SYNOPSIS OF BIOLOGICAL DATA ON THE NORTHERN BLUEFIN TUNA *Kishinoella tonggol* (Bleeker) 1851 (INDIAN OCEAN)

Exposé synoptique sur la biologie du thon *Kishinoella tonggol* (Bleeker) 1851 (Océan Indien)

Sinopsis sobre la biología del atún *Kishinoella tonggol* (Bleeker) 1851 (Océano Indico)

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1 IDENTITY

1.1 Taxonomy

1.1.1 Definition

Phylum Vertebrata
Subphylum Craniata
Superclass Gnathostomata
Series Pisces
Class Teleostomi
Subclass Actinopterygii
Order Thunniformes
Family Thunnidae
Genus Kishinoella 1924
Species Kishinoella tonggol (Bleeker) 1851

1.1.2 Description

- Genus Kishinoella Jordan and Hubbs 1924 Mem.

  Carnegie Mus. 10, 1922-1925, P.219 (Type Neothunnus rarus Kishinouye = Thynnus tonggol Bleeker).

"This genus is near Neothunnus, differing in the total absence of the air-bladder, in the low dorsal and anal fins, and in the small number of gill rakers. The species are much smaller in size than any other of the albacores, not exceeding, so far as known, the weight of 25 pounds. Body with conspicuous silvery markings." (Jordan and Evermann, 1926).

(See Kishinouye, 1923 for description of Neothunnus).

- Kishinoella tonggol (Bleeker) 1851

"Height about 4.3. Head about 4. Eye 5.6, 1.6 in snout. Mouth oblique. Maxillary reaching to below middle of eye. Rather large conical teeth in a single series in the jaws. Patches of small teeth on vomer and palatines. Corselet with two posterior emarginations, the upper one surpassing point of pectoral, the lower one reaching to anus. First dorsal spine equal to snout and eye, following spines gradually decreasing in length to the sixth, the posterior spines only slightly diminishing in size; the upper edge of the fin concave in its anterior half, almost straight posteriorly. Second dorsal and anal falcate, their greatest depth about twice that of the body. The first dorsal and anal finlets are often adnate to the second dorsal and anal, in which case there are only 8 free finlets. Pectorals half length of snout shorter than head. Ventrals somewhat shorter than snout and eye. Origin of pectorals below that of first dorsal. Origin of ventrals slightly behind that of pectorals. Colour according to Bleeker: Back greyish blue, sides silvery greyish with colourless elongated spots in about five longitudinal rows. Dorsals, pectorals, and ventrals blackish, but the tip of the second dorsal and the anal washed with yellow. Anal silvery. Finlets, both dorsal and anal, yellowish with greyish margin." (de Beaufort, 1951). (Figure 1) (For details of internal characters see Kishinouye. 1923).

1.2 Nomenclature

1.2.1 Valid scientific name

Kishinoella tonggol (Bleeker) 1851

1.2.2 Synonyms

?Thynnus argentivittatus Cuvier, 1831

Thynnus tonggol Bleeker 1851

Thynnus tonggol Bleeker 1852

Thunnus rarus Kishinouye 1915

Neothunnus rarus Kishinouye 1923

Kishinoella rara Jordan and Hubbs 1924

Neothunnus tonggol Jordan and Evermann 1926

Thunnus maccoyi (partim) McCulloch 1929

Neothunnus rarus Deraniyagala 1933

Thunnus nicholsoni Whitley 1936

Thunnus tonggol Tortonese 1939

Thunnus (Kishinoella) tonggol Fraser-Brunner 1950

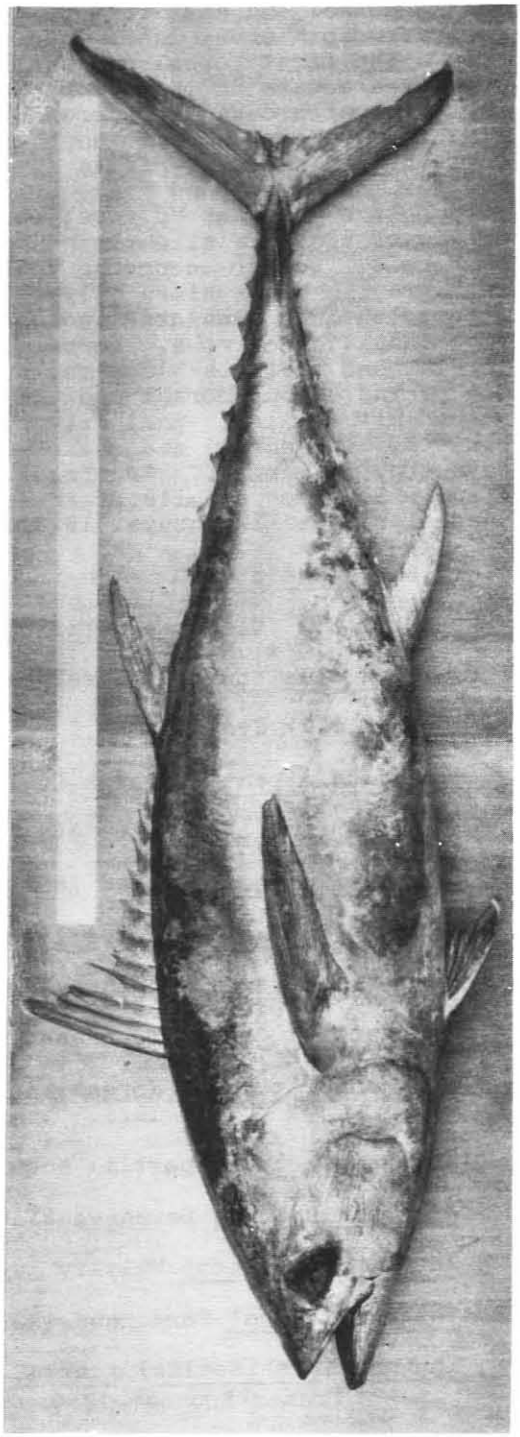

Figure 1. Kishinoella tonggol

76 cm in fork length; from the west coast of India.

Thunnus tonggol Beaufort 1951

Thunnus (Kishinoella) tonggol Deraniyagala 1952

Thunnus tonggol Collette 1961

Thunnus (Kishinoella) tonggol Rosa and Laevastu 1961

?Thynnus argentivittatus Rivas 1961

- Recent taxonomical references under Kishinoella tonggol

Serventy 1942; Munro 1955, 1958;

Jones and Silas 1960; 1962 a, 1962 b;

Whitley 1962.

Jones and Silas (1962 a) have drawn attention to the likelihood of Thynnus argentivittatus Cuvier, 1831 (= Thunnus argentivittatus Schaefer and Walford, 1950 = T. argentivittatus Rivas, 1961) and Thynnus tonggol Bleeker being conspecific. Their views summarised read as follows: "We (Jones and Silas, 1962 a) have elsewhere given reasons for considering Cuvier's T. argentivittatus, the lectotype of which was designated by Schaefer and Walford (1950) and examined and reported by Rivas (1961) as probably more akin to Kishinoella tonggol than to the yellowfin. Briefly stated the reasons are: (1) Kishinoella tonggol is quite common along the Malabar coast during certain seasons when it is caught in appreciable numbers in drift net and hook and line while the yellowfin is rarely ever caught in the coastal waters. (2) The gill raker count of the lectotype, namely, 8 + 18 = 26, falls well within the range for Kishinoella tonggol from Indian waters as shall be presently shown, but the number is too low for the yellowfin which has a total count of about 29 to 32 rakers. (3) Rivas (1961) has given additional gill raker counts for three specimens (topotypes) of T. argentivittatus from the Karachi coast as 6 + 17 = 23. Here again the gill raker counts are too low for a yellowfin. Actual examination of the lectotype may further aid in confirming our viewpoint and as mentioned by us (Jones and Silas, 1962 a) the specific name T. argentivittatus may have priority over T. tonggol. If so it is desirable to supress the lesser known name T. argentivittatus." (Jones and Silas, 1962 b).

1.2.3 Standard common names, vernacular names

See Table I

1.3 General variability

1.3.1 Subspecific fragmentation (races, varieties, hybrids)

The meristic counts given in Table II show hardly any difference in the fin ray counts for the species in the Indian Ocean. However, slight differences in the maximum and minimum counts of gill rakers in samples from the Gulf of Mannar (Silas, 1962) and Western Australia (Serventy, 1956) are noticeable, the modal formula being 7 + 18 (=25) and 6 +16 (=22) respectively. Similar data for samples for the intervening areas, such as the Sunda Archipelago will be desirable in order to evaluate the significance of these differences. Ranade's (1961) observation that "It is possible that a distinct race occurs at Ratnagiri" on the west coast of India south of Bombay (based on gill raker difference 8 + 18 = 26) needs substantiation based on observations on good series.

The characteristic spots may not always be present. In a number of fresh specimens examined at Veraval (Gujarat coast, India) the spots were missing.

The smaller specimens bear some resemblance to the yellowfin tuna Neothunnus macropterus and this sometimes confuses the field workers.

An adult specimen from Mangalore showed abnormality in the first dorsal fin which had only six spines as against the normal complement of twelve to thirteen spines, evidently due to some injury caused early in the life of the fish.

- Meristic counts

The meristic counts given in Table II would indicate the following formula for the species from the Indian Ocean. D_1 XI - XIV; D_2 + finlets 14-15+8-9; P_1 29-35; A+finlets 12-14+8-9; and gill rakers 5-8+14-19 (=19-27).

A specimen from Andamans subsequently examined had 7 + 18 (=25) gill rakers and three specimens from Veraval (Gujerat, India) had 8 + 18 (=26), 7 + 19 (=26), and 7 + 18 (=25) gill rakers.

Table I

Common and vernacular names

Country	Standard common name	Vernacular name(s)
Australia (Western)	Northern bluefin tuna	Northern tunny
India		Kerachoora (Malayalam south) Kethal (Malayalam north) Gethal (Kanarese) Gethar Khavalya gedar (Marathi)
Indonesia		Aboe-aboe Madadiang Tongkol lomoro

Table II

Meristic counts in Kishinoella tonggol from various parts of the Indian Ocean

Authors	D_1	D_2 + finlets	P_1	A + finlets	Gill rakers
Ranade (1961) (Ratnagiri; west coast of India)	-	-	-	-	8 + 18 (=26)
Deraniyagala (1952) (Ceylon)	XIII	4, 10 + 9	32	2, 10 + 8	- + 17 (= ?)
Munro (1955) (Ceylon)	XII-XIII	II, 12 + 8-9	2, 27	II, 12 + 8-9	-
Silas (1962) (Tuticorin, Gulf of Mannar)	XII-XIII	14 + 8 - 9	31	14 + 8	6-8+16-19(=22-27)
de Beaufort (1951) (Sunda Archipelago)	XII-XIII	2,11-12+8-9	2, 27	2,11-12+8-9	-
Munro (1958) (Australia)	XI-XIV	14-15+8-9	31-35	13-14+8=9	5-8+14-17
Serventy (1956) (Western Australia)	XII-XIV	14 + 9	30-35	14 + 8	5-8+14-18(=19-26)

2 DISTRIBUTION

2.1 Delimitation of the total area of distribution and ecological characterization of this area

Its general distribution is from the Gulf of Aden and Somalia coast to Japan, Philippines and Australia. (See Figure 2).

In the Indian Ocean it is known from the Somalia coast, Gulf of Aden, Arabia, West Pakistan, coasts of India, Maldives, Ceylon, Andamans, Malaya, Sunda Archipelago and west coast of Australia as far south as Fremantle.

According to the above, in the eastern sector of the Indian Ocean it is found as far south as about 32°S while in the western sector it is not known south of the equator. Absence of any record of this species from the southern section of the east African coast is rather puzzling.

It has been recorded only from comparatively coastal waters but not from near mouths of very large river systems, indicating its avoidance of areas of low salinity as other tunas.

2.2 Differential distribution

This species is caught in intermediate waters between the shallow coastal waters and the open ocean.

Hardenberg (1949) says "Neothunnus rarus to my experience seems to be rare above deep waters." Serventy (1956) is of the opinion that the fish does not occur beyond the 100 fathom line.

2.2.1 Areas occupied by eggs, larvae and other junior stages; annual variations in these patterns, and seasonal variations for stages persisting over two or more seasons. Areas occupied by adult stages; seasonal and annual variations of these

- Eggs

No information except that given under 3.1.8.

In the Indian Ocean the distribution of the species is confined to the coastal waters not extending far beyond the continental shelf of mainlands and around islands. Though not known to have been caught from far out in the open ocean it is rarely found in very shallow waters within the range of operation of shore seines. Along the south Kerala and west coast of Madras it is caught in 10 to 30 fathom limit off the coast. Along the north Kerala, Mysore and south Maharashtra coasts fishing is also done from 10 to 15 miles off the mainland. In the Gulf of Mannar trolling for scombroids is carried out 10 to 20 miles from the Tuticorin coast in water 12 to 60 fathoms deep (Silas, 1962). In the Maldives it is known to occur close to the atolls.

2.3 Behaviouristic and ecological determinants of the general limits of distribution and of the variations of these limits and of differential distribution

It is a coastal form distributed in areas of high temperature but its absence along the central and southern parts of the east coast of Africa cannot be explained. As other tunas it avoids areas of very low salinity and also muddy and silt laden waters Its distribution in areas of known occurrence in the Indian Ocean appears rather discontinuous, stocks in each zone evidently supported by distinct populations though a certain amount of mixing cannot be ruled out.

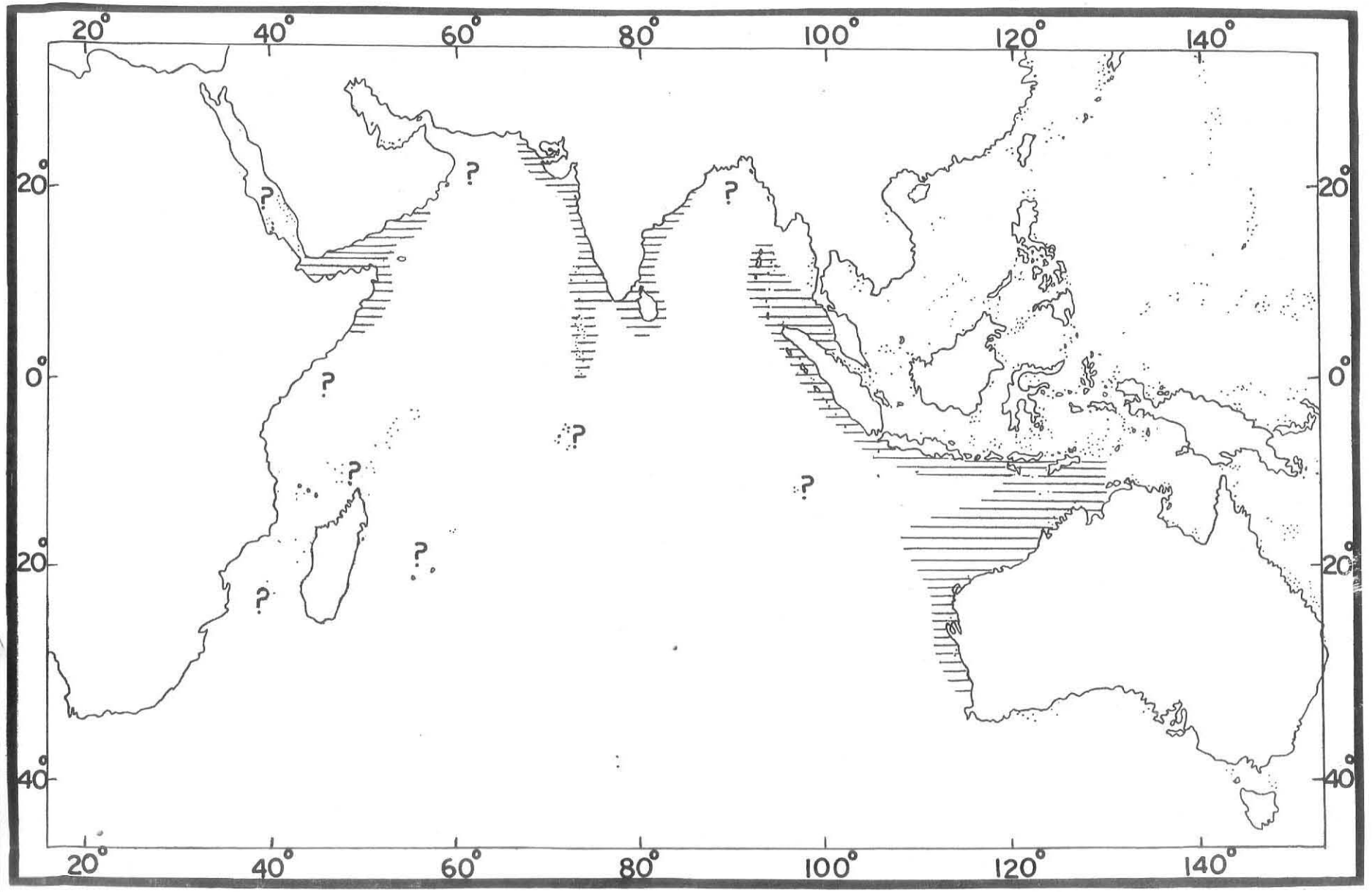

Figure 2. Distribution of Kishinoella tonggol in the Indian Ocean.

3 BIONOMICS AND LIFE HISTORY

3.1 Reproduction

3.1.1 Sexuality (hermaphroditism heterosexuality, intersexuality)

Kishinoella tonggol is heterosexual. No externally observable characters distinguishing the sexes are known.

3.1.2 Maturity (age and size)

There is no information on age, longevity or size at first sexual maturity. The largest size measured at Vizhingam (India) was a female 840 mm in length. The largest male 815 mm in length (as per information furnished by K.V. Narayana Rao). The drift net catches at Vizhingam, however, are mainly composed of fish measuring from 600 mm to 800 mm in length. Size composition of Kishinoella tonggol caught by troll lines in the Gulf of Mannar (Figure 3) indicates modes between 480 mm and 540 mm for the period June - November 1961, while the fish caught range in length from 400 mm to 780 mm. (Silas, 1962).

In Western Australia during the "Isobel Survey" in August - December 1945, thirty-one specimens of Kishinoella tonggol trolled from the vicinity of Shark Bay to Broome were large fish, the heaviest weighing 34 lbs and measuring 105 cm. (Serventy, 1956).

3.1.3 Mating (monogamous, polygamous, promiscuous)

Polygamous.

3.1.4 Fertilization (internal, external)

External.

3.1.7 Egg: Structure, size hatching type, parasites and predators

Rao (1962) found the ripe residual ova translucent and having an average diameter of 1.09 mm each with an oil globule varying in diameter from 0.31 mm to 0.33 mm in fresh condition. In one lot of residual eggs the large oil globule was found to be broken up into two or three small globules. No information is available on parasitic infection or egg predators.

3.3 Adult history

3.3.3 Competitors

It is caught from areas where other tunas (viz Neothunnus macropterus, Euthynnus affinis and Auxis spp.) seerfishes (Scomberomorus spp.) perches and carangids are caught. Sharks and billfishes (marlins and sailfish) also occur in the same area.

3.3.5 Parasites and diseases

Silas and Ummerkutty (1962) record the parasitic copepod Pseudocycnus appendiculatus from the gills of Kishinoella tonggol.

3.4 Nutrition and growth

3.4.2 Food (type, volume)

There is no detailed information on the food of Kishinoella tonggol. K.V. Narayana Rao who examined twenty-six specimens ranging in length from 635 mm to 815 mm caught in gill nets during September 1959 at Vizhingam (India) found the stomachs of fifteen empty. Particulars regarding the rest are given in Table III.

For specimens ranging in length from 400 mm to 780 mm taken on troll lines in the Gulf of Mannar off Tuticorin coast between June - November 1961, Silas (1962) found crustaceans, cephalopods and fish to be the food items in the order of importance.

According to Serventy (1956) "In Western Australia no particular food preferences are indicated by the data available. In northern waters Harengula, pilchards (northwards to Red Bluff) and anchovy predominate among the fishes; leatherjackets, garfish, northern mackerel (Rastrelliger kanagurta, Cuvier), mullet (Mugil compressa, Günther), flying fish, Gerres ovatus Günther, and various plectognaths also occur. Crustacea, particularly stomatopod larvae and prawns, are commonly eaten. Cephalopods are also frequently found in the stomachs and there is no evidence that they are taken only when fish are absent." An extreme example of a tuna with a heterogeneous assortment of food items was a 26-lb specimen caught in Shark Bay, Western Australia in August, 1943. The following items were identified by G.P. Whitley :

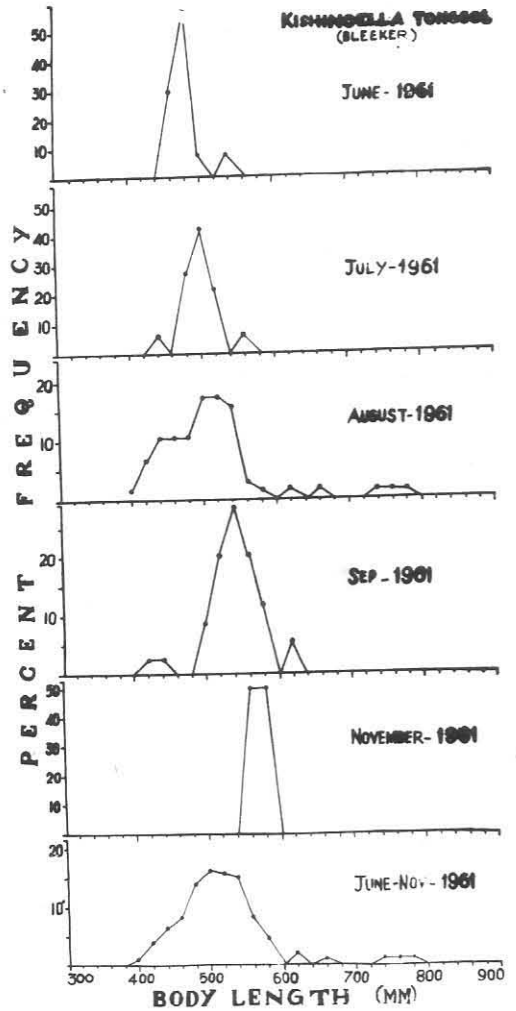

Figure 3. Length frequency of Kishinoella tonggol landed at Tuticorin, Gulf of Mannar during 1961 troll line fishing season (after Silas, 1962)

Table III

Stomach contents of *Kishinoella tonggol*

Fork length (cm)	Approx. weight in kg converted from lb	Stomach contents
76.5	5.45	3 sepia 1 mackerel (12 cm)
77.3	5.45	4 *Caranx kalla*
76.5	5.45	3 *C. kalla*, 1 mackerel (16 cm)
75.5	5.45	3 *C. kalla*
80.0	6.35	Fish bones
76.0	6.35	Fish bones
78.0	5.45	1 mackerel (15 cm)
78.3	5.45	1 *Decapterus*, 1 *C. kalla*
77.0	5.45	3 *Decapterus russelli*
81.5	6.35	2 *D. russelli*

1 garfish, headless, circa 280 mm total length;
3 silver fish (Gerres ovatus, Günther) 126 mm, 112 mm and circa 80 mm;
2 squid, 56 mm and 125 mm;
8 stinkfish (Calliurichthys sp.), 97 mm - 143 mm;
1 flathead (Suggrundus parilis), 100 mm;
18 anchovies (Engraulidae), 37 mm - 84 mm;
3 gobies (Gobiidae, sp.A), 52 mm - 57 mm;
2 gobies (sp.B), 35 mm;
1 parrot fish (Coris auricularis, C & V), 125 mm;
1 herring (?Clupalosa lippa, Whitley) 88 mm;
1 small fish (?Lepadichthys sandaracatus, Whitley), 29 mm.

3.5.2 Schooling

Reported to occur in small shoals off the coasts of India. Large shoals have been reported off the west coast of Australia.

4 POPULATION (STOCK)

4.1 Structure

4.1.1 Sex ratio

Detailed information is not available but a slight preponderence of females has been noticed in some samples examined at Vizhingam.

4.1.3 Size Composition

Generally the same size group appears in the commercial catches.

5 EXPLOITATION

5.1 Fishing equipment

5.1.1 Fishing gear

Adults are generally caught by drift net, hook and line and troll line. There appears to be appreciable increase in catch since the introduction of nylon nets. No special gear is employed for this species, other tunas and several other fishes being caught together with Kishinoella tonggol.

- Drift nets

Along the west coast of India the maximum catches are in drift nets. They are made of hemp, cotton or nylon and have a mesh size between 10 cm and 12.5 cm. In view of the better results nylon nets are becoming increasingly popular and are rapidly replacing the cotton and hemp nets. Fishing is carried out at night and catches are better during the dark phases of the moon. Kishinoella tonggol is also caught along with other fishes.

- Long lines

Line fishing is carried out during the greater part of the year along the southern section of the west coast of India except during very heavy monsoon periods. The long line used along south Kerala and the west coast of Madras is about 300 m long with about 150 hooks (of usually No.4 and/or No.5 size) arranged about 2 m apart. Sardines and other small sized fish are used as bait. Stray specimens of Kishinoella tonggol are caught along with a variety of other fishes. The men usually leave for the fishing grounds early in the morning and return in the evening.

- Troll lines

Trolling for Kishinoella tonggol and other scombroids is carried out off the Tuticorin coast, Gulf of Mannar, where fast sail boats with 7 or 9 lines are used as shown in Figure 4. More details are given elsewhere by Silas (1962).

5.1.2 Fishing boats

In India fishing is done from dugout canoes, carvel boats and catamarans. These craft are not used specifically for Kishinoella tonggol but for other fishes also.

5.2 Fishing areas

Fishing is not done anywhere in the Indian region specifically for Kishinoella tonggol. It is caught in stray numbers along with other fishes along the entire region of its occurrence (Figure 2).

5.2.2 Geographical ranges (latitudes, distances from coast, etc.)

See under 2.2.

5.2.3 Depth ranges

Generally caught from water 10 to 25 fathoms.

5.3 Fishing season

No fishing is carred out specially for Kishinoella tonggol.

5.3.1 General pattern of fishing seasons

Trolling for Kishinoella tonggol and other fishes in the Gulf of Mannar along the Tinnevelly coast lasts only from June to about September and depends on the availability of favourable wind. Along the South Kerala coast the best catches are from August to March-April whereas along the Kanara (Mysore) and Ratnagiri (from the Maharashtra) coasts the fishing season is from October to December. Stray specimens of Kishinoella tonggol are caught during the winter months in areas between Veraval and Dwaraka along the Kathiawar coast since the introduction of nylon nets. On the east coast of India also this fish is caught mainly during the winter months. This is also the case in the Andaman Sea.

5.3.4 Variations in time or duration of fishing season

No information available other than that given under 5.3.1.

5.3.5 Factors affecting fishing season

Optimum wind conditions are essential for taking the boats to the fishing grounds and bringing them back. Fishing is not generally done if the wind is too strong or the sea is very rough.

5.4 Fishing operations and results

5.4.1 Effort and intensity

Catches are very variable and of a mixed type.

5.4.2 Selectivity

The fishing methods employed are not specifically for Kishinoella tonggol.

5.4.3 Catches

Separate catch statistics for Kishinoella tonggol are not available except those given under 3.1.2. Along the Kerala and Mysore coasts it often forms the dominant species caught in drift nets. Along the Kerala coast it comes next to Euthynnus affinis.

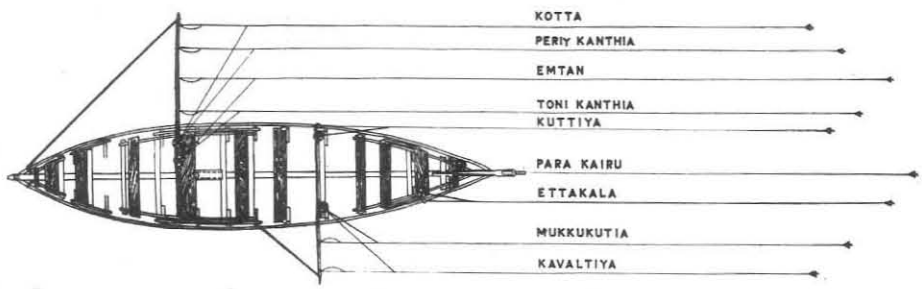

Figure 4. Arrangement of trolling lines on sail boat specially used for catching tunas and seer fishes off Tuticorin Coast, Gulf of Mannar (after Silas, 1962)