvae, fish larvae, Lucifer and other foods. Also the incidence of empty stomachs was 9.8%. Quantitative food analysis of present study showed 29.16% of empty stomach and 28.91% of partially digested food materials.

According to the Table II *Sardinella sp.* ranked first followed by other. *Leiognathus sp.*, *Polynemus sp.*, *Secutor sp.*, *Anchovilla sp.*, *Mugil sp.* and shrimps. From Table I, it is obvious that in the smaller length groups the *Anchovilla sp.* were most dominant followed by shrimps, while in the larger length group *Sardinella sp.* were the favorite food item. The present study shows that the diet of any length group of *T. lepturus* consists *Sardinella sp.* except 31-45 cm group.

#### **Study of the size of the fish caught**

According to Figure 4, the length of the fish in the commercial catch ranged from 35.5cm to 95.5cm. From studies of 5891 of *T. lepturus*, Sastry (1984) revealed the commercial catch range from 31.5cm to 64.5cm at Kakinada during 1977-1980. The length of fish caught in the beach seine range from 35.5cm to 95.5cm, where as at the gill net from 49.5cm to 95.5cm. The above results indicated that beach seine caught relatively more small fish than gill nets. According to Sastry (1984), shore seines were operated during January to May and November to December. The catch rate varied from 2.0 to 231.2 Kg/net with fair catches in February-April. On average ribbon fish constituted 14.1% of the total catches of this gear and the average catch rate was 74.2Kg/unit; where as the small nylon gill nets were operated throughout the year but the ribbon fish catch was poor; 0.04 Kg/unit during November and 4.8 Kg/unit during December. On an average, ribbon fish constituted only 6.9% of the total catches and the catch rate 7 Kg/unit (Sastry, 1984).

The fish catch data taken from Beruwala by the operation of beach seine shows low frequency with that of Negombo. The key feature indicating here is the fish caught in Beruwala by Beach seine shows no selection on the fish length and almost all classes of fish are caught. Rather different in Negombo and the fish catch is limited for high length classes because of the mesh size of the gill nets. In beach seine all the fish in the operation area are caught to the net. So it is not a suitable fishing technique for a successful fishing effort.

The monthly distribution of the number of *T. lepturus* are shown in Table III and IV. The present study showed fishing season of *T. lepturus* lasts from August to January and are most abundant from November to January for both Negombo and Beruwala fishing areas. According to Fischer and Biandi (1967), *T. lepturus* is the most dominant species, fishing season last from August to January and are most abundant from November to December. The observations given by the Fischer and Biandi (1967) agree closely with present observations.

Narasimham (1983), found that the catches are moderate to good throughout the year, except for February-March and June; they were high in November to December, and formed over 28% of the total fish catch in each of these months. According to Sastry (1984), good catches of ribbon fish were obtained during March-October/ November with peak during August-September. The winter period (December-February) is the slack season for this fishery.

The pooled data for 8 year period (1966-1973) showed (Narasimham, 1983) that *T. lepturus* formed 90.8% and 6.5%, of the ribbon fish and total fish catches in the Kakinanda area. Also it is evident that the last quarter of the year was most productive for this species with minor peaks of abundance in April-May and July-August. Usually during these periods of abundance, it was observed that large shoals of *T. lepturus* measuring 50-90cm in length move into the fishing grounds and contribute to a considerable extent for the success of the ribbon fish fishery. The present study found, abundance period from November-January, during this period it was observed that large shoals of *T. lepturus* measuring 61-90cm in length (Table III and IV).

Earlier works recorded juveniles of *T. lepturus* below 129mm during March-December (Narasimhan, 1972). Prabhu(1955), stated that the post-larvae of this fish grow to 70-90mm length within one and half months. On the assumption that the growth rate of the early juveniles is similar during different years, that the spawning period is prolonged, from January- September. Further more juveniles were collected by the Narasimhan, (1972) in May-July, it is reasonable to believe the intensive spawning is confined to the February-June period. This may possibly explain for the adult of *T. lepturus* absent from February- July, because the juveniles of *T. lepturus* are most abundant during the period.

### Age structure of the exploited population

According to the length frequency distribution of *T. lepturus*, the length of the fish in the commercial catch range from 35.5cm to 95.5cm. The largest of the present study measured 97.5cm.

Tampi et al (1979) recorded a maximum length of 112cm, Narasimham (1976), 145.4cm. In Indian waters the ribbon fishery is essentially coastal in nature, confined up to 40m depth line from the shore, whereas the Japanese exploit the ribbon fish far away from their coast, in the major part of the East China and Yellow Seas. This may possibly explain for the larger sizes of *T. lepturus* recorded by Japanese workers (Narasimhan, 1976). Because Misu (1964) recorded a maximum length of 123.5cm and Hamada (1971) recorded a maximum length of 162.6cm at East China and Yellow Seas.

Prabhu, 1955 determined the length of *T. lepturus* at ages 1 to 4 by length frequency method in Madras Coast. That *T. lepturus* attains an average length of 18cm, 30cm, 46cm and 54cm in 1,2,3 and 4 years respectively; which show considerably slow growth rate for this species (Narasimhan, 1976).

Tampi et al (1971) revised the age of Prabhu's 2-year old fish measuring 30cm as 1-year old. Although Tampi et al (1971) did not present their data, their observations are significant in that they recognized that the fish grows at a faster rate at Madras coast. However, present study indicates that these values for the Von Bertalanffy growth coefficient (K) are almost same for the two fishing areas "Negombo and Beruwala", indicating that fishing areas attain the asymptotic length  $L_{\infty}$  at the same rate.

### 5. Acknowledgement:

I express my gratitude to Prof. J. Jinadasa, Senior Lecturer, Department of Zoology, University of Sri Jayewardenapura, for his valuable guidance and encouragement.

### 6. Conclusions

It can be concluded that *T. lepturus* is the most common species in the Family: Trichiuridae in Sri Lanka. Main food of *T. lepturus* consists of *Sardinella* sp., *Leiognathus* sp., *Polynemus* sp., *Secutor* sp., *Anchovelia* sp., *Mugil* sp., and shrimps. The type of food eaten varied with the age. The length of the commercial catch ranged from 35.5cm to 95.5cm. Beach seine caught relatively more small fish than Gill nets. *T. lepturus* showed its fishing season last from August to January for both Negombo and Beruwala fishing areas and are most abundant from September to October for Negombo and November to January for Beruwala fishing areas. The age of the fish in the commercial catch range from year 1 to year 9. The mean length of fish at the age 1,2,3,4, 5,6,7,8,9 and 10 was 28.27cm, 48.27cm, 63.01cm,

73.49cm, 81.02cm, 86.44cm, 90.33cm, 93.12cm, 95.13cm and 96.18cm respectively for Negombo and the mean length of fish at age 1,2,3,4,5,6,7,8,9 and 10 was 30.31cm, 51.46cm, 66.22cm, 76.52cm, 83.70cm, 88.71cm, 92.21cm, 94.65cm, 96.35cm and 97.53cm respectively for Beruwala.

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