

Biology and Ecology of Longtail Tuna, *Thunnus tonggol* (Bleeker, 1851)

Training Course On Stock Assessments of Longtail Tuna
and Kawakawa in The Southeast Asia

17th – 25th April, 2016, Kuala Terengganu, Malaysia

Diagnostic Features (outside)

- A small tuna species.
 - In the Indian Ocean, commercial FL 40~70 cm (Silas & Pillai, 1982).
 - Biggest record; 35.9 kg - 136 cm FL (New South Wales, Australia, 1982)



- Body covered with very small scales behind corselet;
- Pectoral fins are short to moderately long;
 - 22~31% FL (< 60 cm FL), 16~22% FL in larger individuals; Fin rays 30 to 36
- 2nd dorsal fin higher than 1st dorsal fin; 2nd dorsal and anal fins never greatly elongate, < 20% FL;

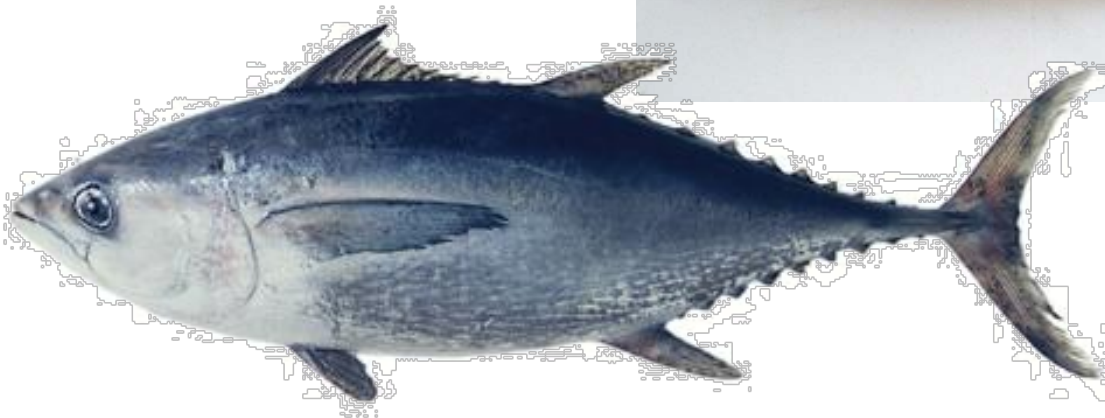
Color (body)

- No black spots on body; back dark blue without any striped pattern;
- Lower sides and belly; silvery white with colorless elongate oval spots arranged in horizontally oriented rows



Color (fins)

- Dorsal, Pectoral and Pelvic fins; Blackish;
- Caudal fin blackish, with streaks of yellowish green;
- Tip of 2nd Dorsal and Anal fins; Washed with yellow;
- Anal fin silvery;
- Finlet; Yellow with greyish margins.

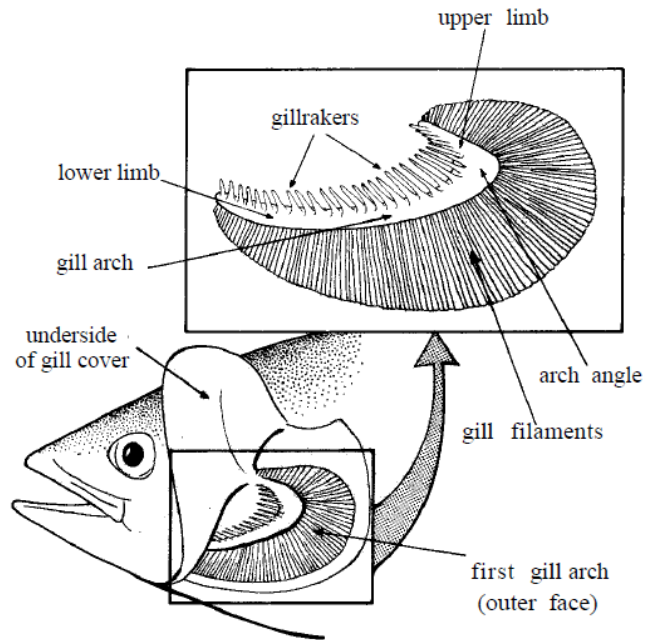


Diagnostic Features (inside)

- Gillrakers; comparably few, 19~27 on first arch
- Vertebrae; 18 + 21 = 39
- Liver; ventral surface not striated, right lobe >> left/central lobes
- Swimbladder; absent or rudimentary;



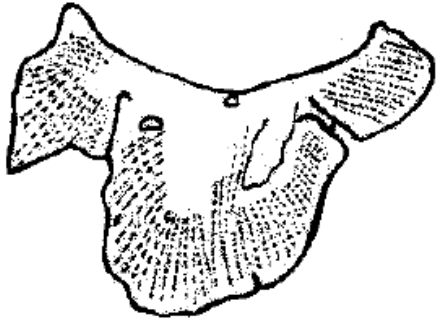
Key Point to Identify Tuna Species: - 1. Number of Gill Rakers



	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
Northern Bluefin Tuna																												
Southern Bluefin Tuna																												
Albacore																												
Bigeye Tuna																												
Yellowfin Tuna																												
Longtail Tuna																												

(FAO, 1983; Nakabo, 2001)

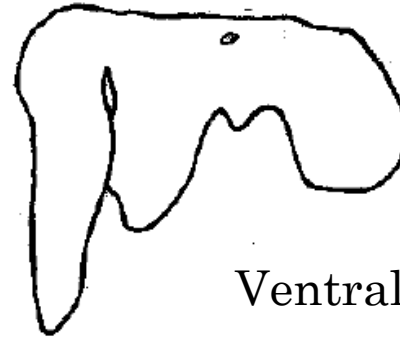
Key Point to Identify Tuna Species: - 2. Liver



- Ventral surface of liver with prominent striations
- Center lobe > Left/Right lobes



Northern Bluefin Tuna
Southern Bluefin Tuna
Albacore
Bigeye Tuna



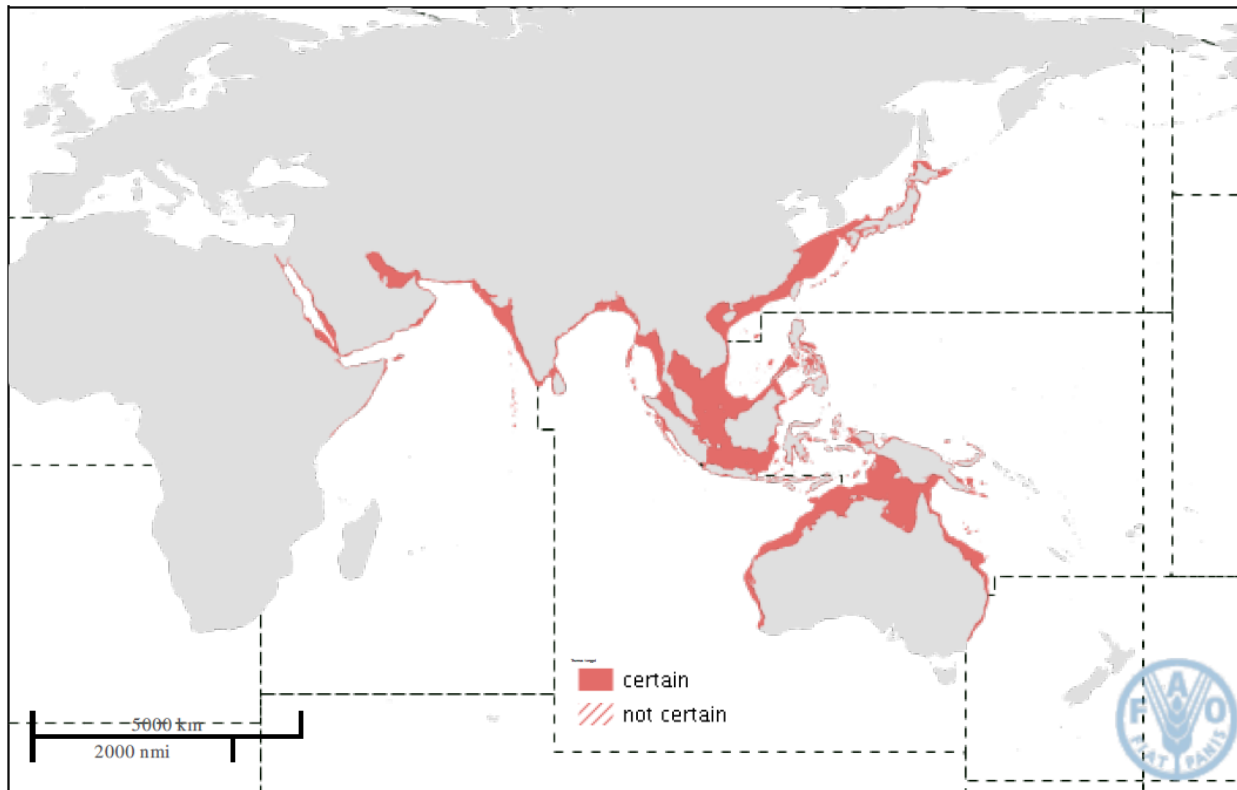
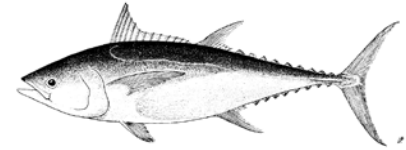
Ventral view

- Ventral surface of liver without striations
- Right lobe > Central/Left lobes

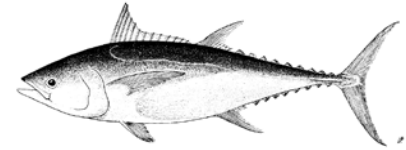


Yellowfin Tuna
Longtail Tuna
Blackfin Tuna

Geographical Distribution



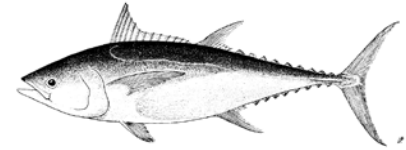
- An epipelagic species inhabiting tropical to temperate provinces of the Indo-Pacific, almost exclusively in the neritic waters close to the shore;
- Indo-West Pacific Ocean
 - South from Japan, all ASEAN waters to Papua New Guinea, New Britain, and Australia except for the most northern area,
 - Both coasts of India, southern Arabian Peninsula, the Red Sea and the Somalia coast.



Length-Weight Relationships

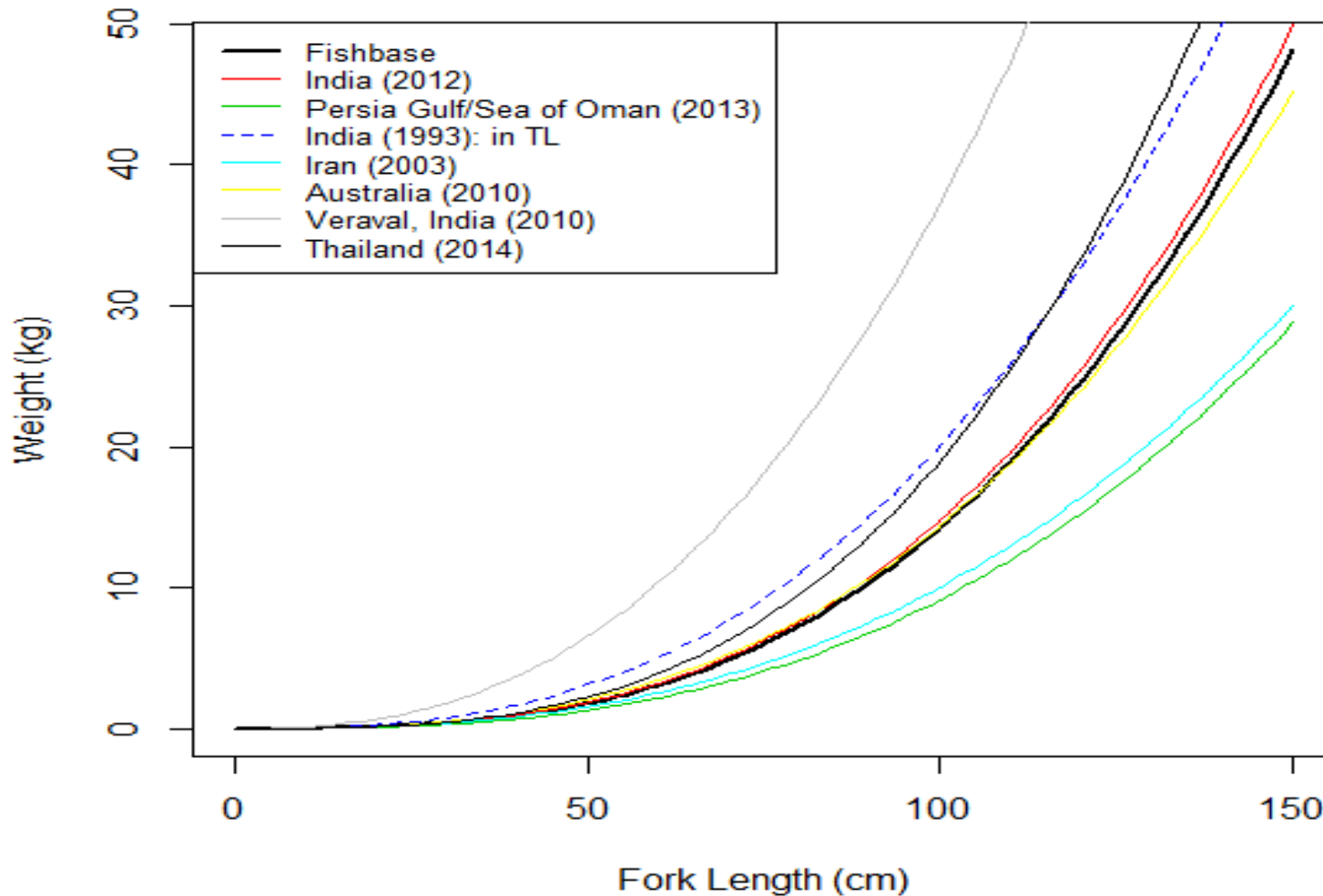
$$W = a * L^b$$

Region	a	b	Units	Reference
	0.01427	3.00	(FL) cm – g	Fishbase
India	0.01480	3.00	(FL) cm – g	Abdussamad et al, 2012
Persia Gulf / Sea of Oman	0.00002	2.83	(FL) cm – kg	Kaymaram et al, 2013
India	0.00008	2.70	(TL) cm – kg	James et al. 1993
Iran	0.00004	2.70	(FL) cm – kg	Darvishi et al, 2003
Australia	0.00005	2.82	(FL) mm – g	Griffiths et al, 2010
Veraval, India	0.357	2.51	(FL) cm – g	Ghosh et al. 2010
Thailand	0.012	3.10	(FL) cm – g	Hassadee et al, 2014
off Pakistan and Arabian Sea	0.1011	2.46	(TL) cm -g	Quratulan Ahmed, et al., 2016



Length-Weight Relationships

$$W = a * L^b$$



Aging Estimation

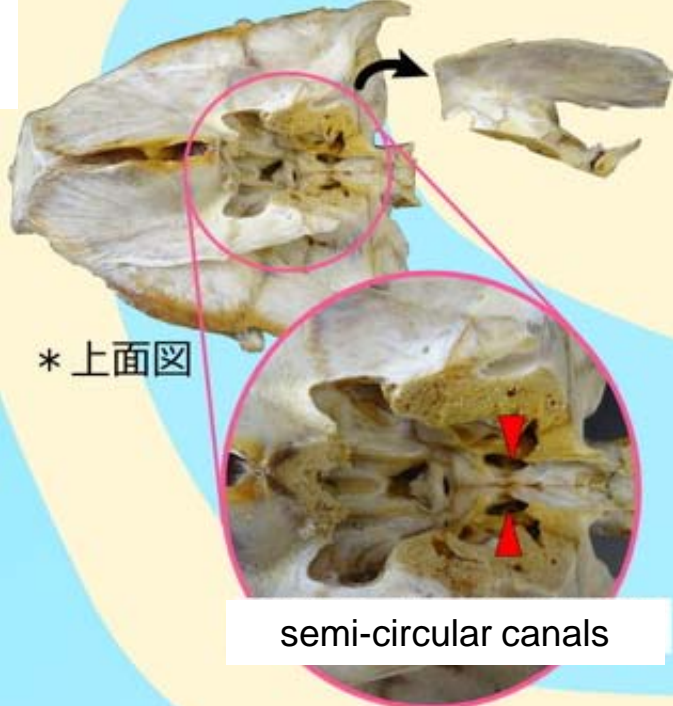
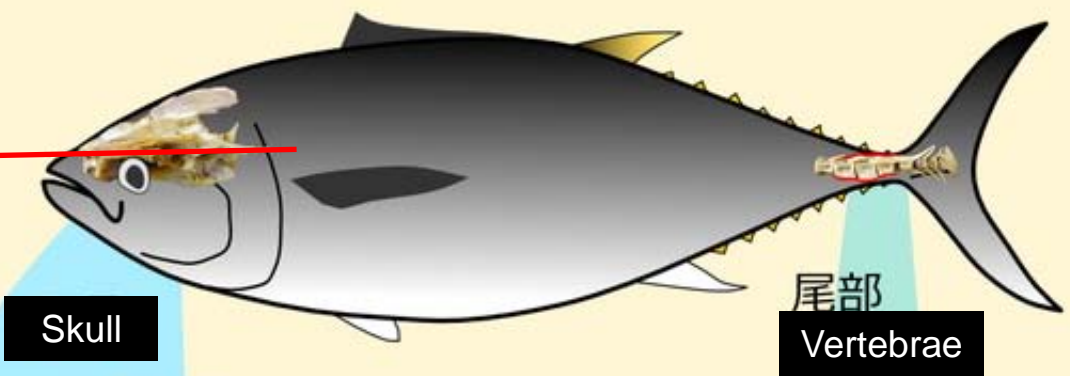
- Scales
- Otoliths
- Calcified/bony structures
 - vertebrae, opercula, fin rays, pectoral spines, and others.)
- Analyzing age class structure
- Tag and recapture



Otolith and other Hard Parts



Cut the line just above the eyes



semi-circular canals



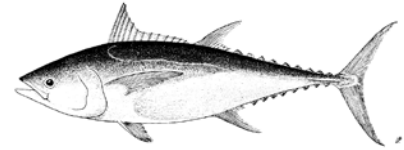
Lapilli Asterisci



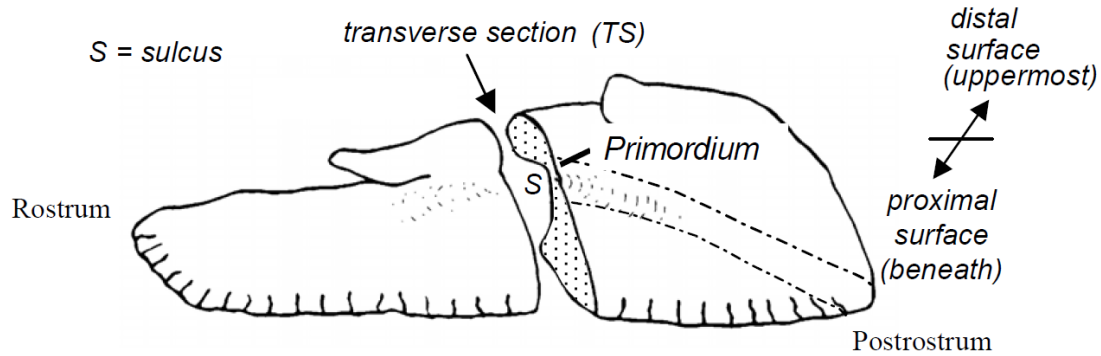
Sagittae

1 cm

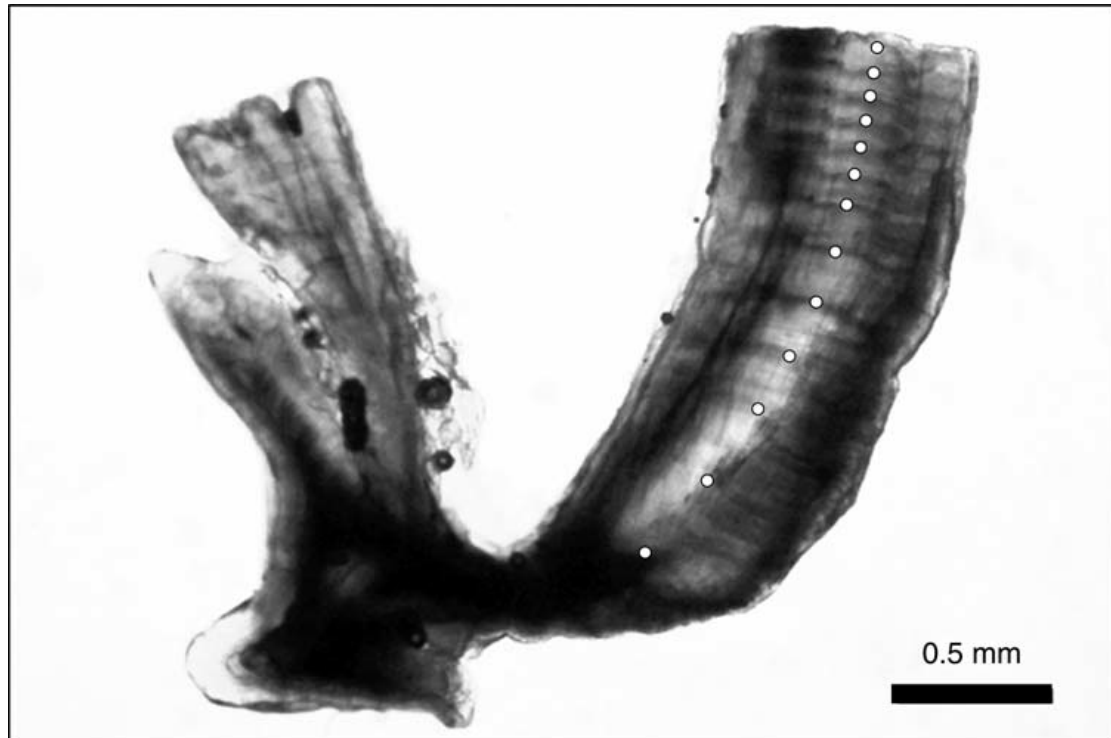
3 pairs of otoliths



Otolith thin section

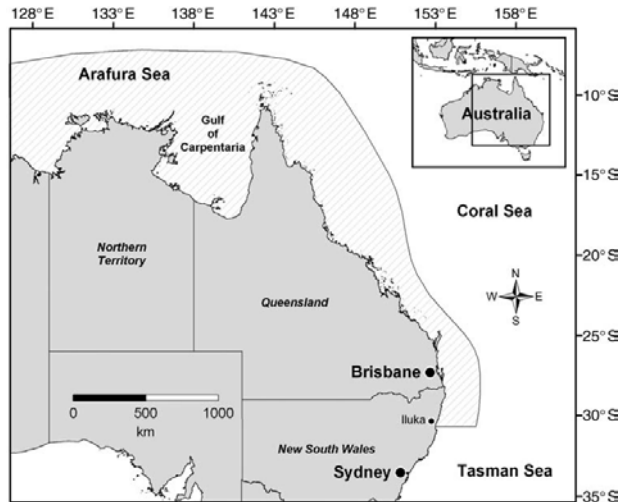


1042 mmFL LTT:
estimated to be
13 years old

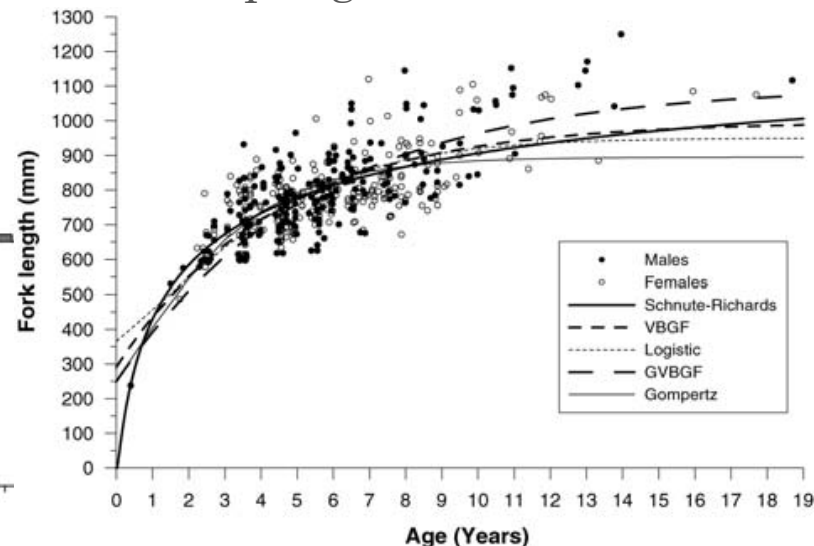
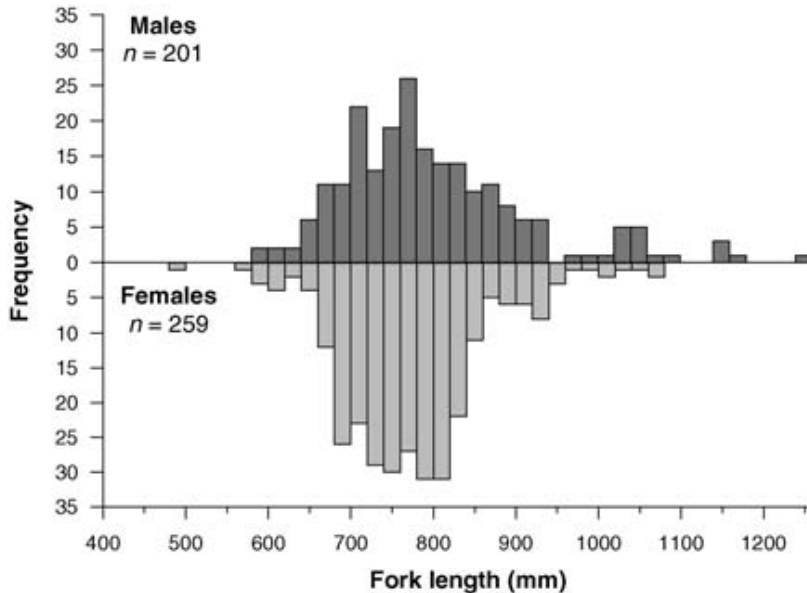




Example of Age Estimation



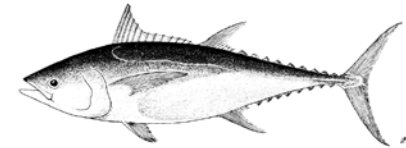
- Australia:
 - longtail tuna is only lightly exploited by commercial fisheries, with annual landings 0 ~ 138 t (FAO, 2009).
- Study region (shaded):
 - Gillnet and hook-and-line sampling.



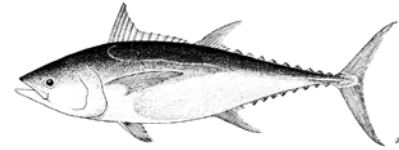
Griffiths *et al*, 2010

Bertalanffy)

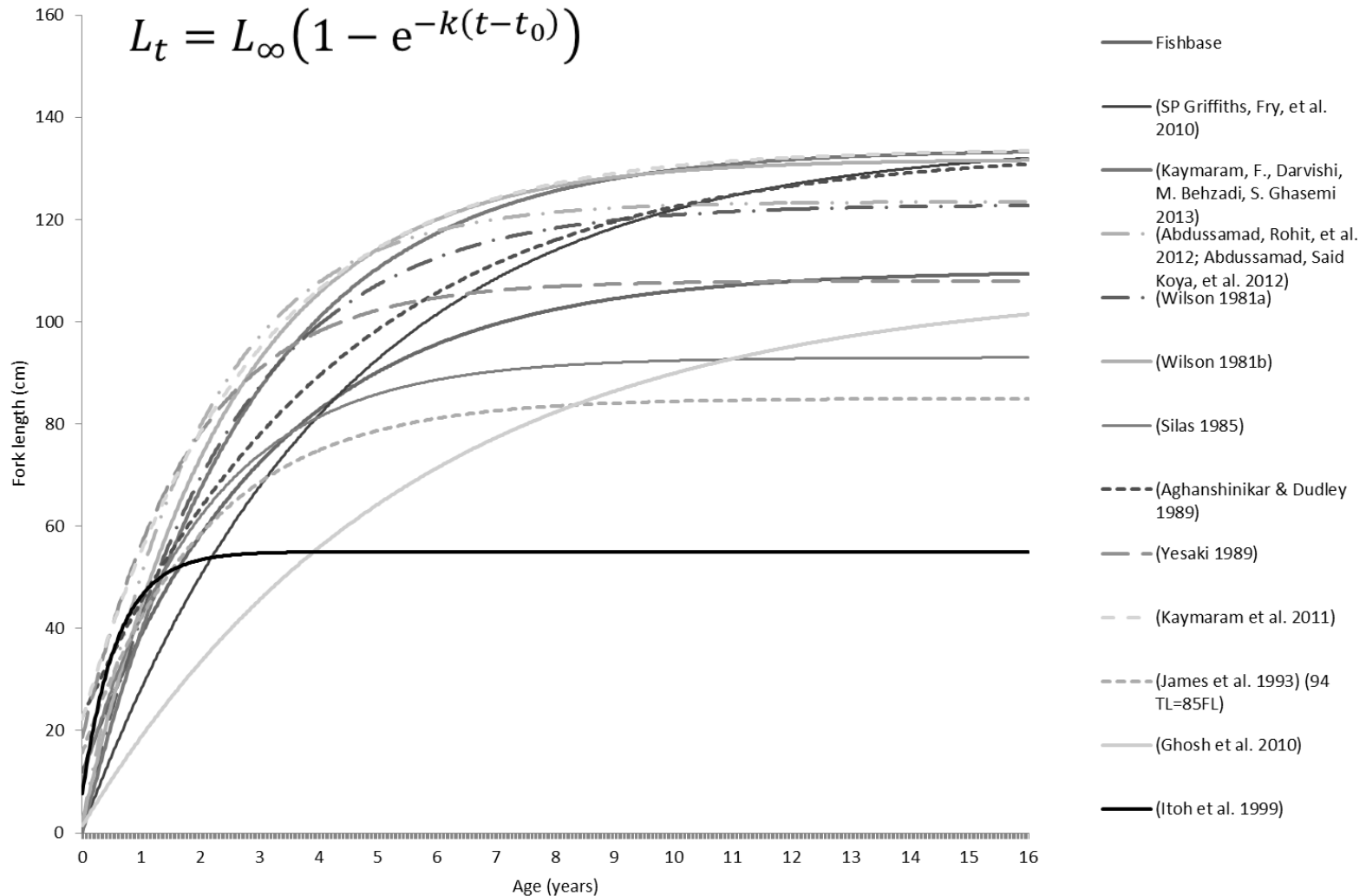
$$L_t = L_\infty (1 - e^{-k(t-t_0)})$$



Region	L_∞ (FL: cm)	k (year ⁻¹)	t_0 (years)	Aging Metho d	Reference
Australia	110	0.32	-0.36		Fishbase
Australia	135.4	0.23	-0.02	Otoliths	Griffiths et al, 2010
Persian Gulf / Sea of Oman	133.72	0.35	-	LF	Kaymaram et al, 2013
India	123.5	0.51	-0.0319	LF	Abdussamad et al, 2012
Papua New Guinea	122.9	0.41	-0.032	LF	Wilson 1981a
Papua New Guinea	131.8	0.40	-0.035	Otoliths	Wilson 1981b
India	93.0	0.49	-0.240	LF	Silas 1985
Oman	133.6	0.23	-	LF	Aghanshinikar & Dudley 1989
Gulf of Thailand	108.0	0.55	-	LF	Yesaki 1989
North Persian Gulf / Sea of Oman	133.8	0.35	-	LF	Kaymaram et al. 2011
India	85	0.48	-	LF	James et al. 1993
Veraval, India	107.4	0.18	-0.0729	LF	Ghosh et al. 2010
Japan	55.0	1.7	-0.089	Otoliths	Itoh et al. 1999

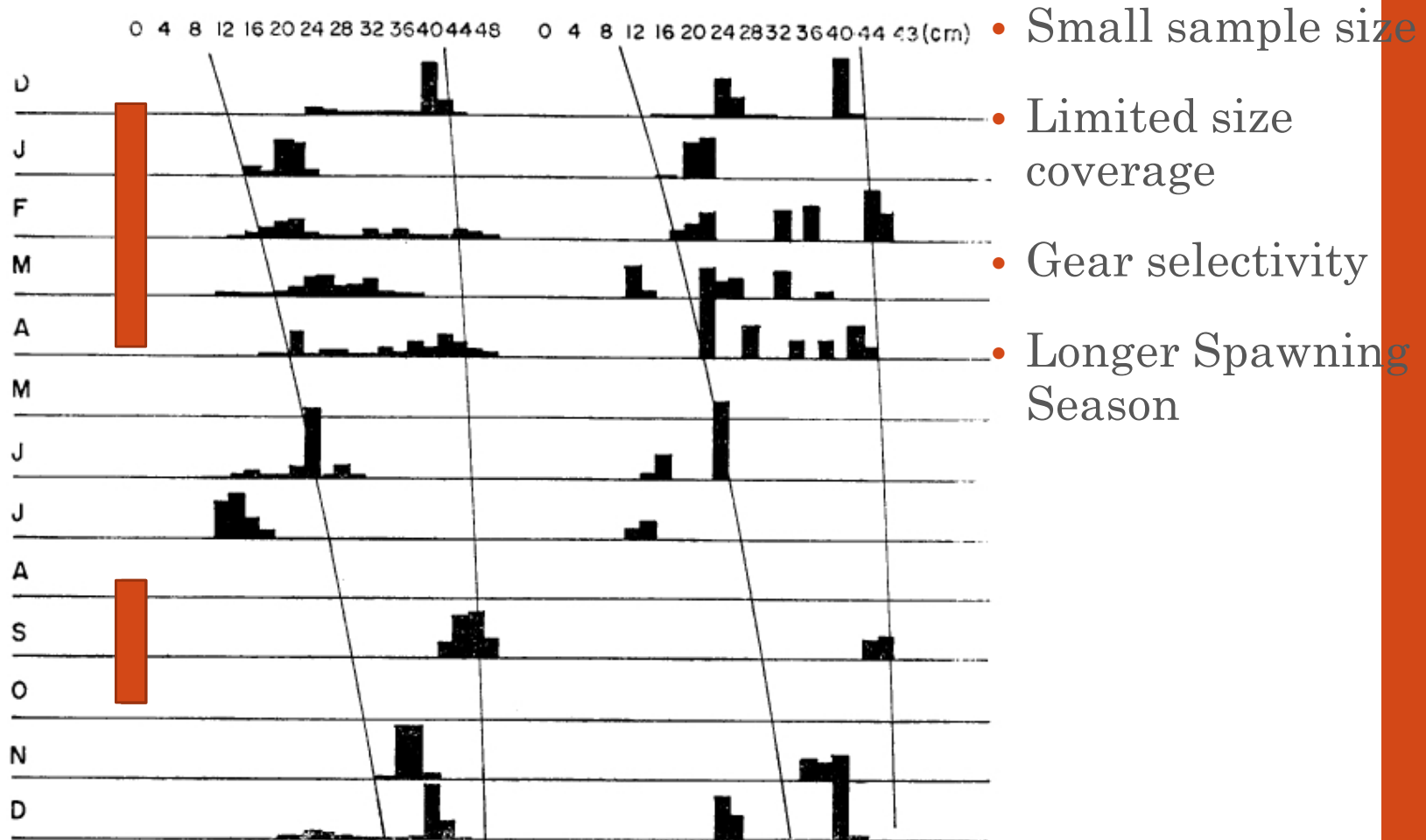


Age-Length Relationships

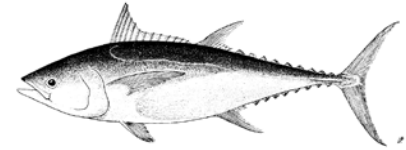


Difficulty to estimate age-length relationship by length frequency

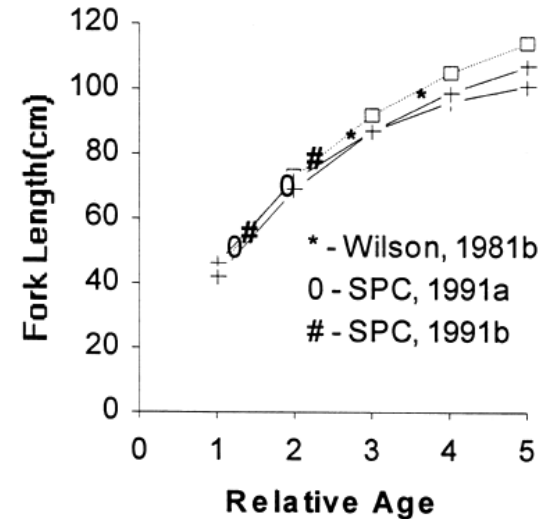
Length Frequency of LOT in west coast of Thailand



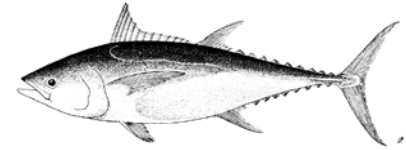
Maturation



Longtail Tuna

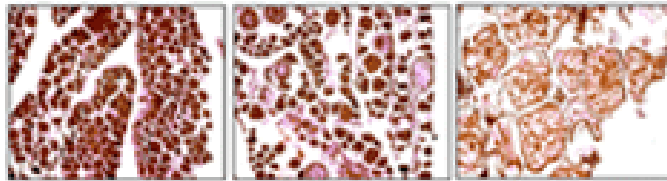


- The length-at-first maturity
 - Thailand: 43 cm FL (Yesaki, 1982)
 - Papua New Guinea: 60cm (Wilson, 1981)
 - Australia: 57.8 cm FL. (Griffiths et al, 2010)
- 50% Maturity:
 - Gulf of Thailand: 396mm (Cheunpan, 1984)
 - Australia: 65 cm FL (female). (Griffiths et al, 2010)
- -→Australia > SE Asia?
- -→Most probably LTT matures at age 1.
- Fecundity:
 - 1.2 ~ 1.9 million eggs (43.8 to 49.1 cm FL) (Klinmuang, 1978)
 - 0.8 ~ 1.9 million eggs (75.5 to 98.0 cm FL) (Wilson, 1981)
- Probably spawns more than once a year, like other tunas.



Spawning Seasons

- Australia: September ~ March, SST >24° C



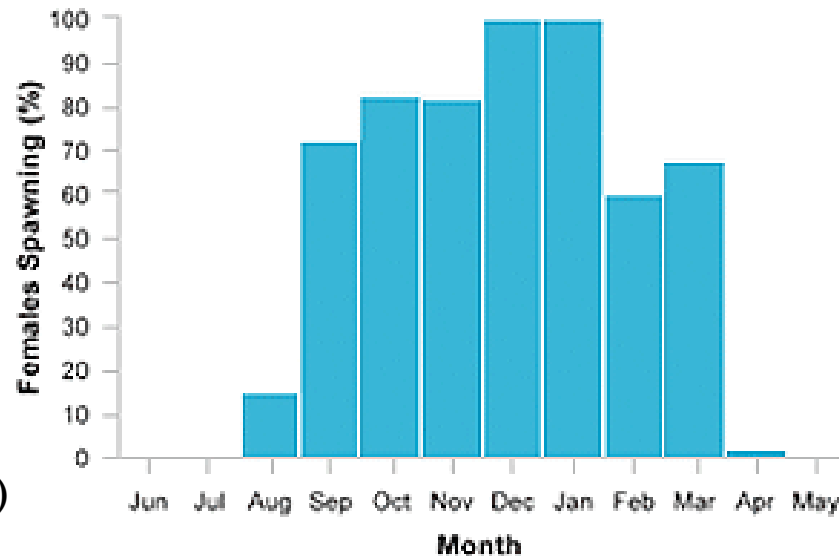
Resting

Developing

Ripe

DEVELOPMENT

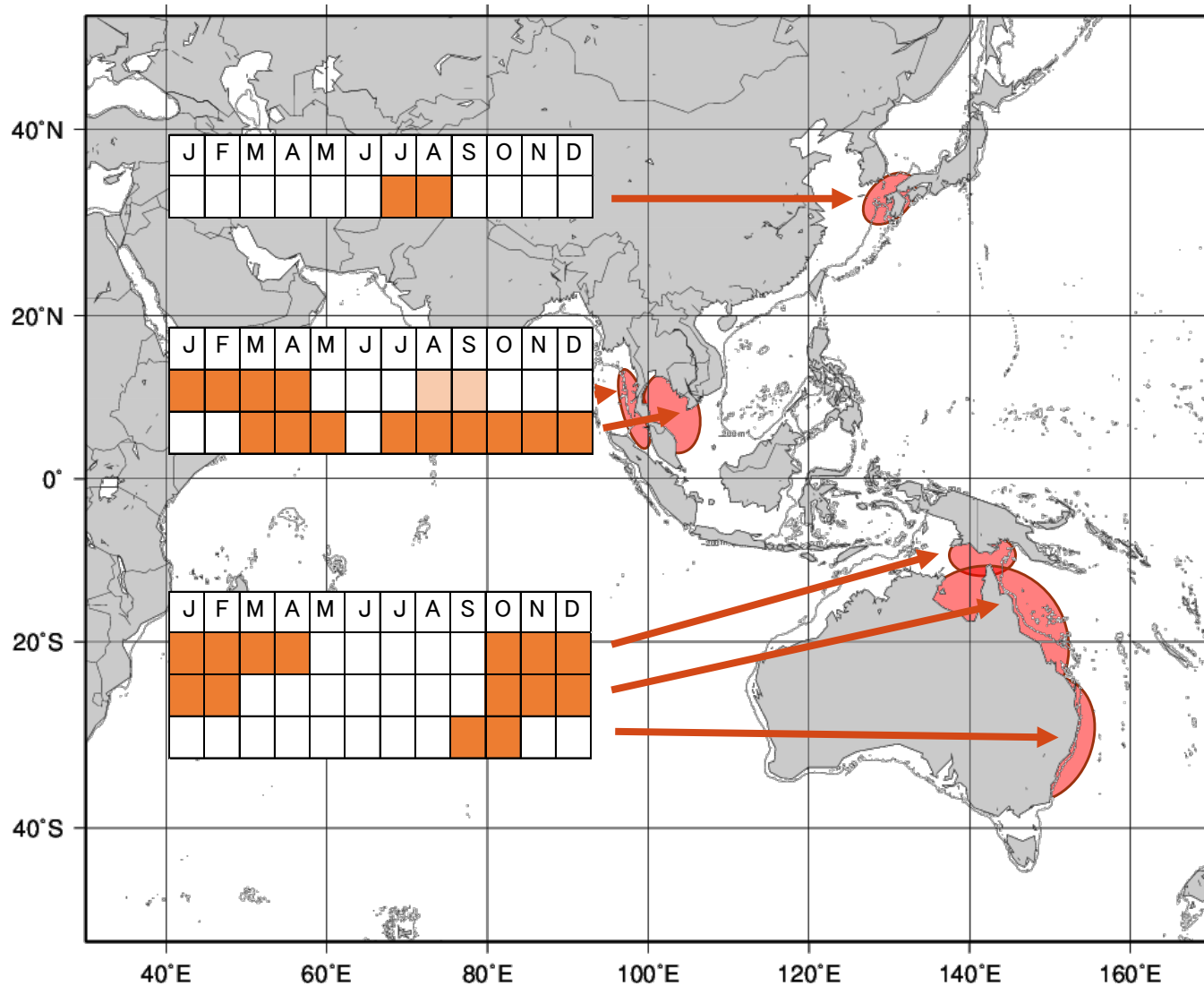
Stained sections of longtail tuna ovary tissue showing the gradual hydration and enlargement of longtail tuna oocytes in preparation for spawning.



(<https://www.longtailtuna.com.au>)

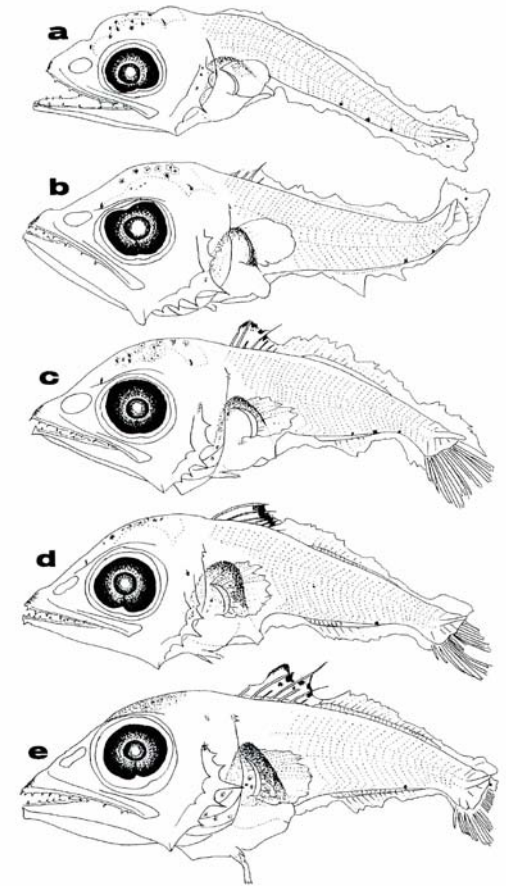
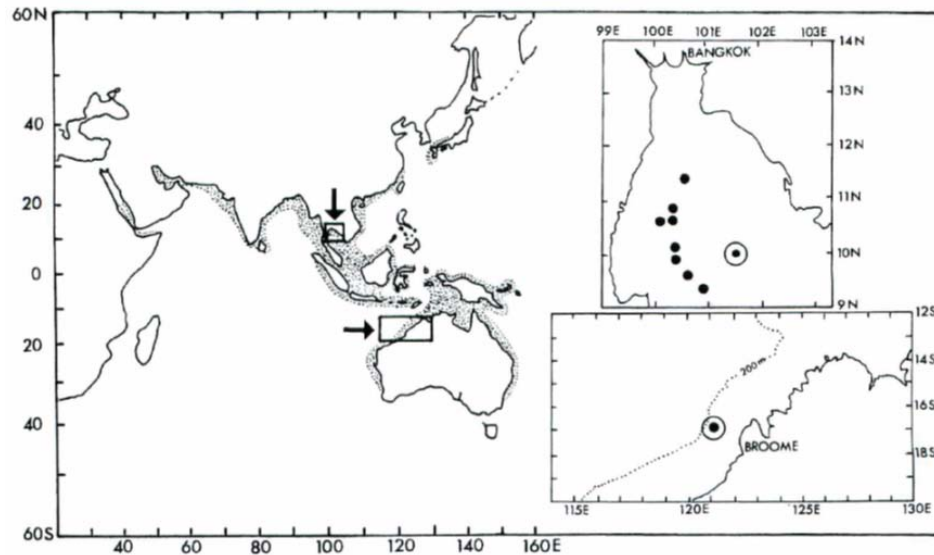
- West coast Thailand: two spawning seasons (Yesaki, 1982)
 - spawn principally in the outer-neritic regime
 - major spawning during the NE monsoon (Jan~Apr)
 - minor spawning during the SW monsoon (Aug~Sep)
- Gulf of Thailand: two spawning seasons (Cheunpan, 1984)
 - March-May, July–December

Spawning Areas and Seasons



Life History

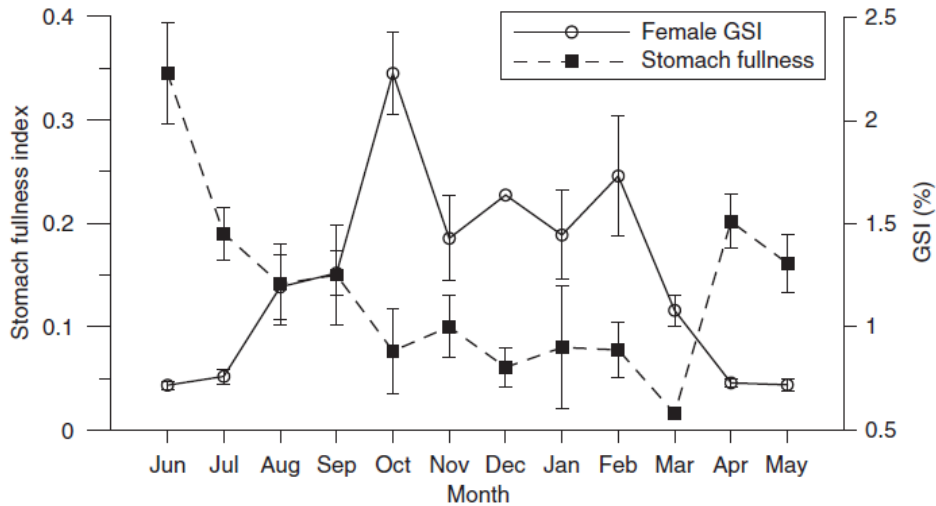
- Little information of distribution of LTT larvae
 - Gulf of Thailand: January~June (Chamchang and Chayakul, 1988)



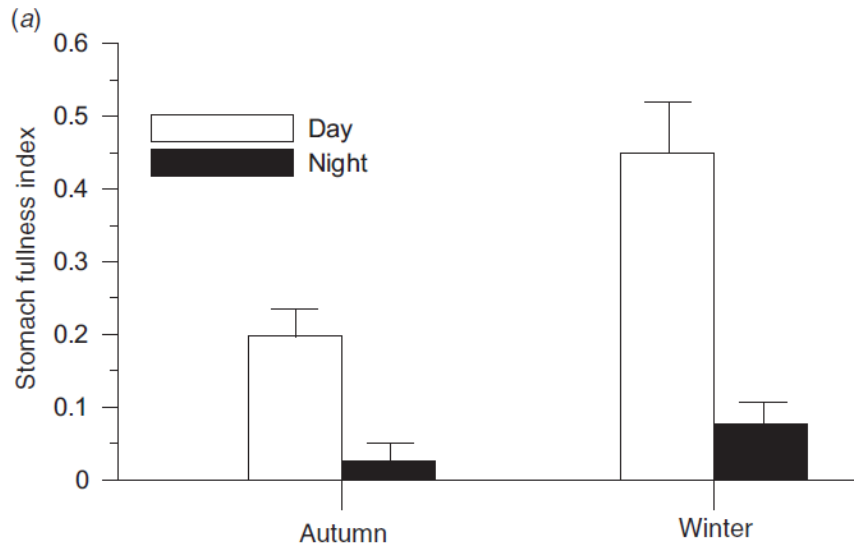
a: 3.75 mm NL, b: 4.86 mm SL, c: 5.25mm SL, d: 5.32 mm SL, e: 5.76 mm SL (from Nishimura and Ueyanagi, 1991)

- Preadults
 - ~20cm: captured by luring purse seines off the west coast of Thailand.
 - Longtail tuna may form schools of varying size.
 - Little information of migration and sub-populations

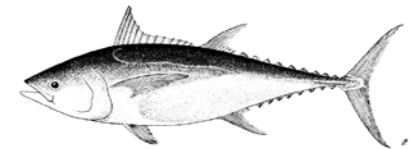
Seasonal and Diurnal Feeding Activities



- Stomach fullness index:
 - Highest April ~ July
 - Lowest October ~ March
 - Inverse relationship with GSI

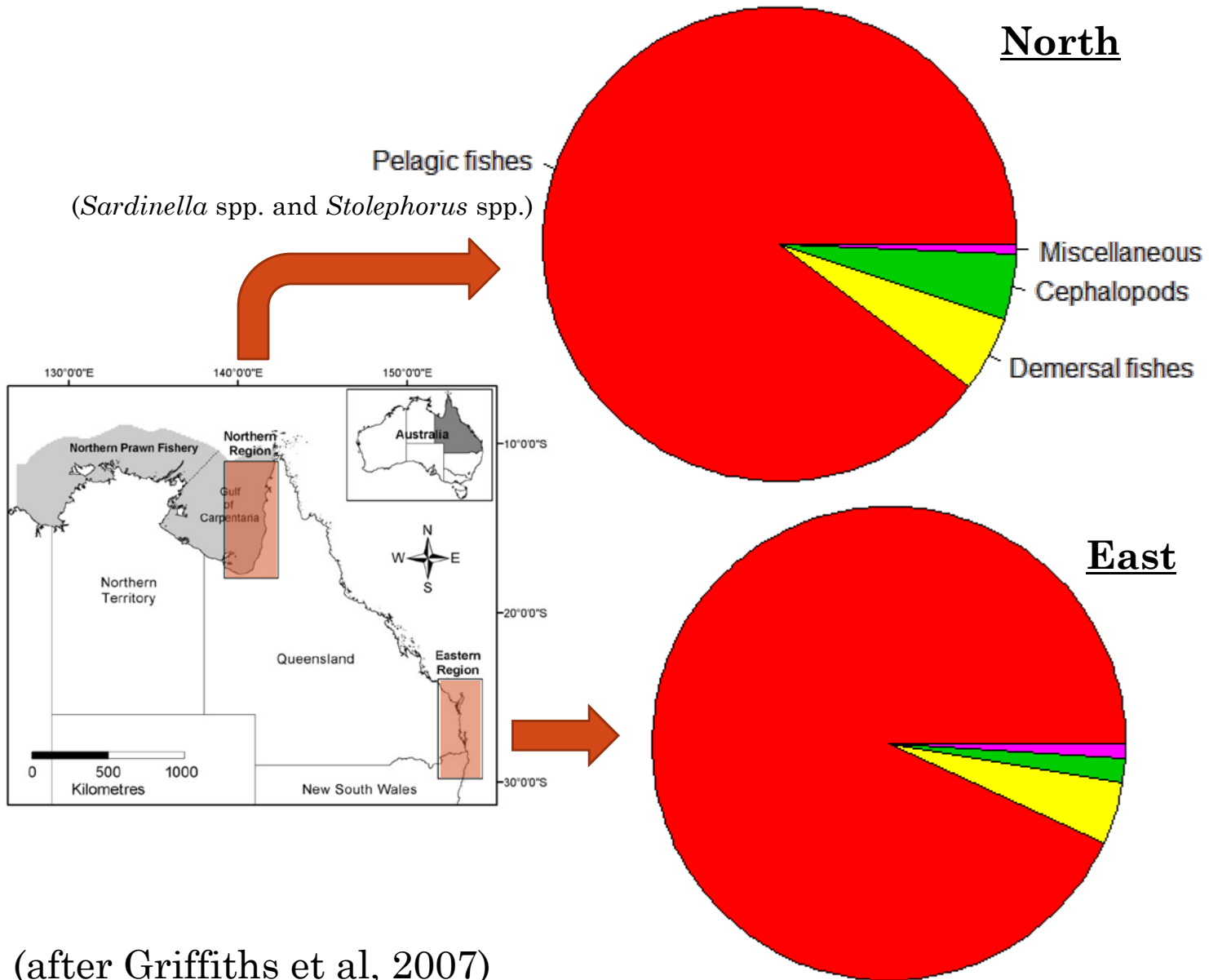
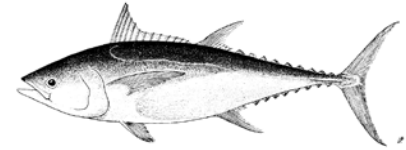


- Feeding primarily during the day: LT rely heavily on their high visual acuity to capture prey.



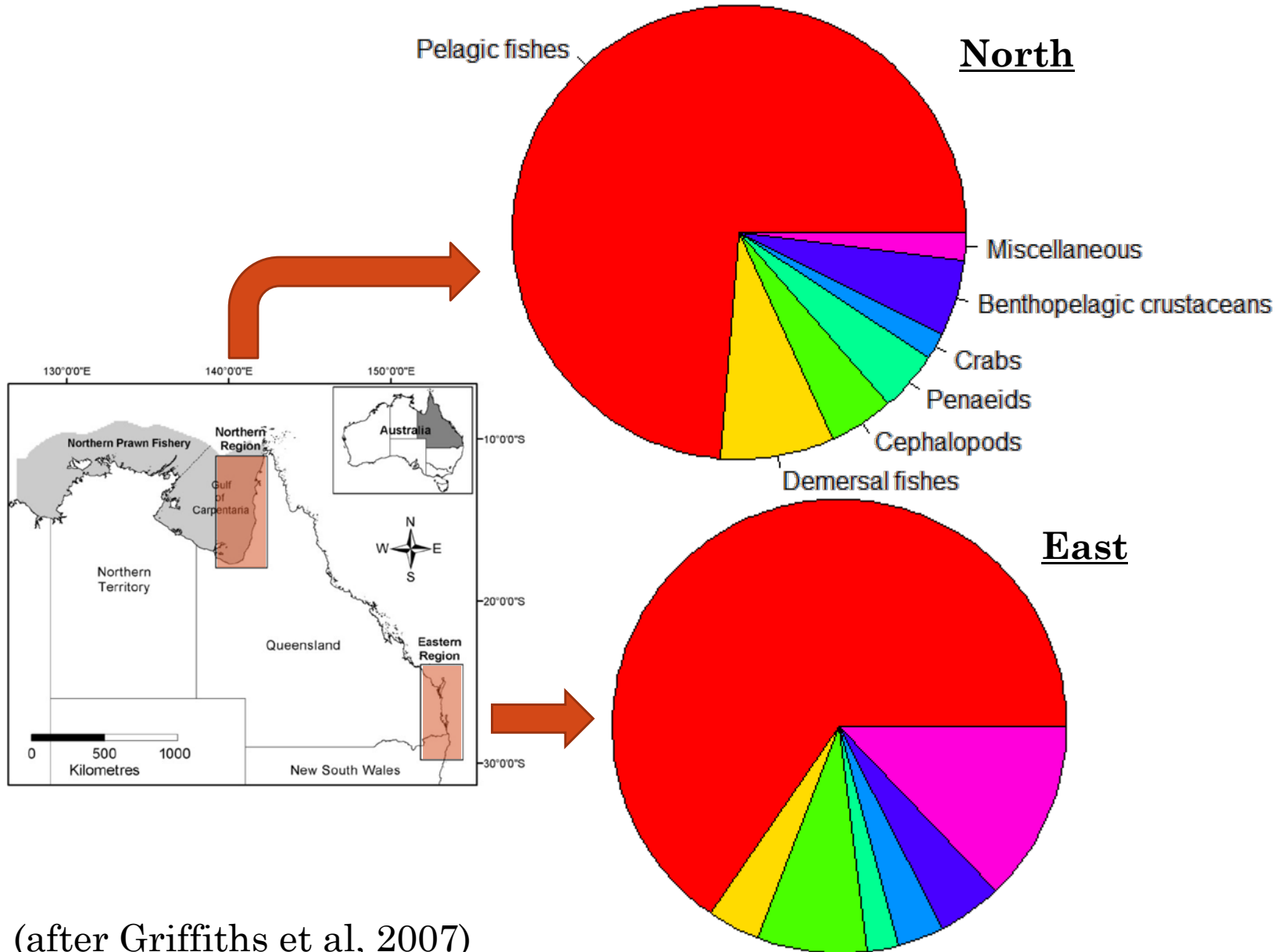
(Griffiths et al, 2007)

Prey Categories (% Dry Weight)



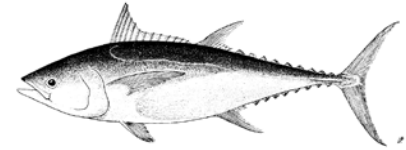
(after Griffiths et al, 2007)

Prey Categories (% Frequency)



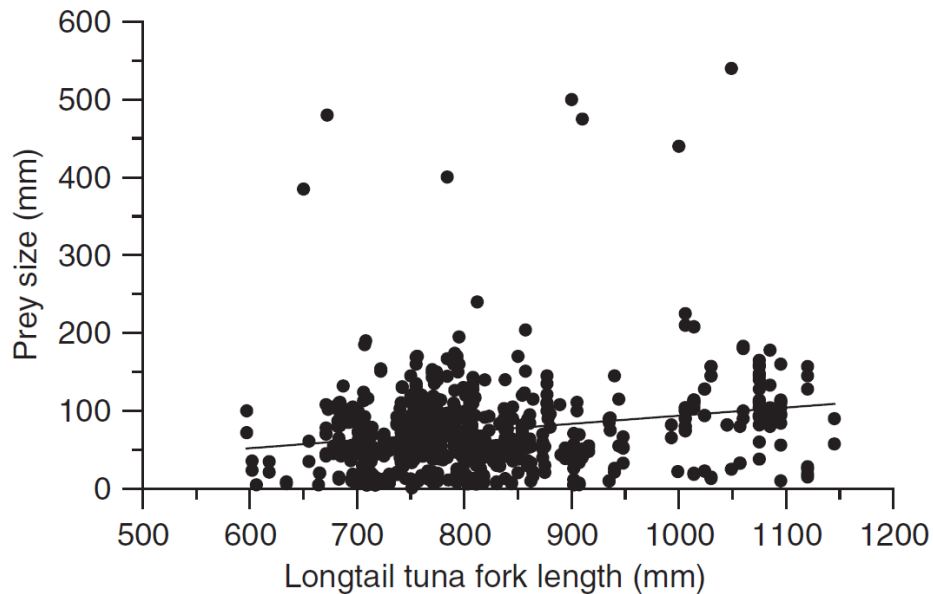
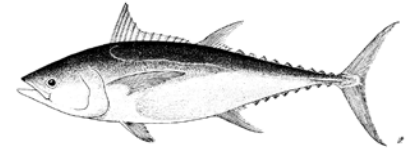
(after Griffiths et al, 2007)

Opportunistic Foraging

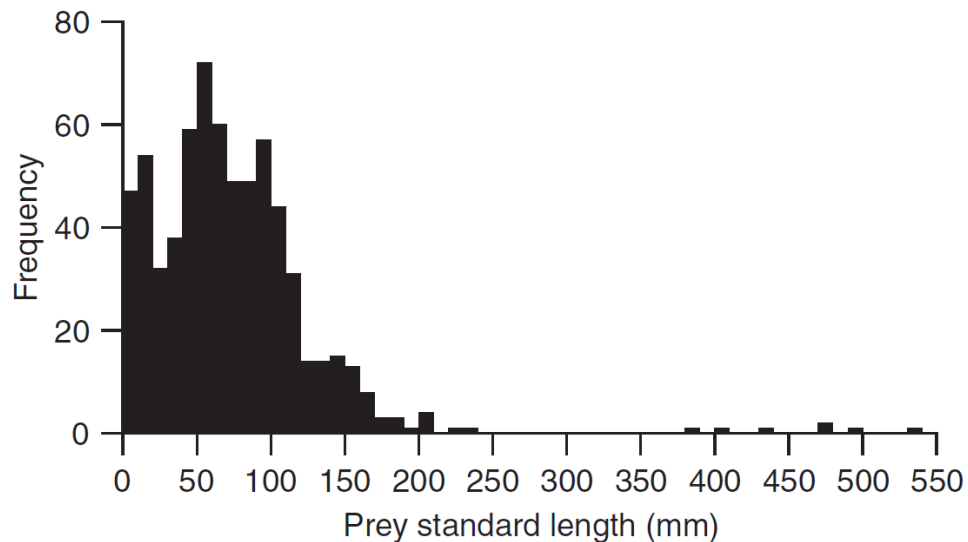


- Northern region Most diverse diet in autumn and winter (47 and 27 taxa) and the least diverse diet in summer (7 taxa).
- The same trend was apparent in the eastern region, where fish had the most diverse diet in autumn and winter (29 and 17 taxa) and the least diverse diet in summer (7 taxa)
- Gulf of Papua (Wilson, 1981)
 - 31 prey taxa; teleosts (85% by vol), crustaceans (8%) and cephalopods (6%),
 - engraulids are the most predominant prey item overall.
- Malaysia (Silas 1967)
 - pelagic & demersal fishes: engraulids, clupeids, sygnathids and scombrids;
 - squids and crustaceans (stomatopods, mysids and megalopa) were the predominant prey in terms of frequency of occurrence.
- These variety of prey species suggest **opportunistic foraging** behavior of LTT.

Prey Size and Diversity

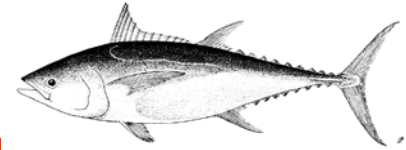


- Fish size: 60~115cm
- Prey size in length: mostly ~200mm
- Little change of prey size in relation with fish size



(Griffiths et al, 2007)

Summary: Longtail Tuna



- An epipelagic, predominantly neritic species inhabiting tropical to temperate provinces of the Indo-Pacific, max size 136cm FL.
- Age1: ~40cm, Age2: ~60cm, Age3; ~80cm FL
- Most probably mature from age 1
- Fecundity: 1~2 million eggs/batch
- Spawning season differs depending on the areas
- Opportunistic feeder, its diet includes many species of pelagic/demersal fish, crustaceans, cephalopods at varying percentages.
- Little information on the early life history, migration, and sub-populations





Request to the Countries

Please send us ANY documents;

Scientific Papers

written in local languages