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SYNOPSIS OF BIOLOGICAL DATA ON THE BLACKFIN TUNA  
Thunnus atlanticus (Lesson) 1830 (WESTERN ATLANTIC)

Exposé synoptique sur la biologie du thon à nageoires noires  
Thunnus atlanticus (Lesson) 1830 (Atlantique Ouest)

Sinopsis sobre la biología del atún de aleta negra  
Thunnus atlanticus (Lesson) 1830 (Atlántico Occidental)

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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 Perciformes  
 Suborder Scombroidei  
 Family Scombridae  
 Genus Thunnus South  
 Species atlanticus (Lesson)

## 1.1.2 Description

Genus Thunnus

"Body oblong, robust, with very slender caudal peduncle. Head conical. Mouth wide, with one series of small, conical teeth in the jaws and bands of minute multiform or sand-like teeth on the vomer and palatines. Scales present, those of the pectoral region forming an obscure corselet. First dorsal of 12 to 15 spines which grow gradually shorter backward, the interval between last spine and second dorsal slight; second dorsal and anal short and rather high, each with 8 or 10 finlets; ventrals moderate; pectorals moderate, inserted below the level of the eye, Vertebrae normal, 39 to 41 in number, the lower foramina small." (Jordan and Evermann, 1896:869-70).

Thunnus atlanticus (Lesson) 1830

"Body thickset, spindle-shaped. Smaller individuals slightly more compressed laterally than the larger. Depth 3.12 to 4.05 in the length, the greatest depth of body about half way from base to tip of pectoral fin. Caudal peduncle depressed, with a triangular, rather short dermal keel on each side, the length of the keel being about one and one-half to two times the diameter of the eye. On the base of the caudal peduncle above and below the large keel is a very short, oblique dermal keel. A small keel on the body above the upper edge of the pectoral fin which allows the upper edge of the fin to lie flat with the contour of the body.

"Body completely scaled, the scales small, compact, absent on head, smallest below, especially anteriorly--those between the pectoral and ventral fins minute. Scale from midside

at vertical of the origin of the second dorsal fin in a 443 mm. fish measuring 2.75 mm. high and 2.6 mm. long. Corselet small, inconspicuous, largely over the base of the pectoral.

"Lateral line complete, slightly wavy, not very high anteriorly, becoming median in position only on the posterior caudal peduncle.

"Head conical, 3.15 to 3.6 in standard length, the lower profile slightly more convex than the upper. Snout not especially sharp, 2.9 to 3.25 in the head length. Eye large, obliquely set in head, 4.35 to 6 in head length (5.3 to 6 in fish over 380 mm.); adipose eyelid very small; interorbital space convex, 2.6 to 3.6.

"Posterior nostril an elongate vertical slit, its length slightly less than one-half the eye diameter. Anterior nostril very small, situated a considerable distance anterior to the posterior nostril and at the level of the upper edge of the latter.

"Mouth oblique, the mouth opening convex when viewed from the side, the convexity being upward. Maxillary 2.4 to 2.5 in the head, its posterior margin extending from anterior margin of eye to anterior margin of pupil, the width of the posterior expansion being about 2 in the diameter of the eye.

"Teeth moderate in jaws, uniserial, simple, conic, 33 to 40 above on each side (27, Fowler), 32 to 41 on each side below (32, Fowler). Vomer, palatines and a patch on the tongue with finely granular teeth.

"Gill-rakers slender but strong, 4 to 6 plus 15 to 18 on the first gill-arch. In 58 specimens in which the gill-rakers were counted, 13, or 22 percent had asymmetrical counts on the arches of the right and left sides.

"Dorsal fin XIII to XIV--III or IV, 10 to 13 (last ray a connected finlet)--VII to IX. Second dorsal spine highest, the first almost as high as the second, the spines after the second becoming progressively shorter, first abruptly and then gradually. Soft dorsal low. Anal fin II to III, 10 to 12 (last ray a connected finlet)--VII to VIII. Anal lobe similar to dorsal in shape and size.

"Coloration: This species in life is exceedingly brilliant. A 555 mm specimen whose colors were recorded before the fish

was removed from water was described as follows: Dorsal surface and inner side of pectoral fins jet black, the former bordered laterally with bright blue. A lateral band from snout to tail of brilliantly iridescent shining gold, very wide and including the outer side of the pectoral fin. Lower sides shining silver, with a large oval patch on the sides between the pectoral and pelvic fins silvery iridescent. Sides and ventral parts with eleven vertical bars and an equal number of bands of spots alternating with the bars. Second dorsal lobe with a tinge of yellow, but all other vertical fins black with a narrow white border, especially marked on the finlets.

"Mowbray's description of his specimens is as follows: "Colour, blue black above, a bright blue stripe, with one of yellow below it, separates the upper colour from the lower, which is a silvery gray; region of the ventrals and the belly, milky white: the spinous dorsal is dusky, the membrane lighter than the spines.

"The soft dorsal and anal are dusky with a silvery lustre, the finlets are dusky, with a trace of yellow: this is more pronounced in some specimens: the pectorals are black, the base outwardly is washed with silver.

"The ventrals are milky white outwardly when closed, and dusky inwardly with a metallic lustre when opened: the caudal is dusky, the sides of the belly show white spots which appear as reticulations: this I believe to be seasonal, as I noticed them only in the winter months; I do not know if they disappear in G. alalunga or not."

"There is considerable variation in color and in some specimens the lower side of the pectoral fin is silvery, the fin not being included in the golden lateral band. At death the golden band fades rapidly and usually only traces of it remain." (Beebe and Tee-Van, 1936: 181-183).

Osteological studies on the blackfin tuna have been carried out by de Sylva (1955).

## 1.2 Nomenclature

### 1.2.1 Valid scientific names

Thunnus atlanticus (Lesson) 1830

### 1.2.2 Synonyms

Thynnus atlanticus Lesson, 1830  
Thynnus balteatus Cuvier and Valenciennes, 1831  
Thynnus coretta Cuvier and Valenciennes, 1831  
Parathunnus obesus (non Lowe), Beebe and Tee-Van 1928  
Parathunnus rosengarteni Fowler, 1934  
Parathunnus ambiguus Mowbray, 1935  
Parathunnus atlanticus, Beebe and Tee-Van, 1936  
Thunnus atlanticus, Rivas, 1951 (Rivas, 1951; 1961)

### 1.2.3 Standard common names, vernacular names

United States - Atlantic blackfin tuna  
 blackfin tuna  
 albacore  
 albacora  
 Bermuda tuna

British Guiana - Blackfin bonito

British West Indies - Blackfin tuna  
 blackfinned tuna  
 blackfin bonito  
 blackfin albacore  
 bonito  
 thon  
 thon nuit  
 thon noir  
 baillolet  
 petit thon (Patois)

Haiti - Bonite  
 deep-bodied tunny

Bermuda - Bigeye tuna (confused with T. obesus?)

Martinique - Petit thon  
 bonite noir

Saintes - Thon noir

Guadeloupe - Thon noir  
 giromon

St. Lucia - Thon nuit

Cuba - Albacora

(largely from Rosa, 1950, and Morice and Cadenat, 1952).

1.3 General variability

1.3.1 Subspecific fragmentation (races, varieties, hybrids)

- Meristic data

Mather (1962) gives the following counts of gill rakers on the first arch for T. atlanticus:

Table I

No.	20	21	22	23	24
Frequency	3	16	24	7	1

Rivas (1961:141) presents proportional data on six specimens of T. atlanticus, from Miami, Panama City, and St. Petersburg, Florida, and from San Juan, Puerto Rico, as follows:

Table II

	Range, mm	Mean, mm
Body length	520-885	650
Head length	284-309	295
Iris diameter	42-57	49
First predorsal length	291-323	309
Second predorsal length	540-584	557
Prepelvic length	313-346	330
Preanal length	625-666	637
Body depth	264-298	282
Pectoral fin length	222-299	266
Height second dorsal	106-138	118
Height anal	100-131	109

The following measurements are adapted from Table I of Beebe and Tee-Van (1936):

Table III

	Bermuda (52 specimens)	Tobago (22 specimens)
Length, mm	263-583	383-570
Depth in length	3.12-3.76	3.7-4.05
Head in length	3.1-3.4	3.25-3.6
Eye in head	4.35-6	5.2-5.5
Snout in head	3 -3.5	2.9-3.3
Maxillary in head	2.45-2.5	2.4-2.5
Interorbital in head	3-3.1	3.06-3.2
First dorsal spines	13-14	13-14
Second dorsal rays III or IV,	III, 11	III, 11
	10-12	
Dorsal finlets	7-8	8-9
Anal rays	II, III, 10-12	III, 11
Anal finlets	7-8	8
Pectoral fin in length	3.3-3.7	3-3.7
Pectoral fin in head	1-1.1	.9-1.08
Pectoral ray count	1, 32-33	1, 31-32
Gill rakers, upper	5-6	5-6
Gill rakers, lower	15-18	15-16
Middle of eye to		
snout in head	2.4-2.5	2.4-2.44
Snout to pelvic fin		
origin in length	2.75-2.9	2.8-2.9
Snout to first dorsal		
fin in length	2.95-3.2	3-3.1
Snout to second dor-		
sal fin in length	1.67-1.76	1.66-1.76
Snout to anus in length	1.45-1.5	1.46-1.53
Height 1st dorsal		
spine in head	2.2-2.45	2.15-2.5
Height 2nd dorsal		
fin lobe in head	2.7-3.1	3.1-3.6
Height anal fin lobe		
in head	2.85-3.4	3.2-4.2

Rivas (1951:220) diagnoses T. atlanticus as having 13 or 14 dorsal spines, 7 to 9 dorsal finlets, 7 or 8 anal finlets, and 15 to 19 gill rakers on the lower limb of the first arch.

## 2 DISTRIBUTION

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

The blackfin tuna is apparently limited to the tropical western Atlantic, from southern Brazil and Trinidad northward to Cape Cod, Bermuda, and throughout the Caribbean and the Gulf of Mexico (Rosa 1950; Morice and Cadenat, 1952; Mather and Day, 1954; Mather and Gibbs, 1957; Springer and Bullis, 1956). According to Rivas (1961:131), a blackfin tuna identified by the International Game Fish Association from off Capetown, South Africa may be in reality a bigeye tuna, Thunnus obesus (Lowe). In the western south Atlantic and in the eastern Atlantic, confusion of the blackfin with T. obesus, and even small individuals of T. albacares, may have occurred.

### 2.2 Differential distribution

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

Klawe and Shimada (1959) reported young specimens of blackfin from the western Gulf of Mexico and in the northern Gulf, well off the Mississippi delta.

Klawe (1961) obtained blackfin tuna from the locations shown in Table IV.

Juveniles and adults have been reported from over deeper waters of the Gulf of Mexico by Springer and Bullis (1956). Adults occur commonly throughout the western north Atlantic at least as far north as Ocean City, Maryland. Off Miami, Florida, blackfins occur in anglers' catches throughout the year, with the peaks

in the fall (November and December) and spring (April and May) (de Sylva, unpublished data). Large schools of blackfin tuna are observed throughout the Gulf and Caribbean areas (Springer, 1957, Wathne, 1959). Rawlings (1951) discussed the occurrence of blackfin tuna off Cuba, which is now more fully documented by Suarez Caabro and Duarte Bello (1961).

In Florida and Cuba, the blackfin tuna occurs throughout the year in anglers' and commercial catches, respectively (de Sylva, unpublished data; Suarez Caabro and Duarte Bello, 1961). Morice and Cadenat (1952) give information for the occurrence of blackfin tuna in the Caribbean (Table V). They add that it is common around the Barbados and the west coast of Tobago, and that it is one of the most commonly found tuna in the Lesser Antilles. Springer (1957) noted large concentrations of blackfins past the 200-fathom curve from Pascagoula, Mississippi. Compact schools of tuna were estimated at 4- to 10 pound fish.

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

The blackfin tuna is a warm-water species limited essentially to the tropical waters of the tropical western Atlantic. As with many other scombrids, it is found further to the north during the summer, regularly appearing in anglers' catches along the coast at least as far north as Ocean City, Maryland, and probably occurring regularly in New Jersey. Its rare appearance off Cape Cod (Mather and Gibbs, 1957) indicates that it is less a far northern migrant than are other species of Thunnus. The 20° isotherm is probably a limiting factor in its distribution.

Table IV

Captures of blackfin tuna (Klawe, 1961)

<u>Date</u>	<u>Length, mm</u>	<u>N. lat.</u>	<u>N. long.</u>	<u>Method of Capture</u>
16 July 1953	96	30°27'	79°01'	Stomach of <u>Acanthocybium</u>
11 Oct. 1953	96	26°01'	78°06'	Stomach of <u>Sphyraena barracuda</u>
12 June 1954	99	27°44'	77°31'	Stomach of <u>Coryphaena</u>
22 June 1954	58	26°10'	78°13'	Stomach of <u>Katsuwonus</u>

Table V

Occurrence of blackfin tuna in the Caribbean  
Morice and Cadenat (1952)

Grenadines	Trolling from March to May
St. Vincent	"Driving" from February to May
St. Lucia	"Driving" from February to May. Trolling in the south of the island during the summer. Seine fishing from October to November
Dominica	Trolling from January to June in the North and South channels
Virgin Islands	Occasionally caught in seines

## 3 BIONOMICS AND LIFE HISTORY

3.1 Reproduction

## 3.1.1 Sexuality (hermaphroditism, heterosexuality, intersexuality)

The blackfin is heterosexual. The sexes are well marked upon dissection. There is no known method of identifying the sex externally.

## 3.1.2 Maturity (age and size)

Ripe females have been taken off Miami, Florida in April at a fork length of 52 cm, corresponding to a weight of about 6 pounds, and an age of two years; ripe males have been found at a length of 48 cm, a weight of 4 1/2 pounds, at an age of about two years (de Sylva, unpublished data). Larger fish apparently ripen earlier in the year.

## 3.1.4 Fertilization (internal external)

From the structure of the gonads, fertilization is believed to be external.

## 3.1.6 Spawning

The spawning season off Miami, Florida, is from April to November (de Sylva, unpublished data). Males are ripe as early as February, but contain free-flowing sperm only to November. As indicated by anglers' catches, there may be a peak season in May. The time of day of spawning is unknown.

In the Gulf of Mexico, based on the appearance of small juveniles, spawning occurs in the western and northern Gulf, in June, August and September (Klawe and Shimada, 1959:113-114).

In Cuba, Suarez Caabro and Duarte Bello (1961) reported ripening blackfin tuna in February and spent tuna in June. The spawning season, from this data, is not well defined.

## 3.1.7 Spawning grounds

From the distribution of the larvae and juveniles (Klawe and Shimada, 1959; Klawe, 1961), it is believed that spawning occurs well offshore, in clear, "blue" oceanic water of the Florida current. Morice and Cadenat (1952) suggest that spawning may occur in the Lesser Antilles.

3.2 Larval history

## 3.2.1 Account of embryonic and juvenile life (prelarva, larva, postlarva, juvenile)

Identification and distribution of larvae and juveniles is discussed by Klawe and Shimada (1959) and Klawe (1961). Nothing is known about the growth stadia involved, except that there is an increase in the number of gill rakers during early growth.

3.3 Adult history

## 3.3.1 Longevity

Preliminary studies (de Sylva, unpublished data) show that on the basis of scale analysis a blackfin tuna of 15 pounds and about 70 cm fork length is 5 years old. Since the species reaches a weight of at least 26 1/2 pounds (Morice and Cadenat, 1952), the species attains a greater age than 5 years.

## 3.3.3 Competitors

The common associate of the blackfin is the oceanic bonito Katsuwonus pelamis (L). This species is found mixed in schools of blackfin. Contrary to the statement of Rivas (1951), it seems unlikely that the little tuna, Euthynnus alletteratus (Rafinesque), schools with the aforementioned two species, since Euthynnus is a shoal-water form (de Sylva and Rathjen, 1961), while the other two are deep-water, blue-water forms.

## 3.3.4 Predators

Krumholz and de Sylva (1958) and Erdman (1962) have found this species to be one of the most common foods of the blue marlin, Makaira nigricans.

## 3.3.6 Greatest size

Rivas (1961:131) records a blackfin weighing 34 pounds and 885 cm long, from St. Petersburg, Florida. A 35-pound fish was taken in the Miami Metropolitan Fishing Tournament in 1955. Mowbray (cited by Rivas, 1951:220) states that the blackfin (as Parathunnus ambiguus) reaches 60 pounds, but it is possible that this refers to Thunnus obesus. Suarez Caabro and Duarte Bello (1961) give the following weight-length relationship:

$$P = 1.376 \times 10^{-2} L^{3.10404}$$

### 3.4 Nutrition and growth

#### 3.4.1 Feeding (time, place, manner, season)

Feeding of this species has been described by Springer (1957), Gudger (1941), and Morice and Cadenat (1952). Food studies indicate that generally the blackfin tuna is a deep-feeding species which occasionally feeds on surface schools of small fishes, and upon the organisms inhabiting Sargassum communities. Beebe (1936) suggests that blackfin tuna are also bottom feeders, as indicated by certain reef fishes in their stomachs.

#### 3.4.2 Food (type, volume)

Extensive food studies have been carried out by Beebe (1936) and by Suarez Caabro and Duarte Bello (1961). In Bermuda waters, Beebe found that surface and deep sea fishes, squids, amphipods, crabs, shrimps, and stomatopod larvae were of greatest importance. Suarez Caabro and Duarte Bello showed that fishes comprised more than 60% of the food of 86 blackfin from Cuba, squids about 24%, stomatopod larvae about 9%, decapod crab larvae about 3% and other crustaceans about 5%. The most important fishes were Balistes

and Monacanthus spp. Acanthurus, seranids, clinids, holocentrids and priacanthids. It is likely that all of these groups are postlarvae and early juveniles. In volume, fishes accounted for nearly 75% of the food, while decapod mollusca (i.e. squids) comprised more than 23%. In Florida, de Sylva and Rathjen (1961) noted deepsea fishes in blackfin stomachs.

### 3.5 Behavior

#### 3.5.1 Migration and local movements

Feeding and general behavior have been discussed by Gudger (1941) Morice and Cadenat (1952), and Springer (1957). Blackfin tuna travel in great schools, reportedly defying the imagination, in the Gulf of Mexico, the eastern Bahamas around Cuba, and in the Lesser Antilles, particularly when the surface is calm. Springer (1957) noted the apparent timidity of this species and its relation to potential commercial fishing.

#### 3.5.2 Schooling

See section 3.5.1.

## 4 POPULATION

4.1 Structure

## 4.1.1 Sex ratio

No information is available on the ratio of males to females at the actual spawning time, but there are twice as many males as females in the anglers' catches off Miami, Florida, even during the spawning season (de Sylva, unpublished data).

Suarez Caabro and Duarte Bello (1961) found a slight predominance of males in the commercial catch from Cuba.

## 4.1.2 Age composition

In Florida, most of the anglers' catch is apparently composed of fish

between one and five years old (de Sylva, unpublished data).

## 4.1.3 Size composition

In Florida, the anglers' catch is composed of fish from about 1 pound to 15 pounds (30 to 72 cm) with an occasional tuna larger than this, the bulk of the catch is from 4 to 11 pounds (46 to 66 cm) (de Sylva, unpublished data). Suarez Caabro and Duarte Bello (1961) report a size distribution of 28 to 60 cm (total length) for blackfins from Cuba, with the bulk of the catch being from 29 to 53 cm.

4.2 Size and density

See section 4.1.3.

## 5 EXPLOITATION

### 5.1 Fishing equipment

Springer (1957) reported on the potential for a blackfin tuna industry in the Gulf, but noted the difficulty of capturing specimens commercially. The largest commercial fishery is in Cuba (Rawlings, 1951; Suarez Caabro and Duarte Bello, 1961), which exists on a Japanese live-bait and jackpole basis, occurs along with a fishery for oceanic bonito. Trolling procedures have produced only small catches commercially; trolling is the common method used by anglers in south Florida and Caribbean for blackfin. In Martinique, blackfins are caught by handline or seines, or by "bullying" (Morice and Cadenat, 1952).

### 5.2 Fishing areas

#### 5.2.1 General geographic distribution

The southeastern shore of Cuba (see Suarez Caabro and Duarte Bello, 1961) supports the largest fishery in the Atlantic, covering a distance of 414 miles. Other industries are supported at Mole St. Nicholas at the northwest corner of Haiti, and casually throughout the Lesser Antilles. In southeastern Florida blackfin tuna from sport catches find a ready but uneven market; the flesh of the blackfin is comparable to that of the albacore (T. alalunga).

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

The Cuban fishery is 3 to 4 miles from land. In the Lesser Antilles, commercial fishing occurs in blue waters to land.

#### 5.2.3 Depth ranges

Most fishing occurs in surface waters after the tuna have been chummed to the surface.

### 5.3 Fishing seasons

In Florida, the sport fishing season occurs year round, with peaks in the fall and spring. In Cuba, the catches of blackfin and oceanic bonito are not separated, and thus fishery statistics are difficult to interpret, but the fishing season seems to occur for 10 months.

### 5.4 Fishing operations and results

Most of the blackfin tuna taken in Cuba is canned. The fishery began in 1932, and from 1949 to 1957, the blackfin and bonito fishery amounted to 23,443,636 pounds, at a value of \$2,784,582.98. In 1958, there were 48 boats employing 450 men. There are nine canning plants in Batabano, Nueva Gerona, La Coloma, and Arroyos de Mantua. The fishing vessels averaged about 14 meters long, ranging from 9 to 17 meters. Fishing begins in the early morning (Suarez Caabro and Duarte Bello, 1961).

