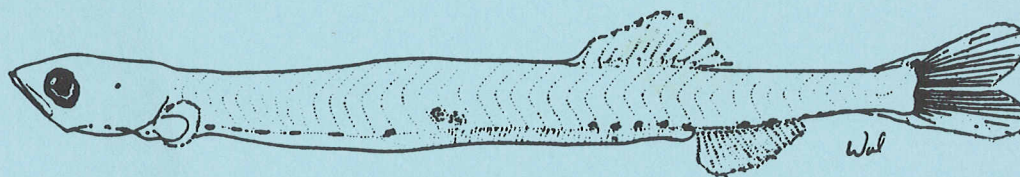
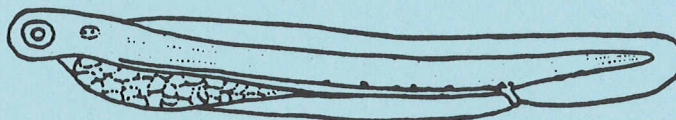
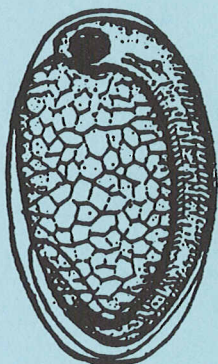


NOAA TECHNICAL MEMORANDUM
NMFS-SEFSC-358

PRELIMINARY GUIDE TO THE IDENTIFICATION
OF THE EARLY LIFE HISTORY STAGES OF ANCHOVIES
(FAMILY ENGRAULIDAE)
OF THE WESTERN CENTRAL ATLANTIC

by

TALAT FAROOQI, RICHARD F. SHAW
and
JAMES G. DITTY



U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
SOUTHEAST FISHERIES SCIENCE CENTER
MIAMI, FLORIDA 33149

JANUARY 1995

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D. James Baker, Administrator

NATIONAL MARINE FISHERIES SERVICE
Rolland A. Schmitten, Assistant Administrator for Fisheries

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Author's affiliations: Center for Coastal, Energy, and Environmental Resources, Coastal Fisheries Institute, Louisiana State University, Baton Rouge, LA 70803.
(504)388-6374, FAX (504)388-6513

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INTRODUCTION

This guide will assist in identifying early life stages of engraulids that occur in marine waters of the western-central North Atlantic, an area bounded by 35° N latitude, 50° W longitude, the equator to the south, and the continents on the west. The western-central North Atlantic is primarily tropical/subtropical, is characterized by coral reef and hard bottom areas, and includes the Gulf of Mexico and Caribbean Sea.

Meristic data and information (where available) on eggs, larvae, and juveniles are included for 7 genera and 28 species. Taxa found primarily in freshwater are excluded. Engraulids are typically marine, pelagic, and coastal but some enter estuarine and fresh-waters (Whitehead et al., 1988). Most, if not all, school and have bouyant eggs and pelagic larvae but little is known about the early life stages. Known anchovy eggs are ellipsoidal and lack an oil globule. Larvae are elongate and the anus is located at about 75% of standard length. Typically, larvae are lightly-pigmented, with pigment concentrated along the ventral midline and above the gut.

Anchovies are notoriously difficult to separate and taxonomic confusion complicates accurate identification. We examined original descriptive work whenever possible. Many discrepancies in meristic counts occur in the literature because researchers have differed in their methods of making counts. For example, Hildebrand (1943) and Cervigon (1966) included unbranched, segmented rays of the dorsal, anal, pectoral, and pelvic fins in counts, whereas Whitehead (1973) and most other authors include only branched rays. Dorsal and anal fins have three unbranched rays preceeding each fin; pectoral and pelvic fins have one. We follow Whitehead et al. (1988) and report only branched soft rays. We accept the taxonomy of Whitehead et al. (1988) except as modified by Nelson (1986) for Anchoa lyolepis and A. nasuta. Number of gill rakers should be used with caution. Gill rakers increase in number with growth for several species and some authors include nubs and tubercles in counts while others do not. Counts given for total gillrakers may not equal the sum of upper and lower gillrakers depending on literature source. Knowledge of the geographic distribution of taxa will narrow choices and allow most anchovies to be identified by lower gillraker and branched anal fin-ray counts (Whitehead et al., 1988). For each species, the left page provides information on meristics, ecology, and larval identification characters, while the right page contains illustrations. Where information is unknown or unavailable, space is provided for additional data and notes. Users should notify us of errors, omissions, or updates so that the final guide will be complete. Wayne LaRoche (Stonefish Environmental Consulting, Enosburg Falls, Vermont) provided several new illustrations.

Table 1. Summary of the characters useful for separating adult engraulids from the western-central North Atlantic.

TAXA	Number of Species in Area	Membrane connecting opercula across isthmus	Canine teeth in lower jaw	Maxilla shape ¹	AFO ² anterior to DFO	Gillrakes on hind face of third epibranchial
<i>Anchoa</i>	15	No	No	P	No	Yes
<i>Anchovia</i>	2	No	No	P/R	No	No
<i>Anchoviella</i>	7	No	No	R	No	Yes
<i>Cetengraulis</i>	1	Yes	No	R	No	No
<i>Engraulis</i>	1	No	No	R	No	Yes
<i>Lycengraulis</i>	1	No	Yes	P	No	?
<i>Pterengraulis</i>	1	No	No	R	Yes	?

¹ P: maxilla tapering to a blunt point, or R: maxilla rounded

² AFO - anal fin origin, DFO - dorsal fin origin

Table 2. Summary of meristics and early life history information for anchovies from the western central North Atlantic. Classification follows Whitehead et al. (1988) except as modified by Nelson (1986) for *Anchoa nasuta* and *A. lyolepis*. Counts include only-branched soft rays, ranges or rare counts in parentheses. Abbreviations: M=marine, E=estuarine, B=brackish, Fw=freshwater.

Species	Number of Fin Rays			Vertebrae	Branchi- ostegals
	Dorsal	Anal	Pectoral		
<i>Anchoa</i>					
<i>cayorum</i>	11(10-12)	24(21-26)	12(11)	42	12-13
<i>choerstoma</i>	10-12	19-22	11-13	41-42	12-13
<i>colonensis</i>	11-14	17-20(21)	13-14(12-15)	41-42(40-43)	12-13
<i>cubana</i>	12(11-13)	19-20(16-21)	13-15	43(41-44)	12-13
<i>filifera</i>	12(11-13)	19-20(17-21)	12-13(12-15)	39(37-41)	12-13
<i>hepsetus</i>	12-13(11-14)	18-19(16-20)	14-15(13-16)	42-43(41-46)	12-13
<i>januaria</i>	12-13(11-14)	20-21(18-22)	12-13(11-13)	40(39-41)	12-13
<i>lamprotaenia</i>	11-13	20-21(18-24)	11-13	41(39-42)	12-13
<i>lyolepis</i>	11-12(10-13)	17-19(15-20)	11-12(14)	41-42(40-43)	12-13
<i>mitchilli</i>	12(10-14)	22-25(20-27)	10-11(9-12)	38(39-41)	12-13
<i>nasuta</i>	12(11-13)	18-20(17-22)	12(11-14)	41-42(40-43)	12-13
<i>parva</i>	12-13(11-14)	19-21(17-22)	11-12(10-13)	39-40(38-41)	12-13
<i>pectoralis</i>	11-13	22-25	14-16	42	12-13
<i>spinifer</i>	12-13(11)	33-35(31-37)	12(11-14)	40-43(44)	14-15
<i>trinitatis</i>	11(10-12)	25-26(23-27)	12-13(11-14)	40(39-41)	12-13
<i>Anchovia</i>					
<i>clupeoides</i>	12(11-13)	27-30(25-32)	13(11-14)	42-43(44)	13
<i>surinamensis</i>	10-12	23-24(20-25)	12(11-13)	38-39	11-12(10-13)
<i>Anchoviella</i>					
<i>blackburni</i>	10-12	22-24	13-15	43	10-12
<i>brevirostris</i>	12-14	16-17(15)	13-14	41	11-12
<i>cayennensis</i>	10-12	12-14	14-15		13
<i>elongata</i>	10-11	18-22	11-12	39	10-12
<i>guianensis</i>	11-12(13)	15-16(14-18)	11-13	39-40	12
<i>lepidentostole</i>	11-13(10-15)	20-22(19-23)	12-13(14)	40	11-12
<i>perfasciata</i>	12(11-13)	14-15(12-16)	14-15(13-16)	42-44	10-12
<i>Cetengraulis</i>					
<i>edentulus</i>	12-14	21-23(18-24)	14-15(16)	41(40-42)	8
<i>Engraulis</i>					
<i>eurystole</i>	12-13	14-15(12-16)	13-15	44(43-45)	12-14(11)
<i>Lycengraulis</i>					
<i>grossidens</i>	13	23-25	14	43	13-14
<i>Pterengraulis</i>					
<i>atherinoides</i>	10-11	30(28-31)	12-14	43-45(42)	12-13(11)

Table 2. Continued.

Species	Gill Rakers			Habitat	Illustrated Early Life Stage		
	Upper	Lower	Total		Egg	Larva	Juvenile
<i>Anchoa</i>							
<i>cayorum</i>	13-15(12-16)	17-18(16-19)	30-33(28-35)	M			
<i>choerstoma</i>	17-20	24-27	41-47	M			
<i>colonensis</i>		19-22	37-41(34-42)	M		+	
<i>cubana</i>	20-23(17-24)	26-27(24-30)	46-50(44-55)	M			
<i>filifera</i>	20-23(17-24)	25-26(24-27)	44-50(42-50)	M, E			
<i>hepsetus</i>	18-19(17-20)	21-22(20-23)	39-41(37-43)	M, E	+	+	+
<i>januaria</i>	21-23(21-24)	26-29(24-29)	47-51(45-53)	M, E			
<i>lamprotaenia</i>	14-16(13-18)	18-20(17-21)	32-36(30-39)	M, E			
<i>lyolepis</i>	17-19(14-20)	21-23(19-25)	38-42(33-45)	M			
<i>mitchilli</i>	16-18(15-20)	22-24(21-25)	38-42(36-45)	M, E, Fw	+	+	+
<i>nasuta</i>	20-22(19-23)	25-26(23-27)	45-48(42-50)	M		+	
<i>parva</i>	19-21(18-22)	25-27(23-30)	44-49(42-53)	M			
<i>pectoralis</i>	13-15	17-20(21)	30-36	M, E			
<i>spinifer</i>	13-15(10-16)	16-17(12-19)	29-32(22-35)	M, E, Fw			
<i>trinitatis</i>	16-17(18)	19-20(18-22)	35-37(34-39)	M, E			
<i>Anchovia</i>							
<i>clupeoides</i>		100-116		M, E, Fw			
<i>surinamensis</i>		51-62(47)		E, Fw			
<i>Anchoviella</i>							
<i>blackburni</i>	10-12	15-18	25-30	M, E			
<i>brevirostris</i>	16-17	24-25(23-27)	40-42(39-43)	M, Fw, E			
<i>cayennensis</i>	16-17	29-35	45-52	E, Fw			
<i>elongata</i>	17-18	21-24	38-42	E, B			
<i>guianensis</i>	17(16-18)	23-24(20-26)	40-41(38-42)	E, Fw			
<i>lepidentostole</i>	18-19	20-22(18-25)	38-41	M, B			
<i>perfasciata</i>	20-22(18-23)	26-29(24-30)	46-51(42-53)	M		+	
<i>Cetengraulis</i>							
<i>edentulus</i>		45-55	75-105	M, E	+		
<i>Engraulis</i>							
<i>eurystole</i>	25-26(24-28)	28-30(27-33)	53-56(51-61)	M	+	+	+
<i>Lycengraulis</i>							
<i>grossidens</i>	14-16(13-17)	18-21(16-27)	31-37(30-38)	M, E, Fw	+		
<i>Pterengraulis</i>							
<i>atherinoides</i>	10-12	12-15	22-26	E, Fw			

Table 3. Characters useful in separating adult *Anchoa*. ✓ means counts overlap given range. Distribution codes are as follows: A = North America, B = Central America, C = Caribbean, D = South America, E = throughout Area.

Taxa	Relationship AFO to DFB ¹			Anus Position Advanced ²	Branched Anal Rays			Lower Gillraker Count			Distribution
	<10%	Middle	>90%		≤20	21-30	>30	≤20	21-29	≥30	
<i>Anchoa</i>											
<i>cayorum</i>		X				X		X			C
<i>choerstoma</i>		X		X	✓	✓			X		Bermuda only
<i>colonensis</i>		X			X			✓	✓		B,C,D
<i>cubana</i>			X	X	✓	✓			X		E
<i>filifera</i>			X		✓	✓			X		B,C,D
<i>hepsetus</i>		X			X				X		A,D
<i>januaria</i>		X		X	✓	✓			X		D
<i>lamprotaenia</i>		X		X		X		X			B,C,D
<i>tyolepis</i>			X		X				X		B,C
<i>mitchilli</i>	X			X		X			X		A
<i>nasuta</i>			X		✓	✓			X		A,D
<i>parva</i>		X		X	✓	✓			X		B,C
<i>pectoralis</i>		X				X				X	D
<i>spinifer</i>		X					X	X			B,D
<i>trinitatis</i>		X		X		X		X			D

¹ Relationship of anal fin origin to dorsal fin base

² Anus closer to tips of pelvic fins than origin of anal fin base

ENGRAULIDAE

MERISTICS

Vertebrae		
Precaudal		
Caudal		
Total	42	
Number of fin spines and rays		
First Dorsal	none	
Second Dorsal	11	(10-12)
Total Dorsal Elements	13-15	
Anal	24	(21-26)
Total Anal Elements	27	(24-29)
Pectoral	12	(11)
Pelvic	6	
Caudal		
Dorsal Secondary		
Principal	10+9	
Ventral Secondary		
Total		
Gillrakers on first arch		
Upper	13-15	(12-16)
Lower	17-18	(16-19)
Total	30-33	(28-35)
Branchiostegals	12-13	

LIFE HISTORY

Range: Florida Keys, Cuba, Bahamas, West Indies, Yucatan and Belize, possibly along Central America to Venezuela

Habitat: marine, pelagic, shelf

ELH pattern: oviparous, schooling

Spawning:

Season: unknown

Area:

Mode:

Migration:

Literature: Cervigon, 1969;

Whitehead et al., 1988

Anchoa cayorum (Fowler, 1906)

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

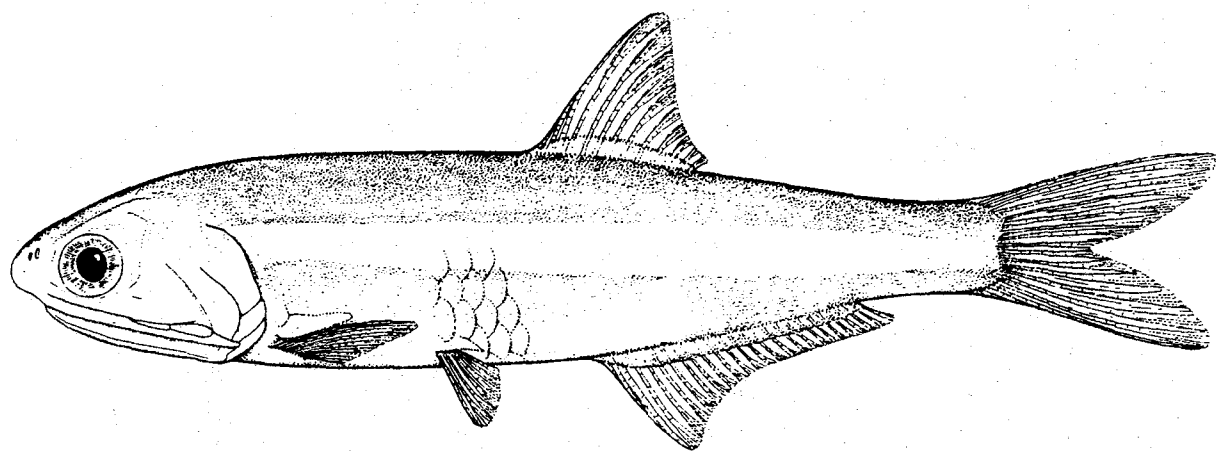
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et. al., 1988.

Anchoa cayorum

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	41-42
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	10-12
Total Dorsal Elements	13-15
Anal	19-22
Total Anal Elements	22-25
Pectoral	11-13
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	17-20
Lower	24-27
Total	41-47
Branchiostegals	12-13

LIFE HISTORY

Range: Bermuda
Habitat: marine; pelagic
ELH pattern: oviparous, schooling
Spawning:
 Season: summer based on ovaries
 Area:
 Mode:
 Migration:

Literature: Hildebrand, 1964;
Whitehead et al., 1988

Anchoa choerstoma (Goode, 1874)

EARLY LIFE HISTORY DESCRIPTION

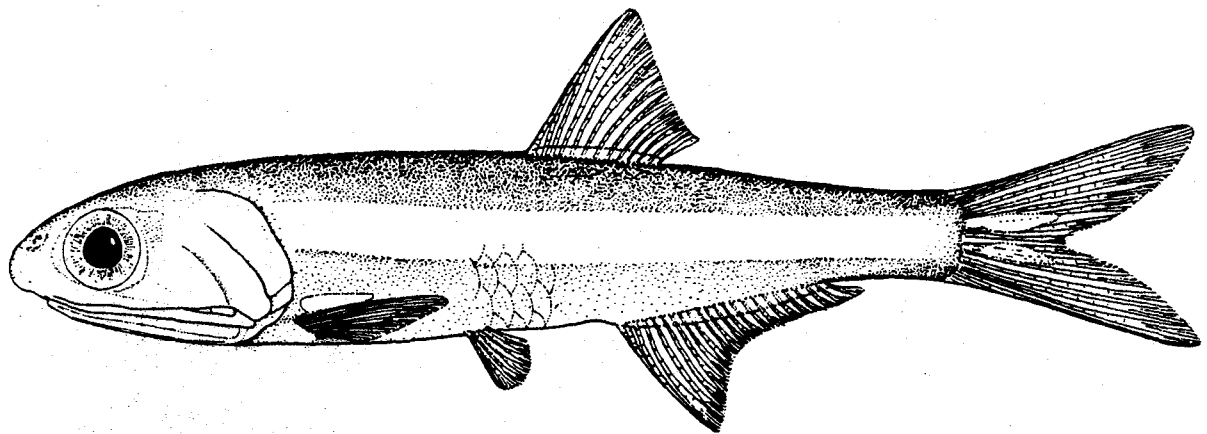
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoa choerstoma

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae		
Precaudal		
Caudal		
Total	41-42	(40-43)
Number of fin spines and rays		
First Dorsal	none	
Second Dorsal	11-14	
Total Dorsal Elements	14-17	
Anal	17-20	(21)
Total Anal Elements	20-24	
Pectoral	13-14	(12-15)
Pelvic	6	
Caudal		
Dorsal Secondary	7	
Principal	10+9	
Ventral Secondary	6-8	
Total	32-34	
Gillrakers on first arch		
Upper		
Lower	19-22	
Total	37-41	(34-42)
Branchiostegals	12-13	

LIFE HISTORY

Range: Cuba, West Indies, and
Yucatan south to Venezuela
Habitat: marine; pelagic, shelf
ELH pattern: oviparous, schooling
Spawning:
 Season: unknown
 Area:
 Mode:
 Migration:

Literature: Hildebrand, 1943; Cervigon,
1969; Whitehead, 1973; Whitehead et al.,
1988

Anchoa colonensis (Hildebrand, 1943)

EARLY LIFE HISTORY DESCRIPTION

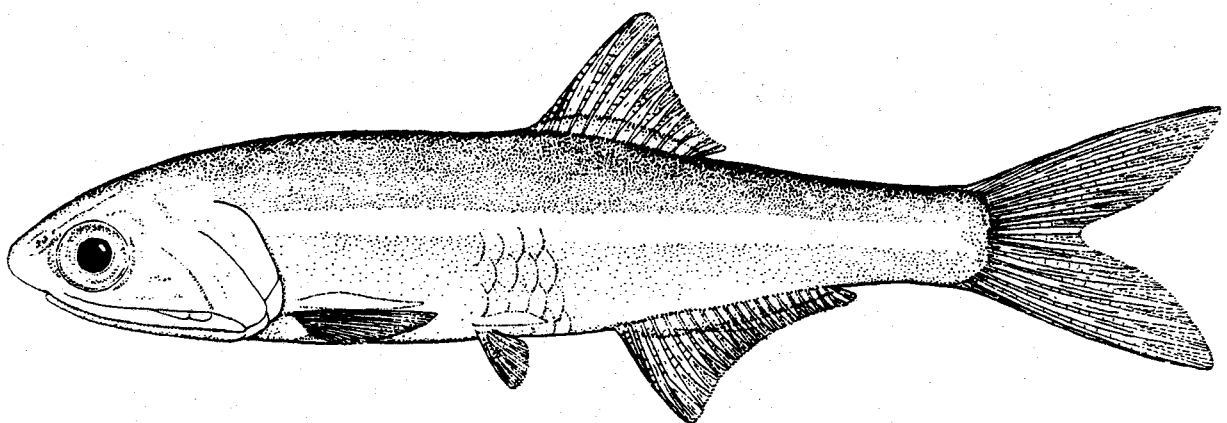
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchoa colonensis

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae		
Precaudal		
Caudal		
Total	43	(41-44)
Number of fin spines and rays		
First Dorsal	none	
Second Dorsal	12	(11-13)
Total Dorsal Elements	14-16	
Anal	19-20	(16-21)
Total Anal Elements	20-25	
Pectoral	13-15	
Pelvic	6	
Caudal		
Dorsal Secondary	7	
Principal	10+9	
Ventral Secondary	6-8	
Total	32-34	
Gillrakers on first arch		
Upper	20-23	(20-25)
Lower	26-27	(24-30)
Total	46-50	(44-55)
Branchiostegals	12-13	
Batch Fecundity	370-850	

LIFE HISTORY

Range: throughout area, except possibly western and southern Gulf of Mexico

Habitat: marine; pelagic, shelf

ELH pattern: oviparous, schooling

Spawning:

Season: July-November based
on ovaries

Area: shelf

Mode: serial spawner

Migration:

Literature: Cervigon, 1969; Whitehead, 1973; Perschbacher and Schwartz, 1982; Whitehead et al., 1988

Anchoa cubana (Poey, 1868)

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Diameter: 1.2-1.5 (major axis)
0.5-0.6 (minor axis)

No. of Oil Globules: none

Oil Globule Diameter: none

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters: elliptical

LARVAE:

Length at flexion:

Length at transformation:

Sequence of fin development:

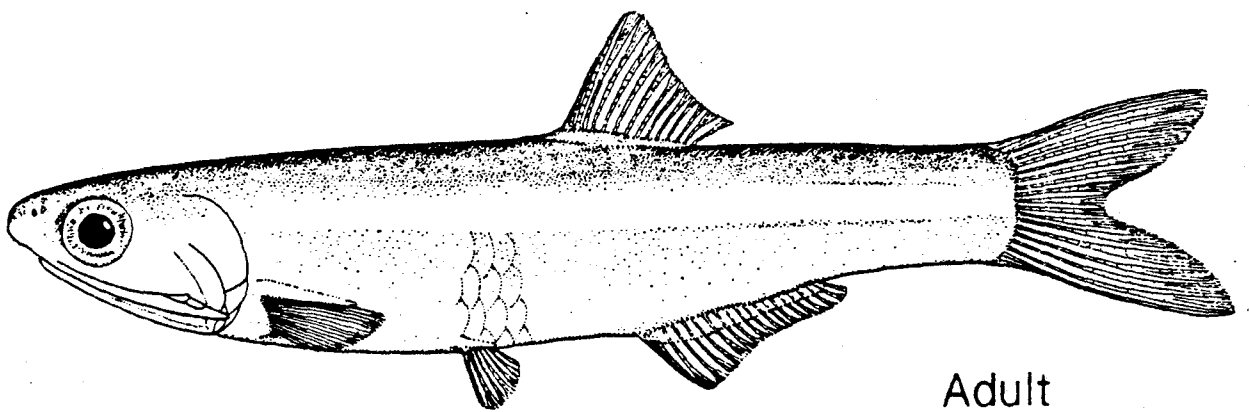
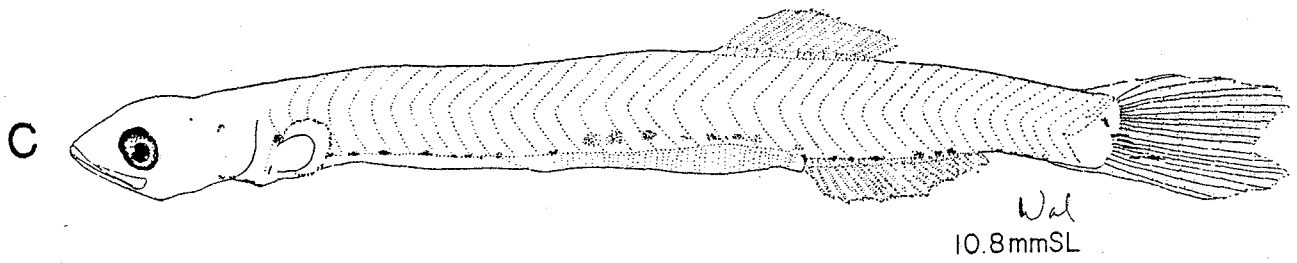
Pigment:

Diagnostic:

Illustrations: C original by W. LaRoche;
Adult from Whitehead et al., 1988.

Anchoa cubana

ENGRAULIDAE



ENGRAULIDAE

MERISTICS

Vertebrae		
Precaudal	20	(19-21)
Caudal	19	(18-20)
Total	39	(37-41)
Number of fin spines and rays		
First Dorsal	none	
Second Dorsal	12	(11-13)
Total Dorsal Elements	15	(14-16)
Anal	19-20	(17-21)
Total Anal Elements	20-24	
Pectoral	12-13	(12-15)*
Pelvic	6	
Caudal		
Dorsal Secondary		
Principal	10+9	
Ventral Secondary		
Total		
Gillrakers on first arch		
Upper	20-23	(17-24)
Lower	25-26	(24-27)
Total	44-50	(42-50)
Branchiostegals	12-13	

* First ray elongate and filamentous

LIFE HISTORY

Range: Cuba, West Indies, and Honduras south

Habitat: marine and estuarine; pelagic

ELH pattern: oviparous, schooling

Spawning:

Season: unknown

Area:

Mode:

Migration:

Literature: Cervigon, 1969; Salaya and Salazar, 1969; Whitehead, 1973; Nelson, 1986; Whitehead et al., 1988

Anchoa filifera (Fowler, 1915)

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

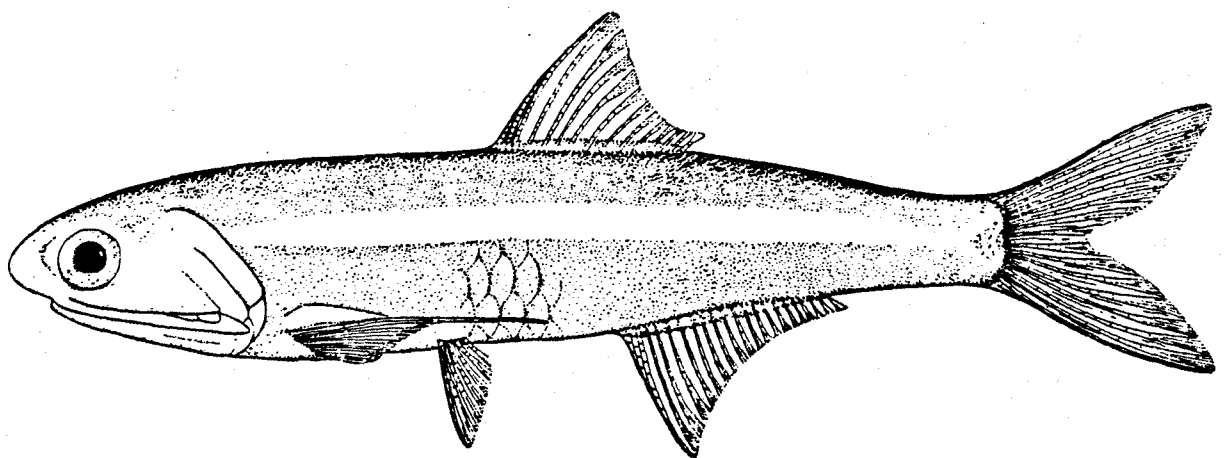
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoa filifera

ENGRAULIDAE



Adult

ENGRAULIDAE

Anchoa hepsetus (Linnaeus, 1758)

MERISTICS

Vertebrae	
Precaudal	21-22
Caudal	20-21
Total	42-43 (41-44)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12-13 (11-14)
Total Dorsal Elements	14-17
Anal	18-19 (16-20)
Total Anal Elements	19-23
Pectoral	14-15 (13-16)
Pelvic	6
Caudal	
Dorsal Secondary	7-9
Principal	10+9
Ventral Secondary	7-8
Total	33-36
Gillrakers on first arch	
Upper	18-19 (17-20)
Lower	21-22 (20-23)
Total	39-41 (37-43)
Branchiostegals	12-13
Batch Fecundity	1,500-7000
Age at maturity	7-8 months

LIFE HISTORY

Range: U. S. Atlantic and Gulf of Mexico (but not Florida Keys), and Venezuela south
Habitat: marine and estuarine; pelagic
ELH pattern: oviparous, schooling, pelagic eggs and larvae
Spawning:
 Season: spring-summer along North America
 Area: shelf
 Mode: serial spawner
 Migration:

Literature: Hildebrand, 1943; Cervigon, 1969; Daly, 1970; Miller and Jorgenson, 1973; Whitehead et al., 1988

EARLY LIFE HISTORY

EGGS:

Diameter: 1.20-1.60 mm (major axis)
 0.70-0.94 mm (minor axis)

No. of Oil Globules: none

Oil Globule Diameter: none

Yolk: yolk segmented, perivitelline space narrow

Shell: smooth and transparent

Hatch Size: 3.6-4.0 mm TL

Incubation: 48 hrs. at 19-21°C

Pigment:

Diagnostic Characters: elliptical

LARVAE:

Length at flexion: 10 mm

Length at transformation: 25-30 mm

Sequence of fin development: dorsal and anal, pectoral, pelvic

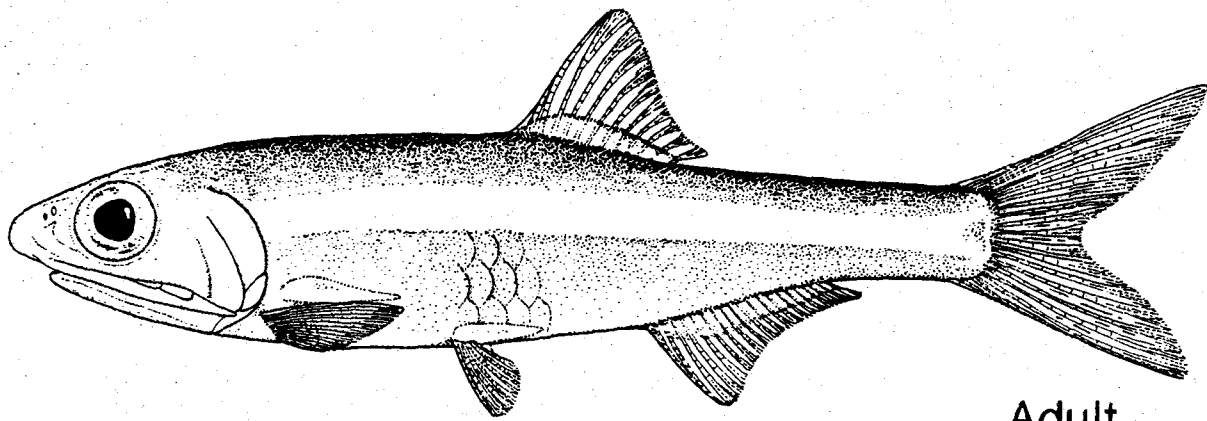
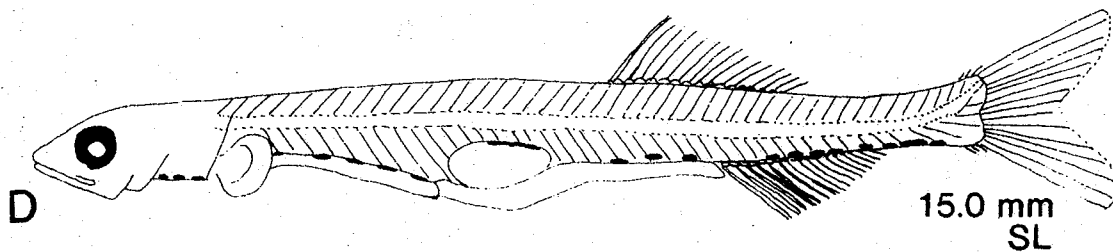
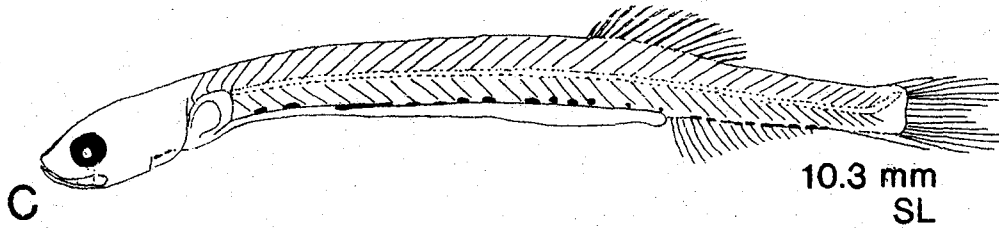
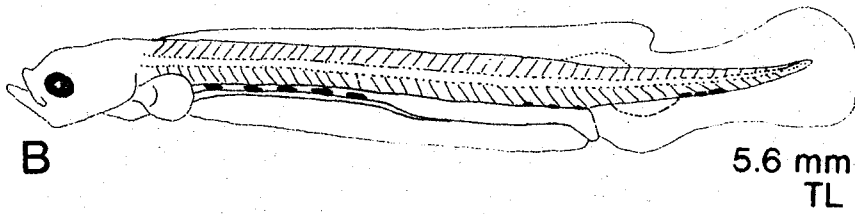
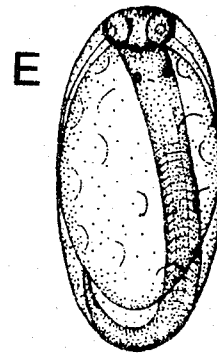
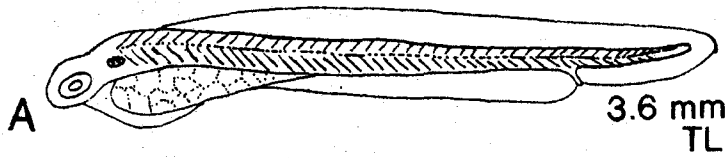
Pigment:

Diagnostic:

Illustrations: A, B, D redrawn from Fahay, 1983; C original by W. LaRoche; Adult from Whitehead et al., 1988; E from Hildebrand and Cable, 1930.

Anchoa hepsetus

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	40 (39-41)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12-13 (11-14)
Total Dorsal Elements	14-17
Anal	20-21 (18-22)
Total Anal Elements	21-25
Pectoral	12-13 (11-13)
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	21-23 (21-24)
Lower	26-29 (24-29)
Total	47-51 (45-53)
Branchiostegals	12-13

LIFE HISTORY

Range: primarily south of equator but may extend northward to Gulf of Venezuela
Habitat: marine and estuarine; pelagic
ELH pattern: oviparous, schooling
Spawning:
Season: unknown
Area:
Mode:
Migration:

Literature: Hildebrand and Carvalho, 1948;
Cervigon, 1969; Whitehead et al., 1988

Anchoa januaria (Steindachner, 1880)

EARLY LIFE HISTORY DESCRIPTION

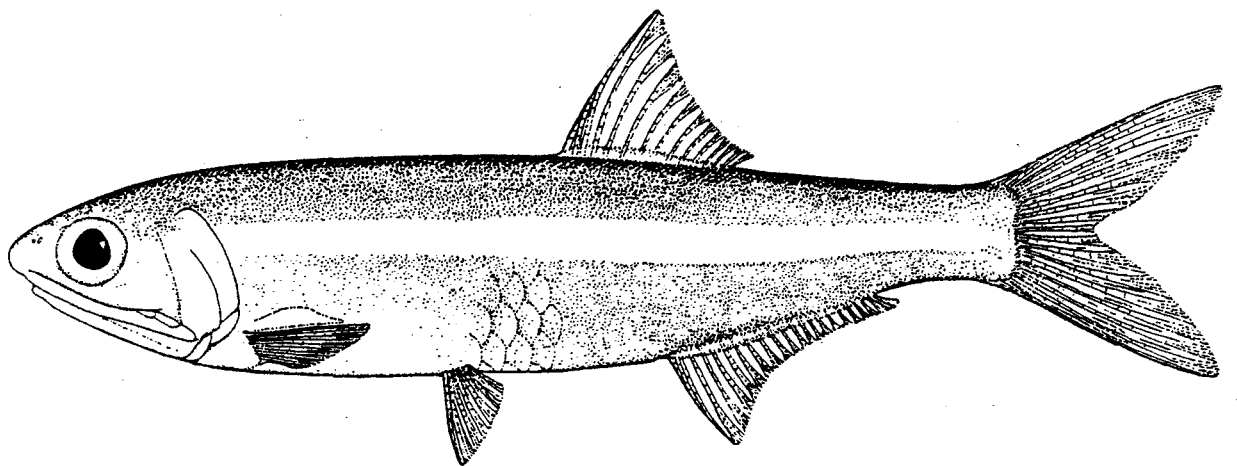
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoa januaria

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	41 (39-42)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	11-13
Total Dorsal Elements	14-16
Anal	20-21 (18-24)
Total Anal Elements	21-27
Pectoral	11-13
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	14-16 (13-18)
Lower	18-20 (17-21)
Total	32-36 (30-39)
Branchiostegals	12-13

LIFE HISTORY

Range: south Florida, Cuba, West Indies, and Yucatan to Venezuela, not Gulf of Mexico
Habitat: marine and estuarine; pelagic
ELH pattern: oviparous, schooling
Spawning:
 Season: summer based on ovaries
 Area:
 Mode:
 Migration:

Literature: Cervigon, 1969; Daly, 1970; Whitehead et al., 1988

Anchoa lamprotaenia (Hildebrand, 1943)

EARLY LIFE HISTORY DESCRIPTION

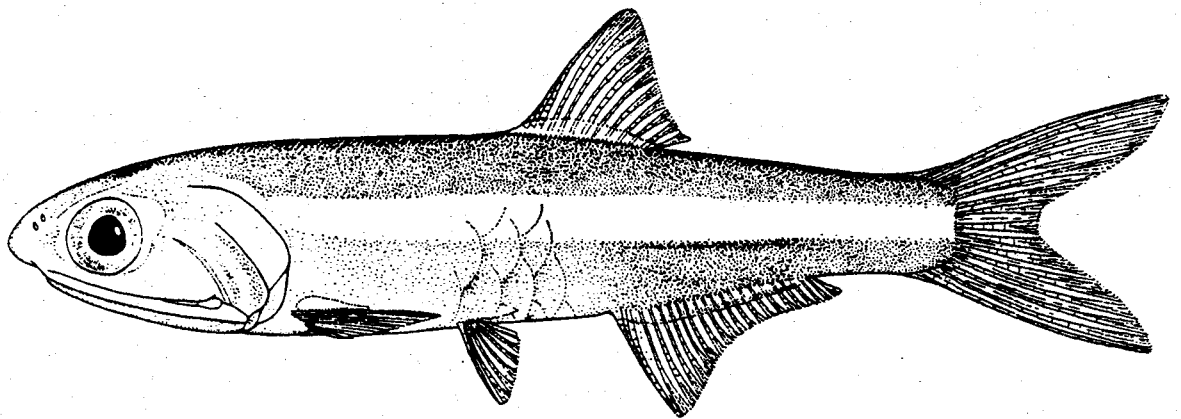
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoa lamprotaenia

ENGRAULIDAE



Adult

ENGRAULIDAE

Anchoa lyolepis (Evermann and Marsh,
1902)

MERISTICS

Vertebrae		
Precaudal	22	(20-23)
Caudal	20	(18-21)
Total	41-42	(40-43)
Number of fin spines and rays		
First Dorsal	none	
Second Dorsal	11-12	(10-13)
Total Dorsal Elements	14-16	
Anal	17-19	(15-20)
Total Anal Elements	18-23	
Pectoral	11-12	(14)
Pelvic	6	
Caudal		
Dorsal Secondary	7-8	
Principal	10+9	
Ventral Secondary	6-8	
Total	32-35	
Gillrakers on first arch		
Upper	17-19	(14-20)
Lower	21-23	(19-25)
Total	38-42	(33-45)
Branchiostegals	12-13	

LIFE HISTORY

Range: Yucatan to Colombia, Cuba,
and West Indies

Habitat: marine; pelagic, shelf

ELH pattern: oviparous, schooling

Spawning:

 Season: unknown

 Area: shelf

 Mode:

 Migration:

Literature: Nelson, 1986

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

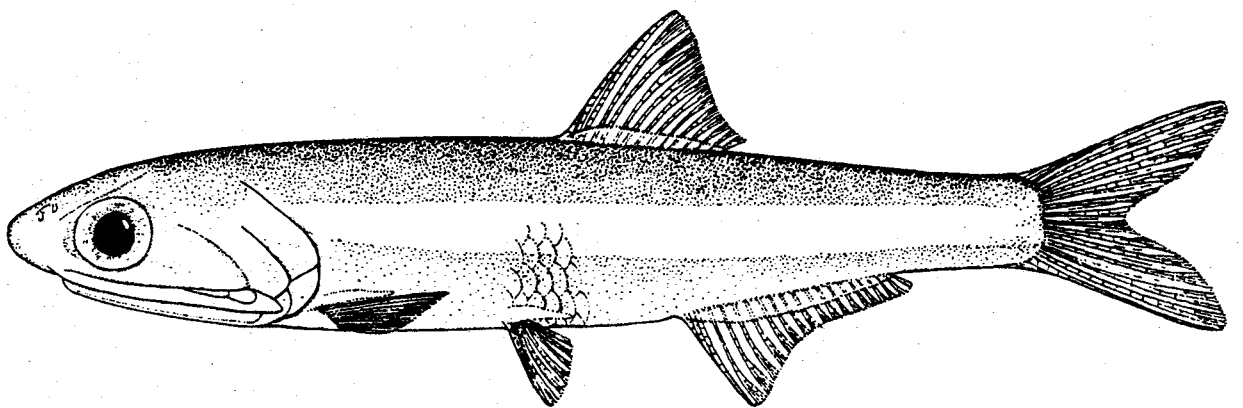
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchoa lyolepis

ENGRAULIDAE



Adult

MERISTICS

Vertebrae	
Precaudal	19
Caudal	21-22
Total	39-41 (38)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12 (10-14)
Total Dorsal Elements	13-17
Anal	22-25 (20-27)
Total Anal Elements	23-30
Pectoral	10-11 (9-12)
Pelvic	6
Caudal	
Dorsal Secondary	9-10
Principal	10+9
Ventral Secondary	7-8
Total	35-37
Gillrakers on first arch	
Upper	16-18 (15-20)
Lower	22-24 (21-25)
Total	38-42 (36-45)
Branchiostegals	12-13
Batch Fecundity	429-1,186
Age at maturity	2.0-3.0 months

LIFE HISTORY

Range: U. S. Atlantic and Gulf coast
Habitat: primarily estuarine; pelagic
ELH pattern: oviparous, pelagic eggs and larvae, schooling
Spawning:
 Season: spring-early fall
 Area: bays and shallow coastal waters
 Mode: serial spawner
 Migration:

Literature: Hildebrand, 1964; Daly, 1970;
Fives et al. 1986; Whitehead et al., 1988;
Luo and Musick, 1991

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Diameter: 0.84-1.11 mm
No. of Oil Globules: none
Oil Globule Diameter: none
Yolk: segmented, perivitelline space narrow
Shell: smooth, transparent
Hatch Size: 1.8-2.7 mm
Incubation: 24 hrs. at 28°C
Pigment:
Diagnostic Characters: barely elliptical

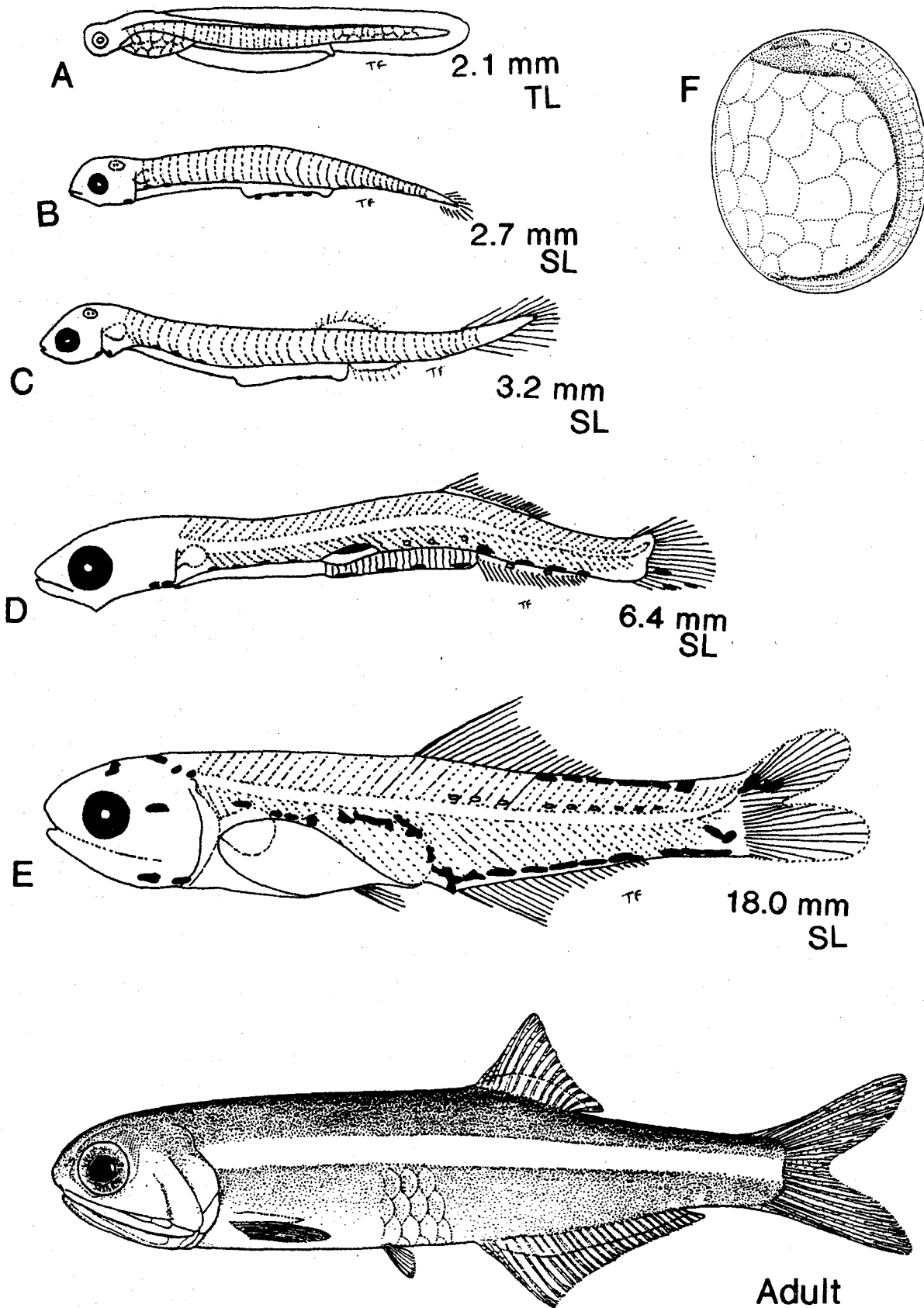
LARVAE:

Length at flexion: 7-8 mm
Length at transformation: 20 mm
Sequence of fin development: dorsal and anal - pectoral - pelvic
Pigment:
Diagnostic characters :

Illustrations: A-E original; F-Kuntz, 1915;
Adult from Whitehead et al., 1988.

Anchoa mitchilli

ENGRAULIDAE



ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	21-22 (23)
Caudal	19-20 (18-21)
Total	41-42 (40-43)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12 (11-13)
Total Dorsal Elements	15 (14-16)
Anal	18-20 (17-22)
Total Anal Elements	21-23 (20-25)
Pectoral	12 (11-14)
Pelvic	6
Caudal	
Dorsal Secondary	7-8
Principal	10+9
Ventral Secondary	6-8
Total	32-35
Gillrakers on first arch	
Upper	20-22 (19-23)
Lower	25-26 (23-27)
Total	45-48 (42-50)
Branchiostegals	12-13
Batch Fecundity	570-710

LIFE HISTORY

Range: northern and western Gulf of Mexico, and Columbia south

Habitat: marine; pelagic, shelf

ELH pattern: oviparous, pelagic eggs and larvae, schooling

Spawning:

 Season: unknown

 Area: shelf

 Mode:

 Migration:

Literature: Hildebrand and Carvalho 1948; Daly, 1970; Nelson, 1986; Perschbacher and Schwartz (unpubl. manuscr.)

Anchoa nasuta (Hildebrand and Carvalho, 1948)

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Diameter: 0.16-1.4 (major axis)
 0.05-1.1 (minor axis)

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters: elliptical

LARVAE:

Length at flexion:

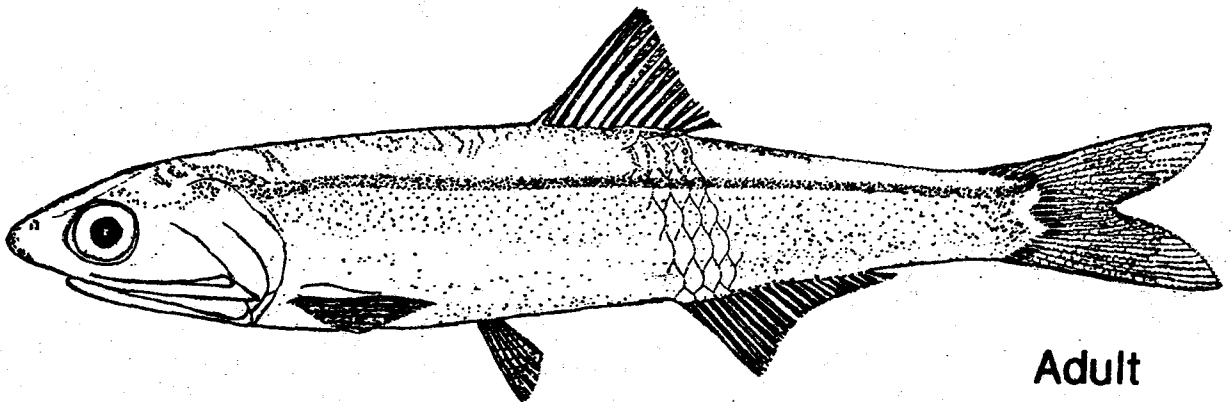
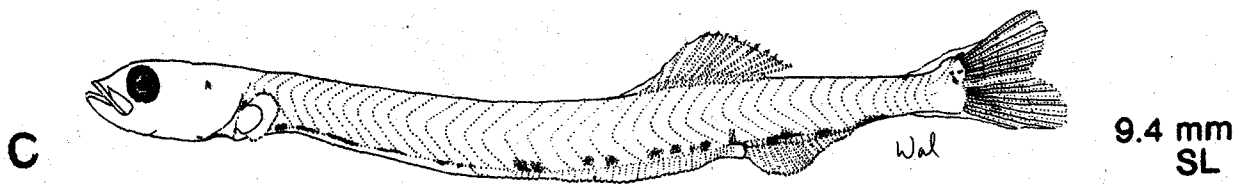
Length at transformation:

Sequence of fin development:

Pigment:

Diagnostic:

Illustrations: C original by W. LaRoche;
Adult from Hildebrand and Carvalho, 1948



MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	39-40 (38-41)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12-13 (11-14)
Total Dorsal Elements	14-17
Anal	19-21 (17-22)
Total Anal Elements	20-25
Pectoral	11-12 (10-13)
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	19-21 (18-22)
Lower	25-27 (23-30)
Total	44-49 (42-53)
Branchiostegals	12-13

LIFE HISTORY

Range: Cuba, West Indies, and Yucatan to
Trinidad

Habitat: marine; pelagic, shelf

ELH pattern: oviparous, schooling

Spawning:

 Season: unknown

 Area:

 Mode:

 Migration:

Literature: Meek and Hildebrand, 1923;
Cervigon, 1966, 1969; Whitehead et al.,
1988

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

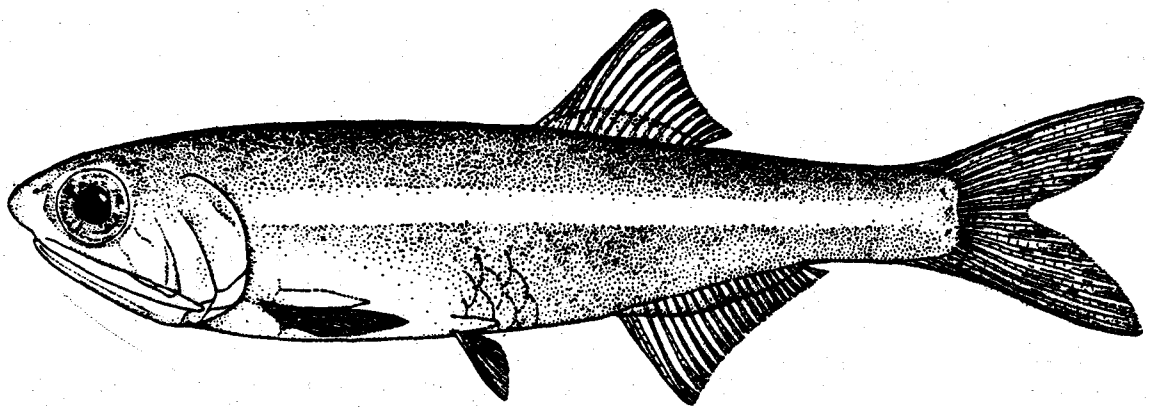
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchoa parva

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	42
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	11-13
Total Dorsal Elements	14-16
Anal	22-25
Total Anal Elements	25-28
Pectoral	14-16
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	13-15
Lower	17-20 (21)
Total	30-36
Branchiostegals	12-13

LIFE HISTORY

Range: Brazil south (from about equator south but may extend into area)
Habitat: estuarine; pelagic
ELH pattern: oviparous, schooling
Spawning:
 Season: unknown
 Area:
 Mode:
 Migration:

Literature: Hildebrand, 1943;
Hildebrand and Carvalho, 1948;
Whitehead et al., 1988

Anchoa pectoralis (Hildebrand, 1943)

EARLY LIFE HISTORY DESCRIPTION

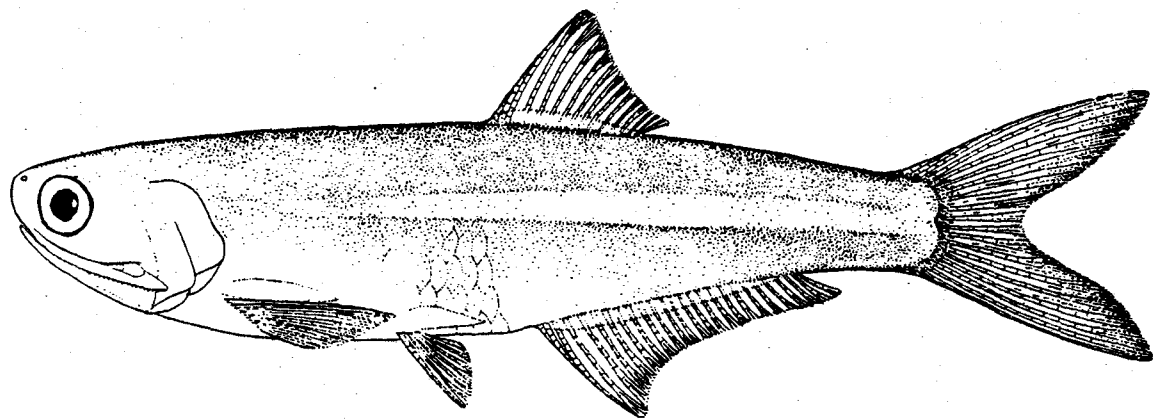
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoa pectoralis

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	19-21
Caudal	21-22
Total	40-43 (44)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12-13 (11)
Total Dorsal Elements	14-16
Anal	33-35 (31-37)
Total Anal Elements	34-40
Pectoral	12 (11-14)
Pelvic	6
Caudal	
Dorsal Secondary	10-11
Principal	10+9
Ventral Secondary	8-9
Total	37-39
Gill arches on first arch	
Upper	13-15 (10-16)
Lower	16-17 (12-19)
Total	29-32 (22-35)
Branchiostegals	14-15

LIFE HISTORY

Range: Panama south, not Caribbean

Habitat: estuarine; pelagic

ELH pattern: oviparous, schooling

Spawning:

Season: Oct-Dec based on ovaries

Area:

Mode:

Migration:

Literature: Peterson, 1956; Simpson, 1959; Cervigon, 1969; Whitehead et al., 1988

Anchoa spinifer (Cuvier and Valenciennes, 1848)

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

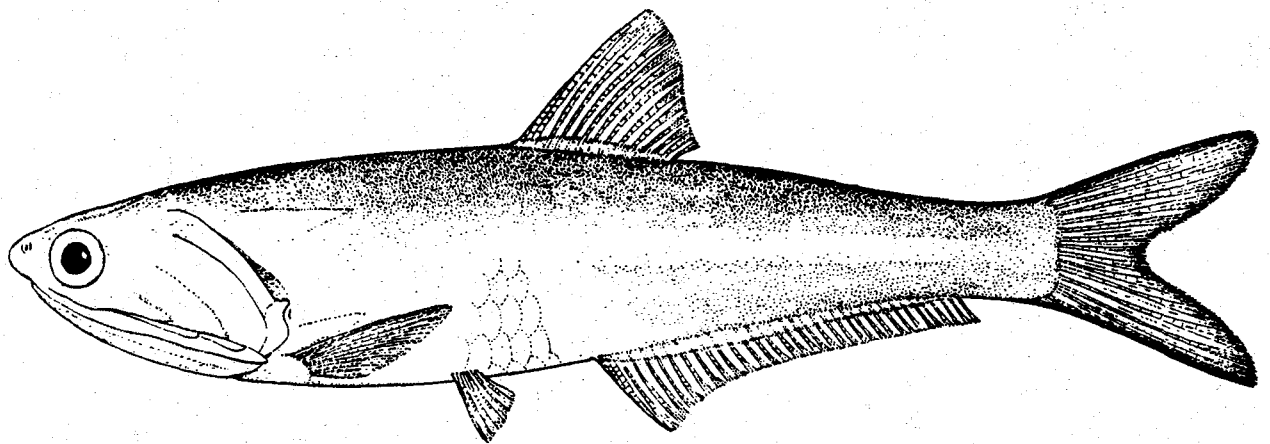
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoa spinifer

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	40 (39-41)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	11 (10-12)
Total Dorsal Elements	13-15
Anal	25-26 (23-27)
Total Anal Elements	26-30
Pectoral	12-13 (11-14)
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	16-17 (18)
Lower	19-20 (18-22)
Total	35-37 (34-39)
Branchiostegals	12-13

LIFE HISTORY

Range: Columbia south to Venezuela, and
Trinidad

Habitat: primarily estuarine; pelagic

ELH pattern: oviparous, schooling

Spawning:

 Season: unknown

 Area:

 Mode:

 Migration:

Literature: Cervigon, 1969; Whitehead et al.,
1988

Anchoa trinitatis (Fowler, 1915)

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

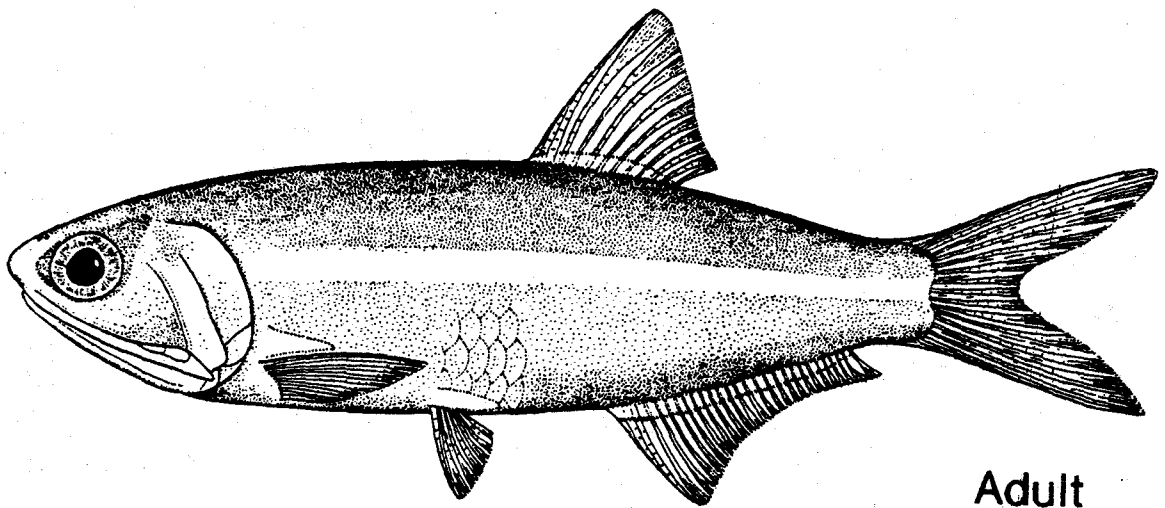
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchoa trinitatis

ENGRAULIDAE



Adult

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	42-43 (44)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12 (11-13)
Total Dorsal Elements	14-16
Anal	27-30 (25-32)
Total Anal Elements	28-35
Pectoral	13 (11-14)
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	
Lower	100-116
Total	
Branchiostegals	13

LIFE HISTORY

Range: Cuba, West Indies, and Guatemala south
Habitat: estuarine; pelagic
ELH pattern: oviparous, schooling
Spawning
 Season: unknown
 Area:
 Mode:
 Migration:

Literature: Schultz, 1949; Cervigon 1966, 1969; Whitehead, 1973; Whitehead et al., 1988

EARLY LIFE HISTORY DESCRIPTION

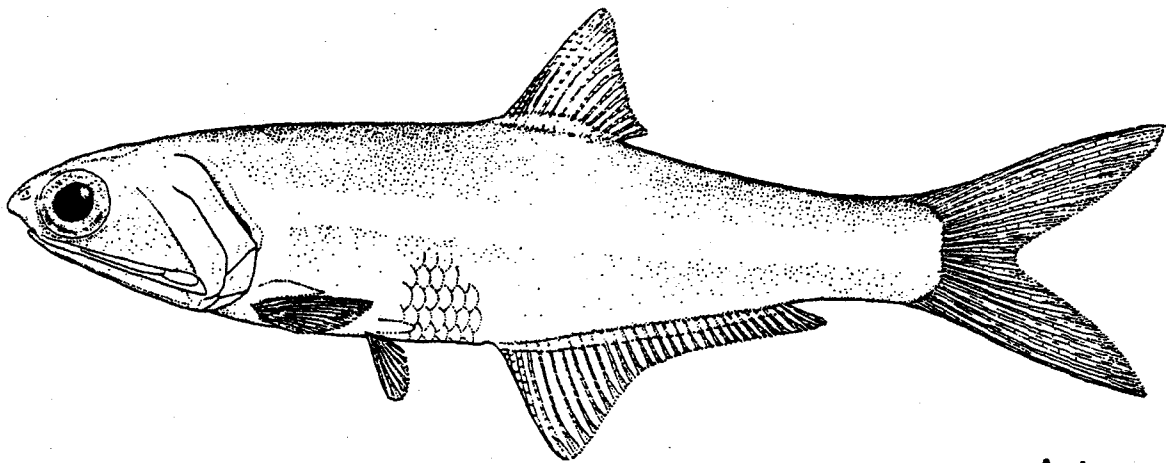
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchovia clupeioides

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	38-39
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	10-12
Total Dorsal Elements	13-15
Anal	23-24 (20-25)
Total Anal Elements	23-28
Pectoral	12 (11-13)
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	
Lower	51-62 (47)
Total	
Branchiostegals	11-12 (10-13)

LIFE HISTORY

Range: Trinidad and eastern Venezuela

Habitat: estuarine and riverine; pelagic

ELH pattern: oviparous, schooling

Spawning:

 Season: Sept-Oct based on

 ovaries

 Area:

 Mode:

 Migration: between estuary
 and river

Literature: Whitehead, 1973; Cervigon,
1982; Whitehead et al., 1988

Anchovia surinamensis (Bleeker, 1866)

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

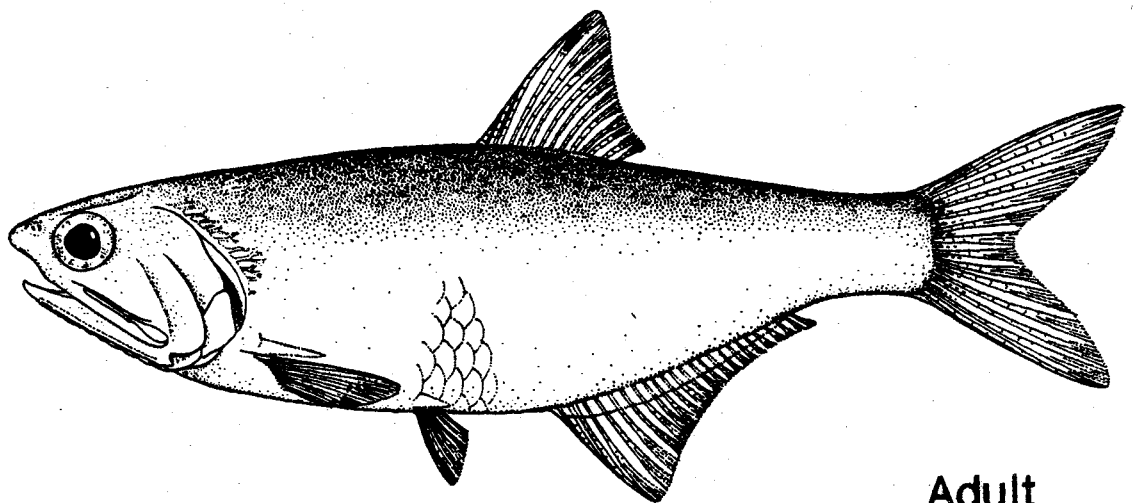
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchovia surinamensis

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	43
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	10-12
Total Dorsal Elements	13-15
Anal	22-24
Total Anal Elements	25-27
Pectoral	13-15
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	10-12
Lower	15-18
Total	25-30
Branchiostegals	10-12

LIFE HISTORY

Range: north coast of Venezuela
Habitat: marine and estuarine; pelagic
ELH pattern: oviparous, schooling
Spawning:
 Season: unknown
 Area:
 Mode:
 Migration:

Literature: Hildebrand, 1943; Cervigon, 1966; Whitehead et al., 1988

Anchoviella blackburni (Hildebrand, 1943)

EARLY LIFE HISTORY DESCRIPTION

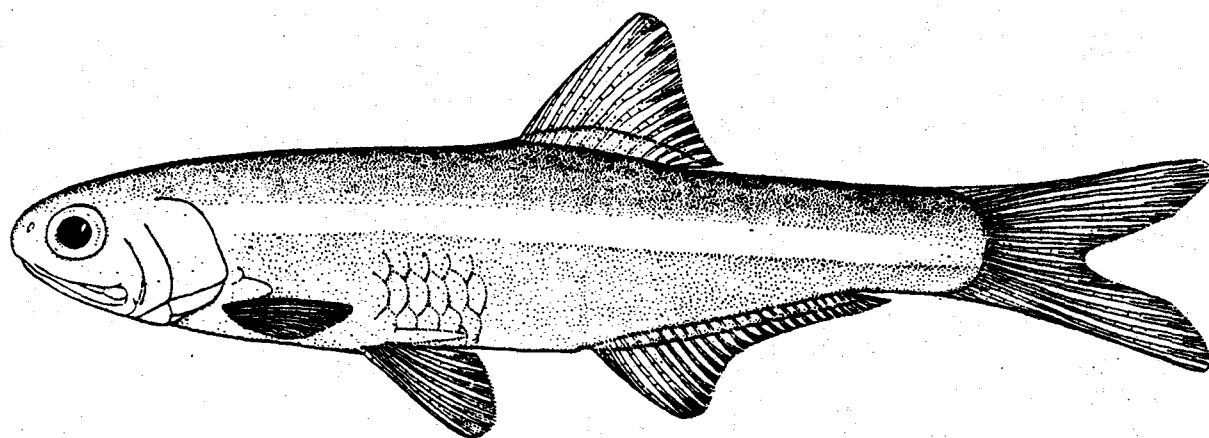
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoviella blackburni

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	41
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	2-14
Total Dorsal Elements	15-17
Anal	16-17 (15)
Total Anal Elements	18-20
Pectoral	13-14
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	16-17
Lower	24-25 (23-27)
Total	40-42 (39-43)
Branchiostegals	11-12

LIFE HISTORY

Range: French Guiana south
Habitat: marine, estuarine, and freshwater;
pelagic
ELH pattern: oviparous, schooling
Spawning:
 Season: ovaries nearly ripe
 March and May
 Area:
 Mode:
 Migration:

Literature: Whitehead, 1973; Cervigon,
1982; Whitehead et al., 1988

Anchoviella brevirostris (Gunther, 1868)

EARLY LIFE HISTORY DESCRIPTION

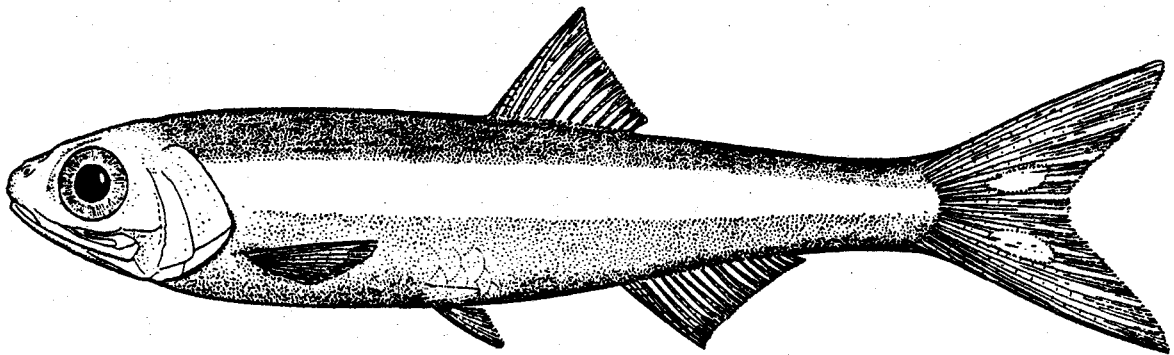
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchoviella brevirostris

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	10-12
Total Dorsal Elements	13-15
Anal	12-14
Total Anal Elements	15-17
Pectoral	14-15
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	16-17
Lower	29-35
Total	45-52
Branchiostegals	13

LIFE HISTORY

Range: French Guiana south
Habitat: primarily estuarine; pelagic
ELH pattern: oviparous
Spawning:
 Season: unknown
 Area:
 Mode:
 Migration:

Literature: Whitehead, 1973; Whitehead et al., 1988

Anchoviella cayennensis (Puyo, 1945)

EARLY LIFE HISTORY DESCRIPTION

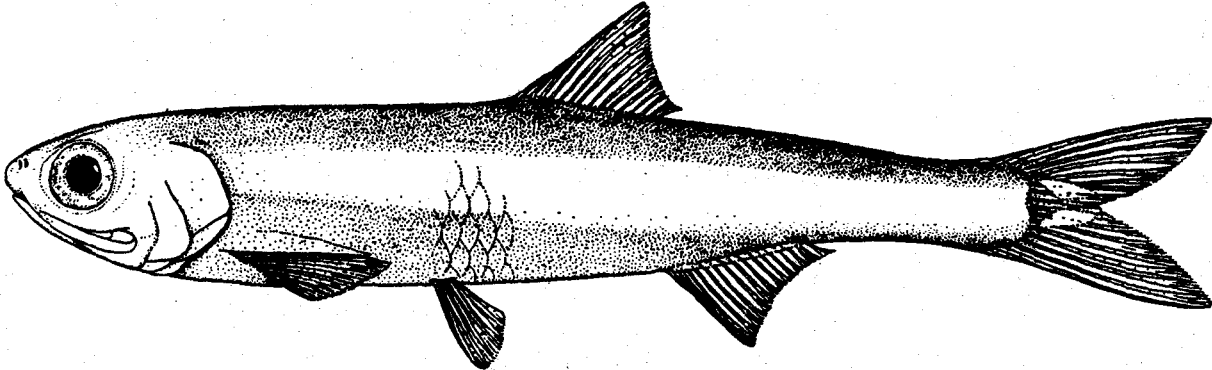
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development.
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoviella cayennensis

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	39
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	10-11
Total Dorsal Elements	13-14
Anal	18-22
Total Anal Elements	21-25
Pectoral	11-12
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	17-18
Lower	21-24
Total	38-42
Branchiostegals	10-12

LIFE HISTORY

Range: Belize south to northern Columbia
Habitat: primarily estuarine; pelagic
ELH pattern: oviparous, schooling
Spawning:
Season: unknown
Area:
Mode:
Migration:

Literature: Hildebrand, 1943; Whitehead et al., 1988

Anchoviella elongata (Meek and Hildebrand, 1923)

EARLY LIFE HISTORY DESCRIPTION

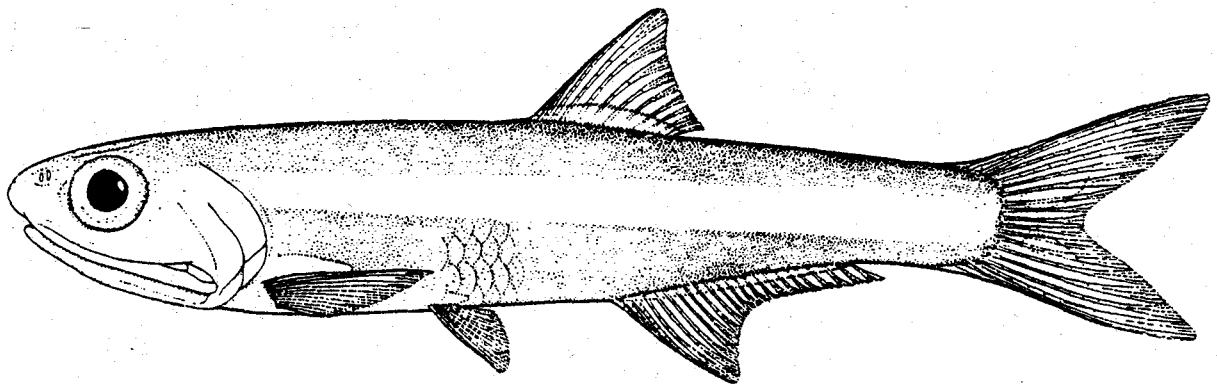
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Anchoviella elongata

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	39-40
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	11-12 (13)
Total Dorsal Elements	15 (14-16)
Anal	15-16 (14-18)
Total Anal Elements	17-20
Pectoral	11-13
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	17 (16-18)
Lower	23-24 (20-26)
Total	40-41 (38-42)
Branchiostegals	12

LIFE HISTORY

Range: southern Columbia to northern Brazil

Habitat: estuarine and riverine, mostly
freshwater; pelagic

ELH pattern: oviparous, schooling

Spawning:

 Season: December based
 on ovaries

 Area:

 Mode:

 Migration:

Literature: Cervigon, 1982; Whitehead et al.,
1988

Anchoviella guianensis (Eigenmann, 1912)

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE: unknown

Length at flexion:

Length at transformation:

Sequence of fin development:

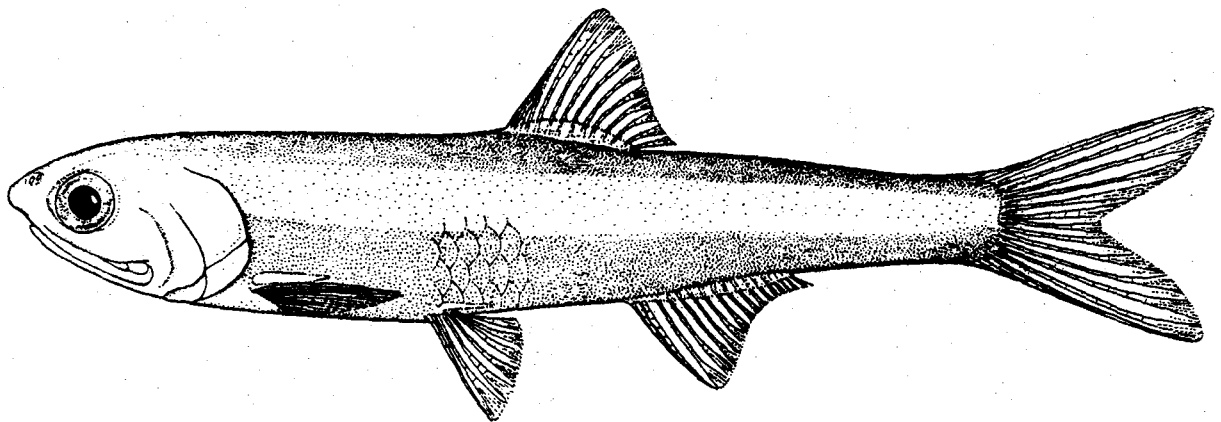
Pigment:

Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchoviella guianensis

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	19
Caudal	21
Total	40
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	11-13 (10-15)
Total Dorsal Elements	14-16
Anal	20-22 (19-23)
Total Anal Elements	22-26
Pectoral	12-13 (14)
Pelvic	6
Caudal	
Dorsal Secondary	6-9
Principal	10+9
Ventral Secondary	6-8
Total	31-36
Gillrakers on first arch	
Upper	18-19
Lower	20-22 (18-25)
Total	38-41
Branchiostegals	11-12

LIFE HISTORY

Range: northern Brazil south
Habitat: estuarine; pelagic
ELH pattern: oviparous, schooling
Spawning:
 Season: May based on ovaries
 Area: estuaries
 Mode:
 Migration: possibly anadromous

Literature: Miller and Jorgenson, 1973;
Cervigon, 1982; Whitehead et al., 1988

Anchoviella lepidentostole (Fowler, 1911)

EARLY LIFE HISTORY DESCRIPTION

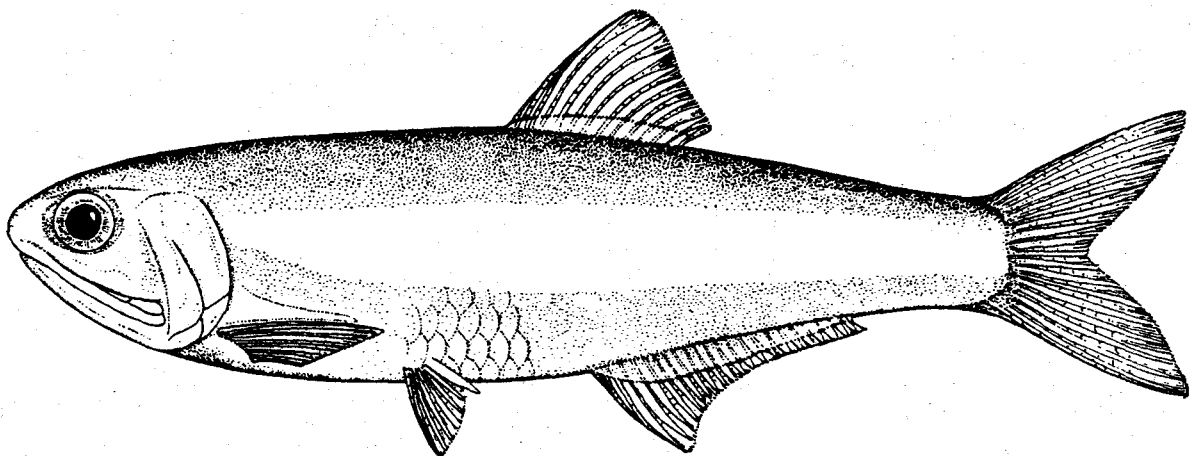
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al.,
1988.

Anchoviella lepidentostole

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	42-44
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12 (11-13)
Total Dorsal Elements	14-16
Anal	14-15 (12-16)
Total Anal Elements	15-19
Pectoral	14-15 (13-16)
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	20-22 (18-23)
Lower	26-29 (24-30)
Total	46-51 (42-53)
Branchiostegals	10-12

LIFE HISTORY

Range: North Carolina through northern Gulf of Mexico, Cuba, West Indies and Panama, possibly throughout Central America

Habitat: marine, pelagic, shelf

ELH pattern: oviparous, schooling

Spawning:

 Season: unknown

 Area: shelf

 Mode:

 Migration:

Literature: Daly, 1970; Whitehead et al., 1988

Anchoviella perfasciata (Poey, 1860)

EARLY LIFE HISTORY DESCRIPTION

EGGS: unknown

Diameter:

No. of Oil Globules:

Oil Globule Diameter:

Yolk:

Shell:

Hatch Size:

Incubation:

Pigment:

Diagnostic Characters:

LARVAE:

Length at flexion:

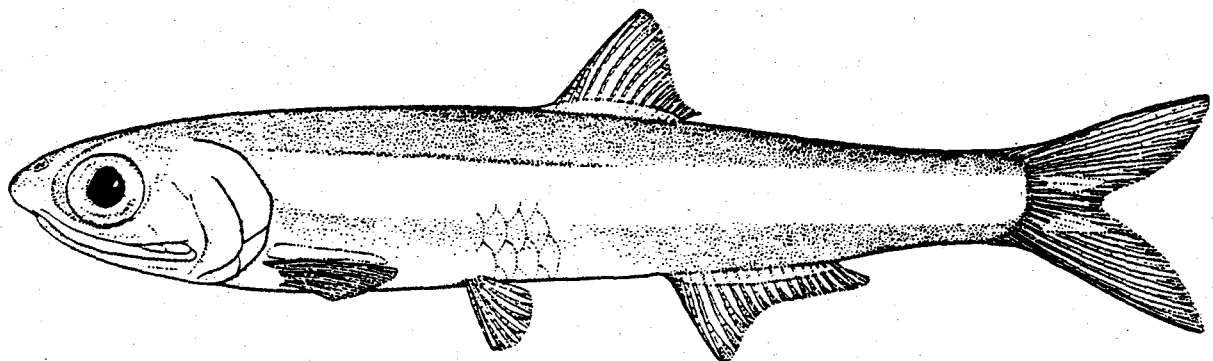
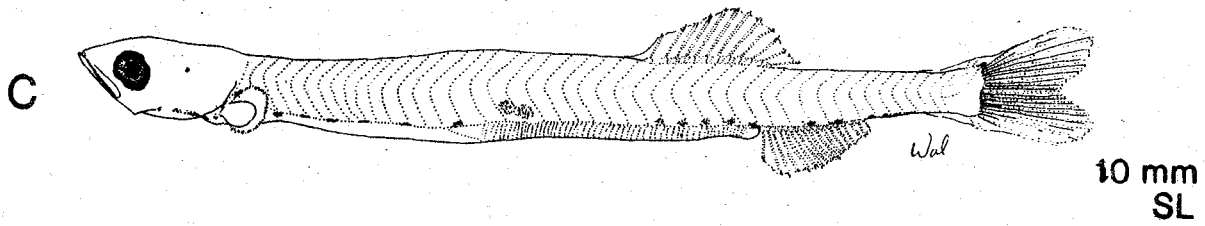
Length at transformation:

Sequence of fin development:

Pigment:

Diagnostic:

Illustrations: C original by W. LaRoche; Adult from Whitehead et al., 1988.



Adult

ENGRAULIDAE

MERISTICS

Vertebrae		
Precaudal	21	(20-22)
Caudal	20	(19-21)
Total	41	(40-42)
Number of fin spines and rays		
First Dorsal	none	
Second Dorsal	12-14	
Total Dorsal Elements	15	(16-17)
Anal	21-23	(18-24)
Total Anal Elements	24	(21-27)
Pectoral	14-15	(16)
Pelvic	6	
Caudal		
Dorsal Secondary	8	
Principal	10+9	
Ventral Secondary	8	
Total	35	
Gillrakers on first arch		
Upper		
Lower	45-55	
Total	75-105	
Branchiostegals	8	

LIFE HISTORY

Range: Panama, and Cuba through West Indies south

Habitat: marine and estuarine; pelagic

ELH pattern: oviparous, schooling

Spawning:

Season: Sept-Dec

Area: inshore

Mode:

Migration:

Literature: Hildebrand, 1943; Simpson, 1965; Gilbert and Kelso, 1971; Whitehead, 1973; Nelson, 1984; Whitehead et al., 1988

Cetengraulis edentulus (Cuvier, 1829)

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Diameter: (1.1-1.3) 1.21 (major axis)
(0.6-0.7) 0.59 (minor axis)

No. of Oil Globules: none

Oil Globule Diameter: none

Yolk: segmented

Shell: translucent, unsculptured

Hatch Size:

Incubation: 20-24 hrs. at 24-27° C

Pigment: none

Diagnostic Characters: elliptical

LARVAE:

Length at flexion:

Length at transformation:

Sequence of fin development:

Pigment:

Diagnostic: opercular membrane

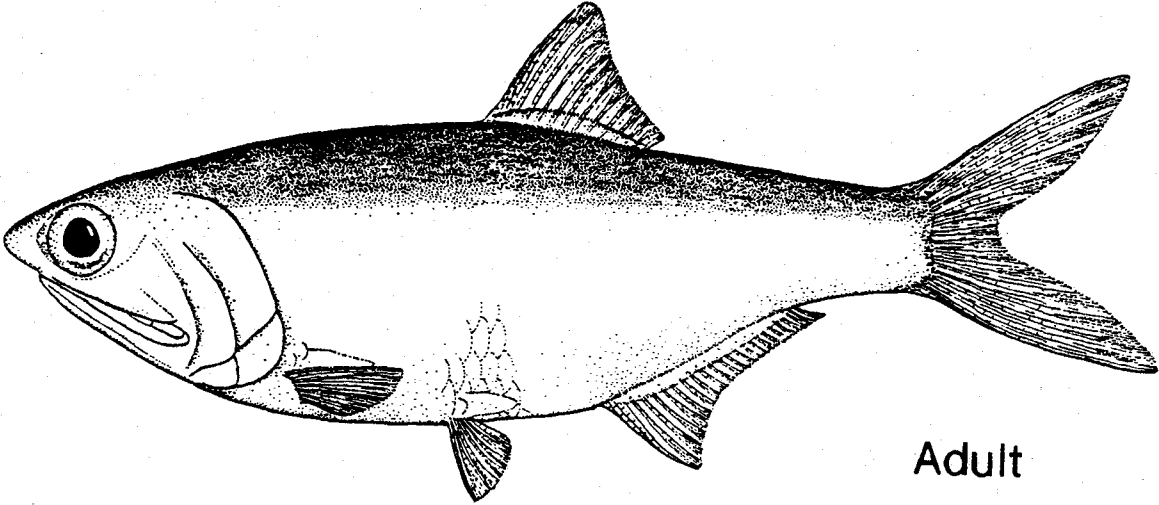
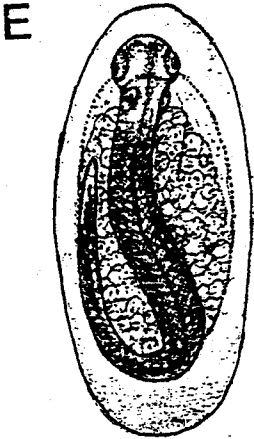
units gills across isthmus

at >30 mm SL

Illustrations: E from Simpson, 1965;
Adult from Whitehead et al., 1988.

Cetengraulis edentulus

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	26 (25-27)
Caudal	17 (18-19)
Total	44 (43-45)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	12-13
Total Dorsal Elements	15-16
Anal	14-15 (12-16)
Total Anal Elements	15-19
Pectoral	13-15
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	25-26 (24-28)
Lower	28-30 (27-33)
Total	53-56 (51-61)
Branchiostegals	12-14 (11)
Batch Fecundity	4,400-24,920
Age at maturity	1 year

LIFE HISTORY

Range: U. S. Atlantic coast through northern Gulf of Mexico, and Venezuela south to northern Brazil

Habitat: marine; pelagic,

ELH pattern: oviparous, pelagic eggs and larvae, schooling

Spawning:

Season: spring-fall along

North America

Area: shelf

Mode:

Migration:

Literature: Whitehead, 1973; Jones et al., 1978; Nelson, 1984; Whitehead et al., 1988

Engraulis eurystole (Swain and Meek, 1884)

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Diameter: 1.02-1.25 mm (major axis)
0.50-0.80 mm (minor axis)

No. of Oil Globules: none

Oil Globule Diameter: none

Yolk: coarsely granular, segmented

Shell: transparent, smooth

Hatch Size: 2.0 mm

Incubation:

Pigment:

Diagnostic Characters: elliptical

LARVAE:

Length at flexion:

Length at transformation: 23 mm

Sequence of fin development: dorsal and anal-pectoral-pelvic

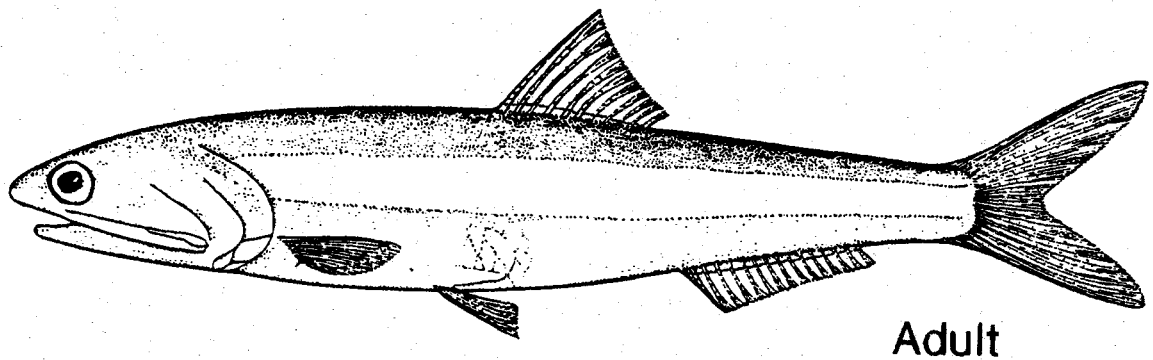
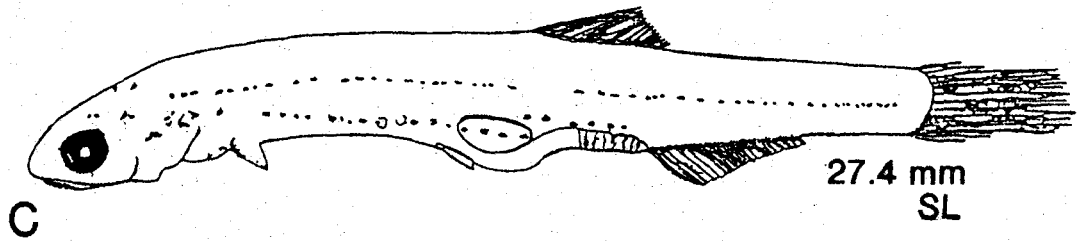
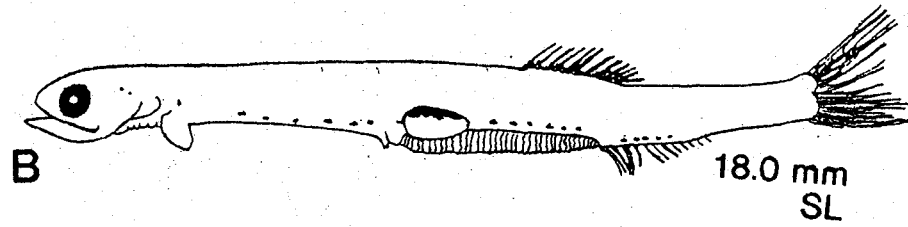
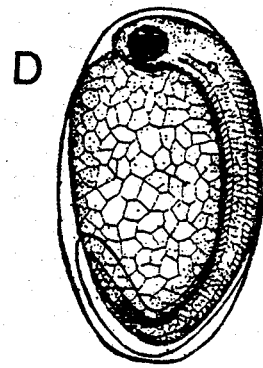
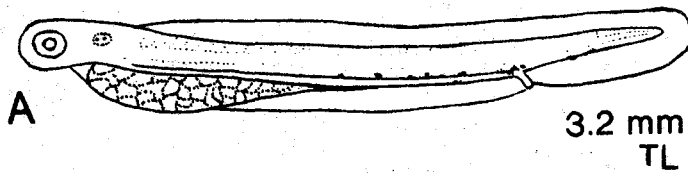
Pigment:

Diagnostic: anal fin origin behind base of last dorsal ray

Illustrations: A and D from Kuntz and Radcliff, 1917 ; B-C from Markle et al., 1980; Adult from Whitehead et al., 1988.

Engraulis eurystole

ENGRAULIDAE



ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	20-22
Caudal	23
Total	43-45
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	13
Total Dorsal Elements	15-16
Anal	23-25
Total Anal Elements	26-28
Pectoral	14
Pelvic	6
Caudal	
Dorsal Secondary	8
Principal	10+9
Ventral Secondary	8
Total	35
Gillrakers on first arch	
Upper	14-16 (13-17)
Lower	18-21 (17-21)
Total	32-37 (30-38)
Branchiostegals	13-14

LIFE HISTORY

Range: Belize, and Venezuela south
Habitat: marine; estuarine and freshwater
ELH pattern: oviparous, pelagic eggs and larvae, schooling
Spawning:
 Season: Sept-Dec
 Area: estuarine
 Mode:
 Migration: sea or estuaries to freshwater

Literature: Hildebrand, 1943; Weiss and Krug, 1977; Weiss and Souza, 1977; Whitehead et al., 1988

Lycengraulis grossidens (Agassiz, 1829)

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Diameter: 1.0-1.2 mm (major axis)
 0.7-0.9 mm (minor axis)

No. of Oil Globules: none

Oil Globule Diameter:

Yolk: segmented

Shell: transparent

Hatch Size: 3.0 mm

Incubation:

Pigment: none

Diagnostic Characters: ovoid, narrow perivitelline space

LARVAE:

Length at flexion: 5 mm

Length at transformation: > 10 mm

Sequence of fin development: dorsal - pectoral-anal-pelvic

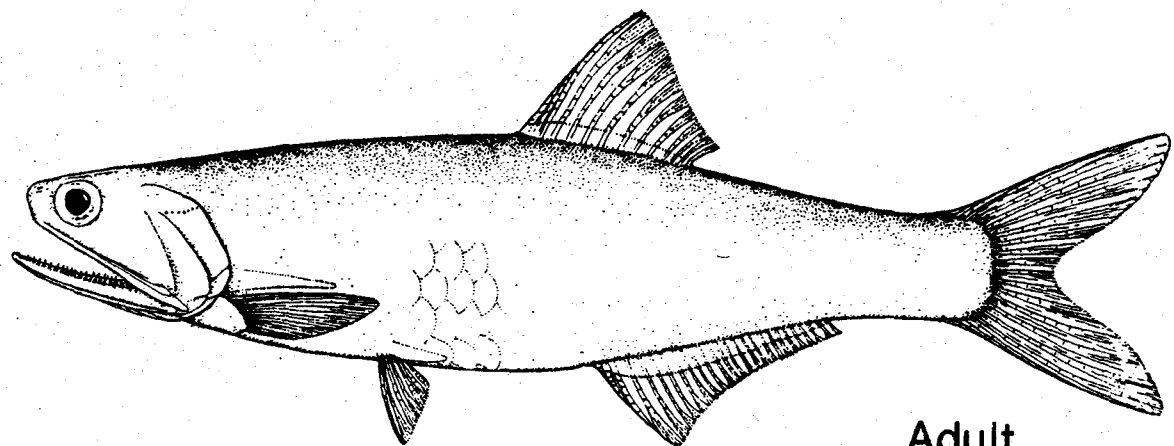
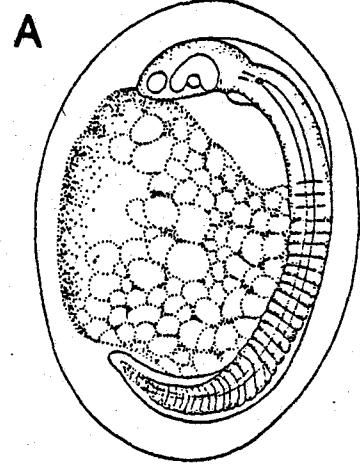
Pigment:

Diagnostic:

Illustrations: E from Phonlor, 1977; Adult from Whitehead et al., 1988.

Lycengraulis grossidens

ENGRAULIDAE



Adult

ENGRAULIDAE

MERISTICS

Vertebrae	
Precaudal	
Caudal	
Total	43-45 (42)
Number of fin spines and rays	
First Dorsal	none
Second Dorsal	10-11
Total Dorsal Element	13-14
Anal	30 (28-31)
Total Anal Elements	31-34
Pectoral	12-14
Pelvic	6
Caudal	
Dorsal Secondary	
Principal	10+9
Ventral Secondary	
Total	
Gillrakers on first arch	
Upper	10-12
Lower	12-15
Total	22-26
Branchiostegals	12-13 (11)

LIFE HISTORY

Range: Venezuela south
Habitat: estuarine and freshwater; pelagic
ELH pattern: oviparous
Spawning:
 Season: Nov, Jan-Feb based on ovaries
 Area:
 Mode:
 Migration:

Literature: Jordan and Seale, 1926; Puyo, 1949; Whitehead, 1973; Cervigon, 1982; Whitehead et al., 1988

Pterengraulis atherinoides (Linnaeus, 1766)

EARLY LIFE HISTORY DESCRIPTION

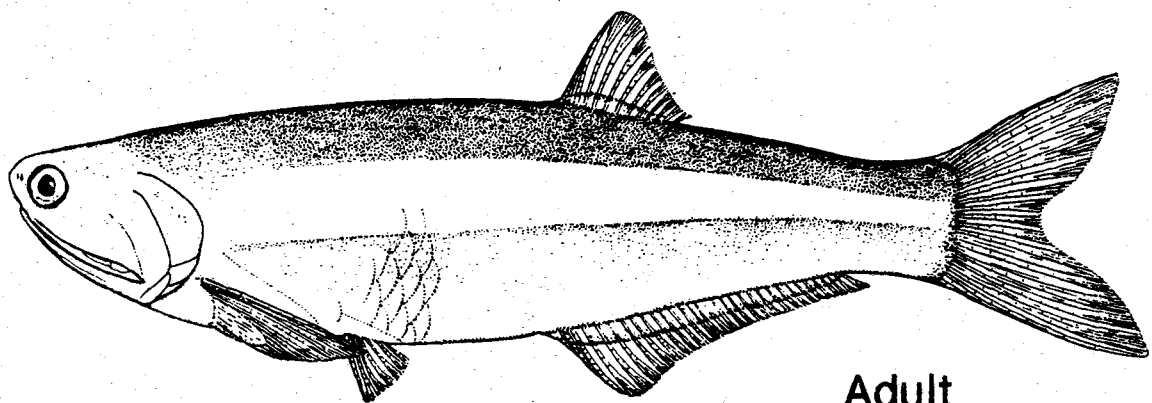
EGGS: unknown
Diameter:
No. of Oil Globules:
Oil Globule Diameter:
Yolk:
Shell:
Hatch Size:
Incubation:
Pigment:
Diagnostic Characters:

LARVAE: unknown
Length at flexion:
Length at transformation:
Sequence of fin development:
Pigment:
Diagnostic:

Illustrations: Adult from Whitehead et al., 1988.

Pterengraulis atherinoides

ENGRAULIDAE



Adult

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