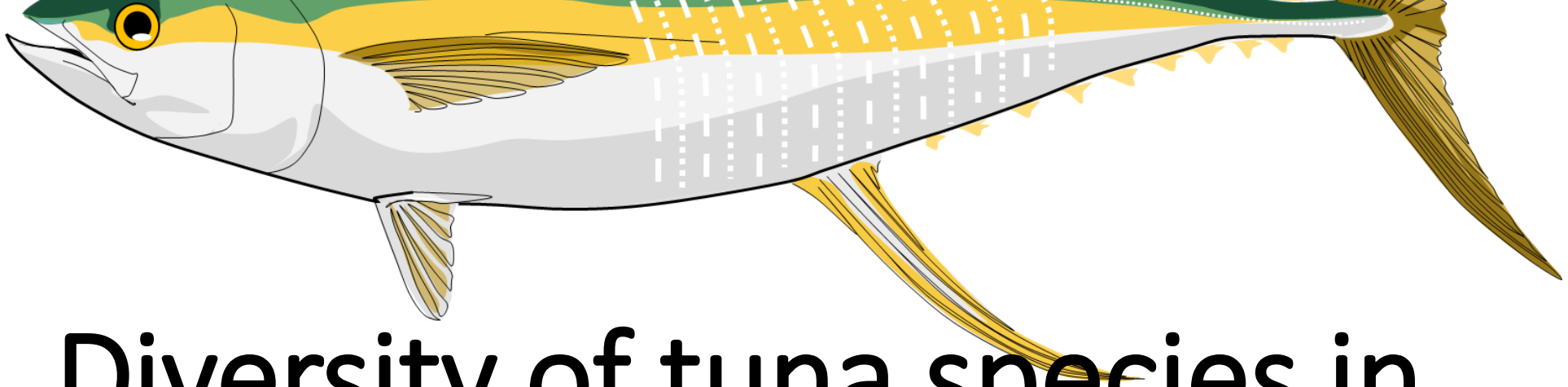


Diversity of tuna species in the Southeast Asia

Supapong Pattarapongpan, FO, FGOS/RDD, SEADEC/TD

Main reference:

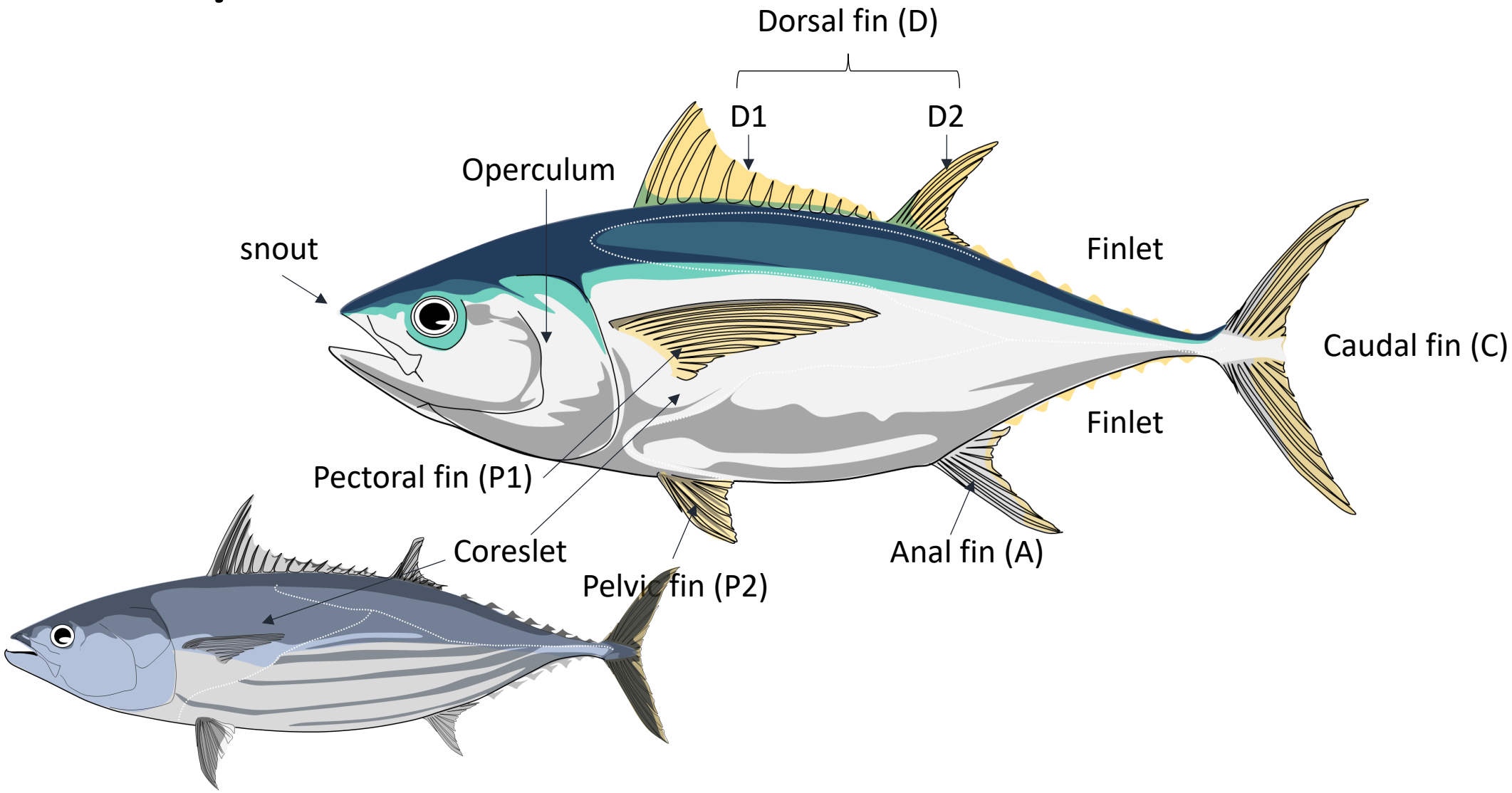
Majkowski, J., 2007, Global Fishery Resources of Tuna and Tuna-Like Species. FAO Fisheries Technical Paper. 483. 66pp. (https://www.fao.org/4/a1291e/a1291e.pdf)

Juan-Jorda, M.J., Mosqueira, I., Freire, J., Dulvy, N.K., 2013. The Conservation and Management of Tunas and Their Relatives: Setting Life History Research Priorities. PLOS One. 8(8): e70405. doi:10.1371/journal.pone.0070405

What is Tuna?

- Tuna and its relatives (Tuna-like species) are the bony fishes under the family Scombridae, which can be divided into various tribes
  - Tunini (Tunas)
  - Sardini (Bonitos)
  - Scomberomorini (King Mackerels)
  - Scombrini (Mackerels)
- All are known to be predator in their habitat with high economic value and are subject to high fishing pressures
- For the Thunnini Tribe, it can be divided into two major focused groups: temperate (albacore and bluefin) and tropical tuna group (skipjack, yellowfin, and bigeye).

Body Parts

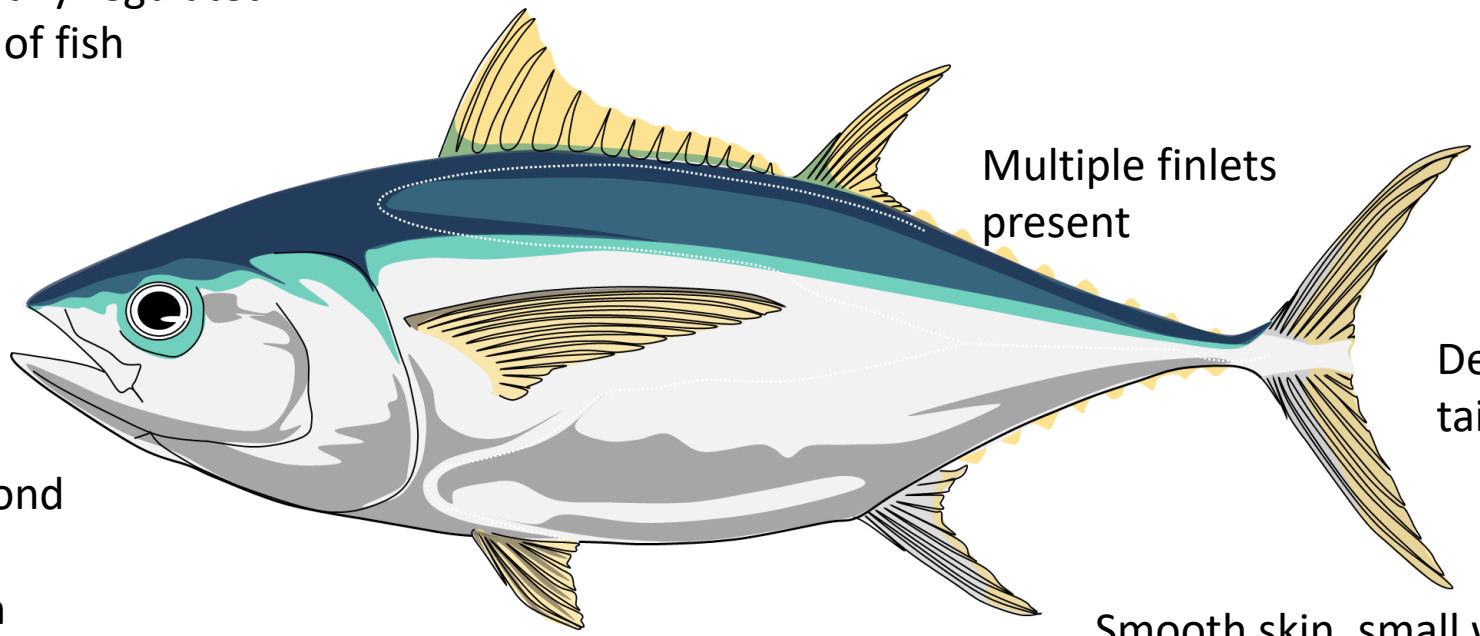

Dorsal fin (D)
D1
D2
Operculum
snout
Finlet
Caudal fin (C)
Finlet
Pectoral fin (P1)
Coreslet
Pelvic fin (P2)
Anal fin (A)

Distinctive Characteristics

Thermally regulated group of fish

Two distinct sets of dorsal fin

Pointy snout



Multiple finlets present

Deep folk or lunated tail

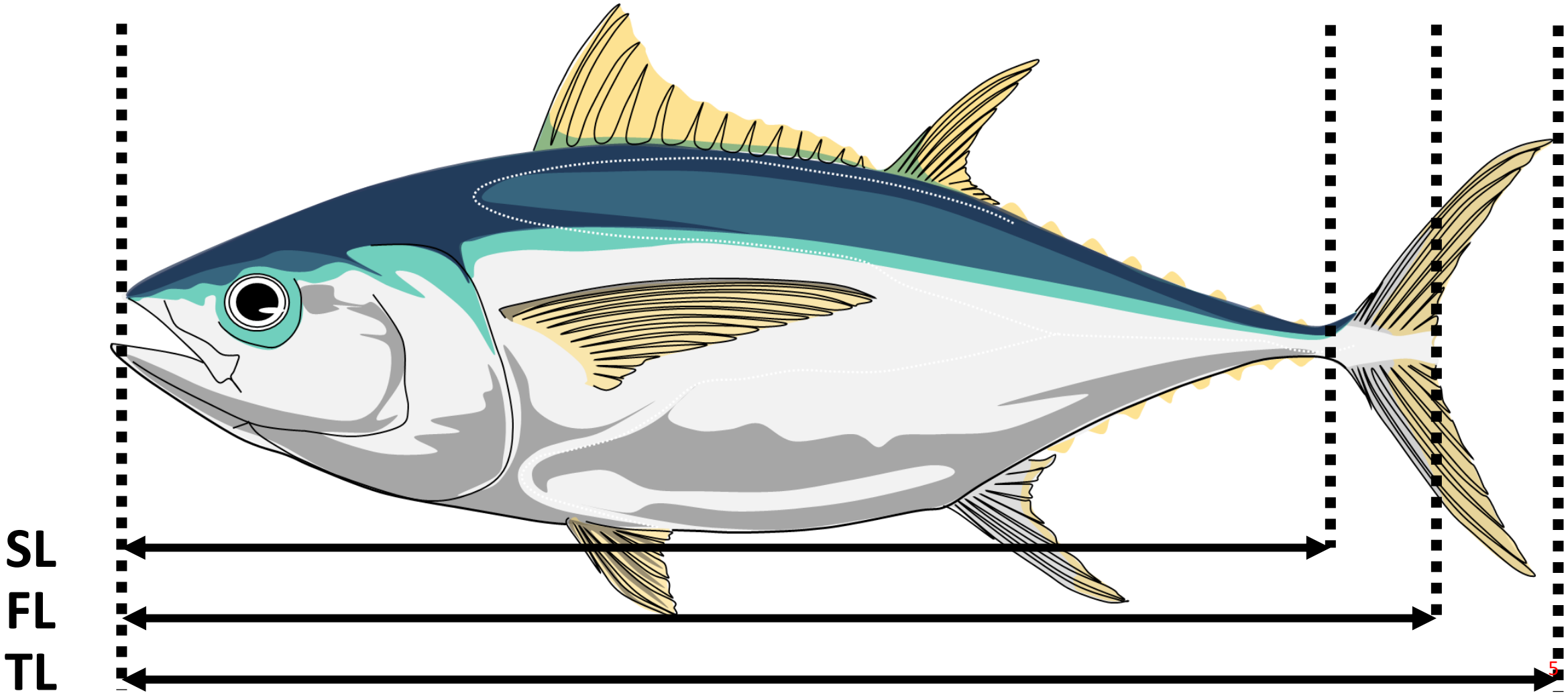
Wide mount, opening at or beyond the eye orbit
Some species with canine teeth

Pectoral on the center or the upper half of the body

Body rounded, torpediform

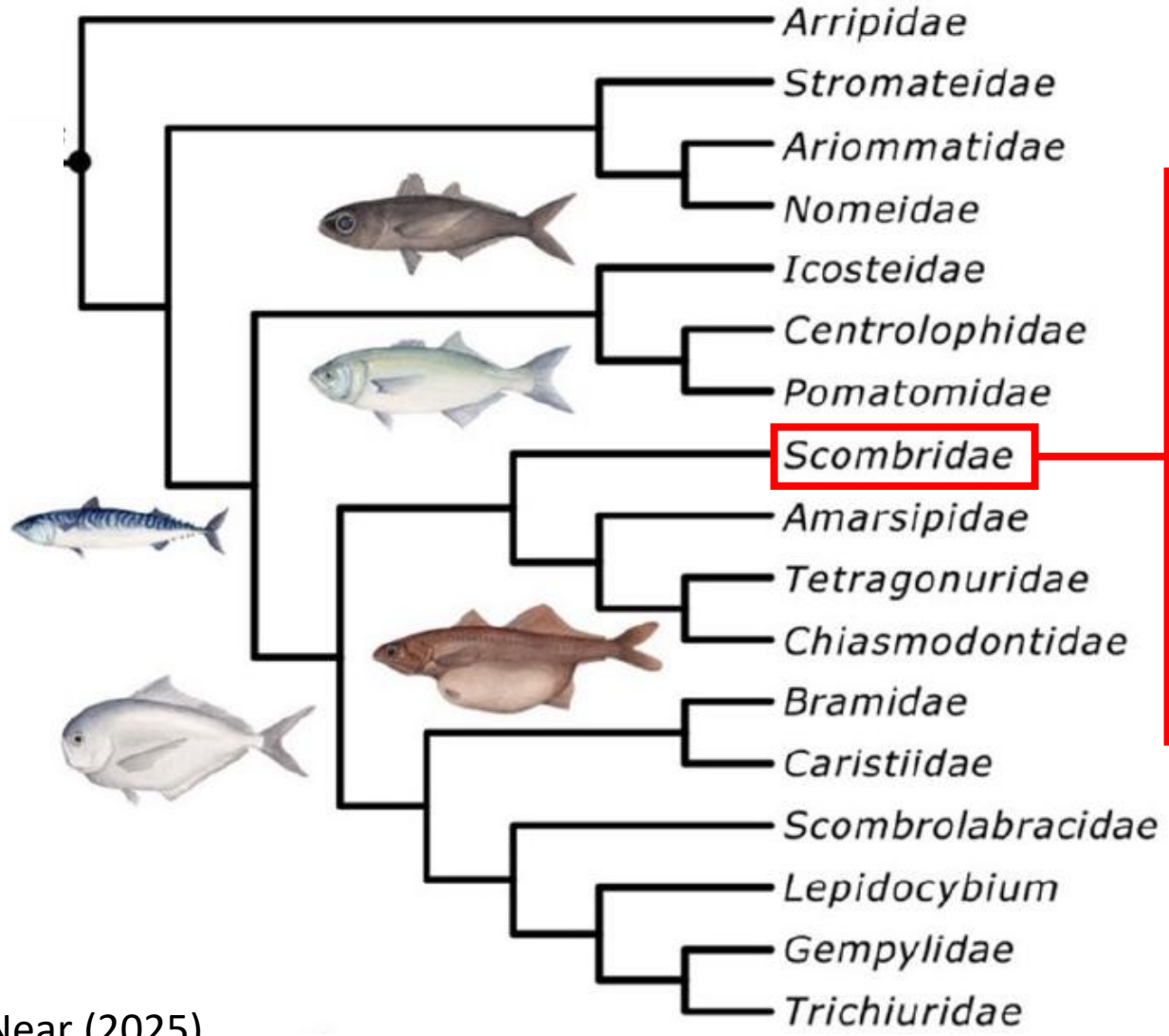
Smooth skin, small well-developed scale, no lateral ridges, spines, etc.

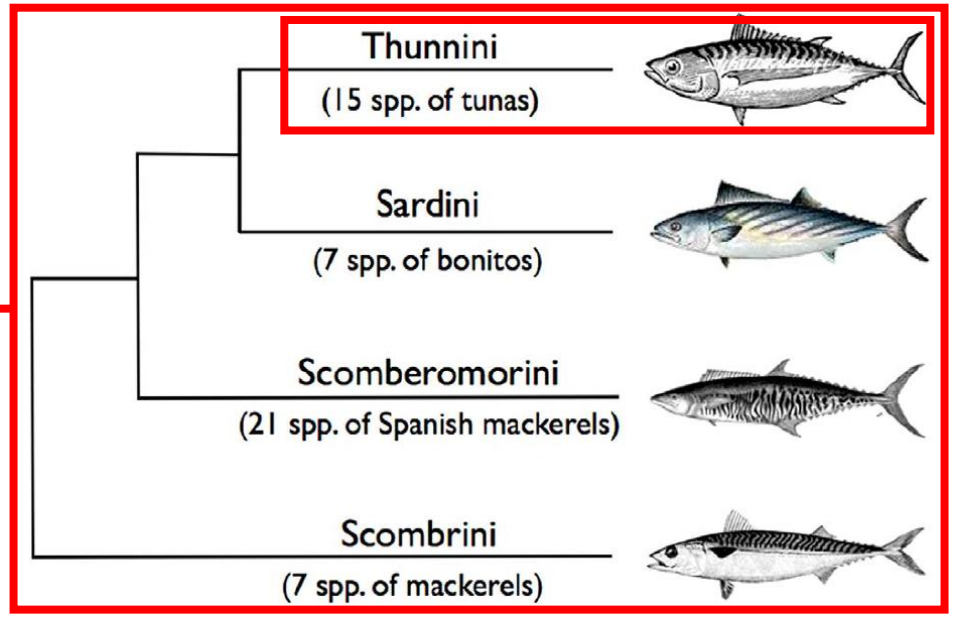
Measurements



Phylogenetic Tree

Scombriformes





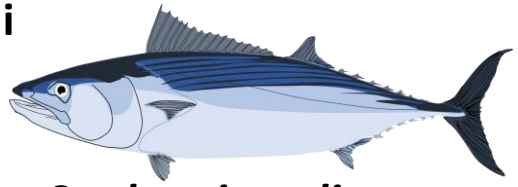
Juan-Jorda et al. (2013)

Thacker and Near (2025)

Tuna Classifications

Scombridae

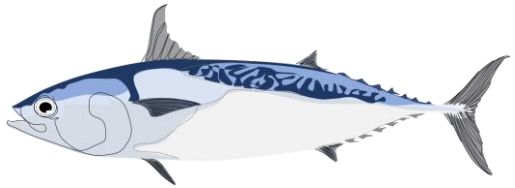
Canine teeth present → **Sardini**



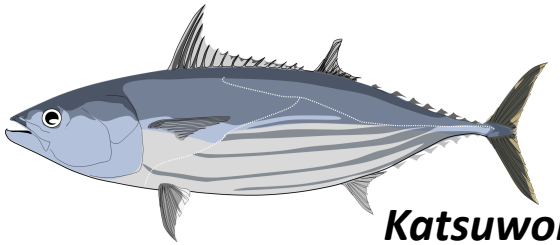
Sarda orientalis

Canine teeth absent → **Thunnini**

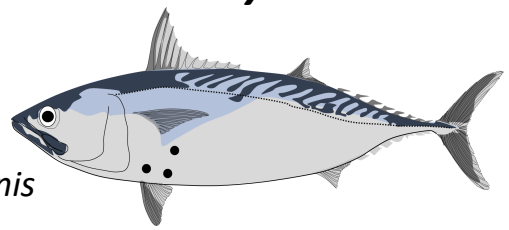
Dorsal fin clearly separated → ***Auxis***



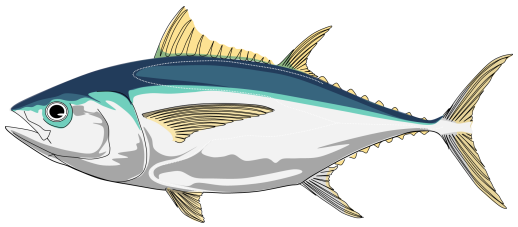
Dorsal fin not clearly separated → Longitudinal stripes presented ventrally → ***Katsuwonus pelamis***



Body naked behind the thick-scaled area in the position of D1, P1, and P1-fin (corselet) → ***Euthynnus***



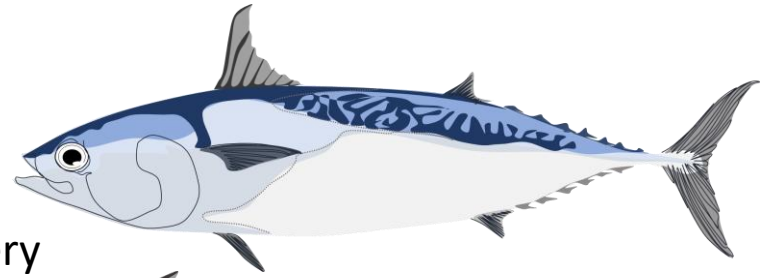
Small and fine scales are present throughout the body → ***Thunnus***



*Only *Euthynnus affinis* is found in the SEA

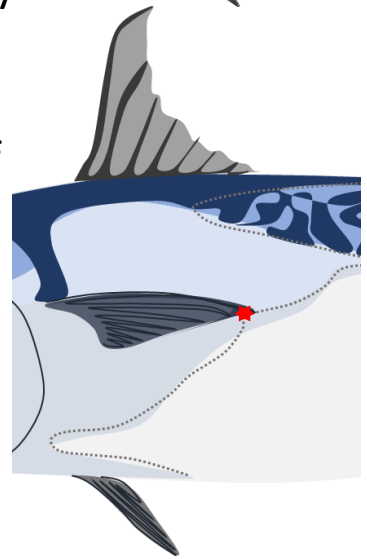
Genus *Auxis*

- 2 species found in SEA, *A. thazard* and *A. rochei*
- Can be distinguished using coreslet and pectoral fin (P1)

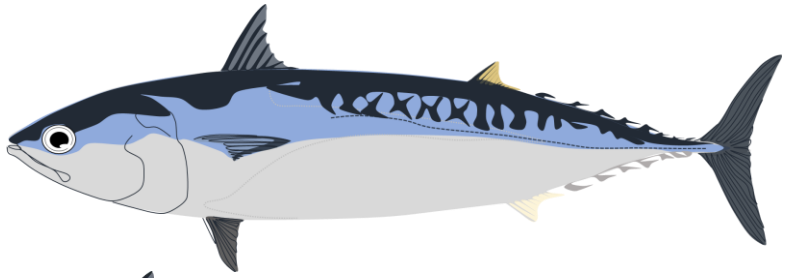


Auxis thazard

D1 very high, almost 50% of body depth

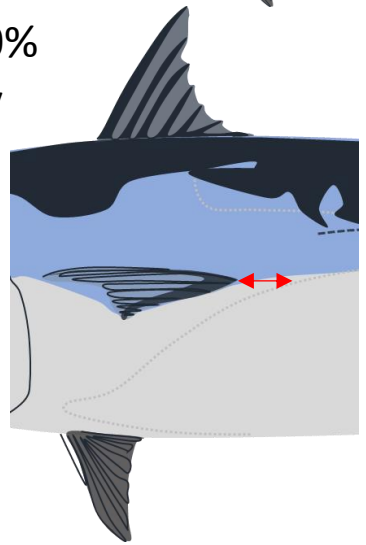


P1 and the edge of coreslet overlapped



Auxis rochei

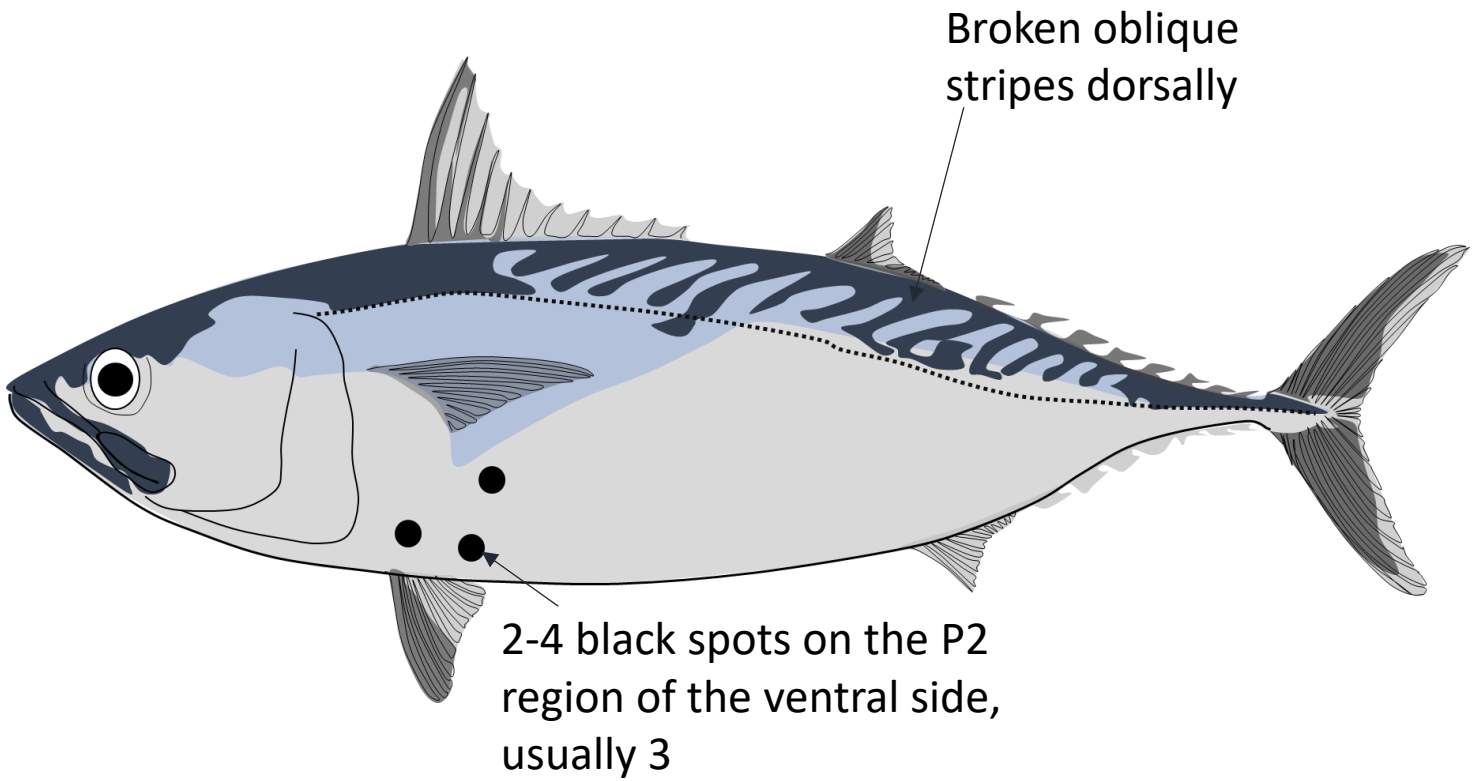
D1 less than 50% of body depth



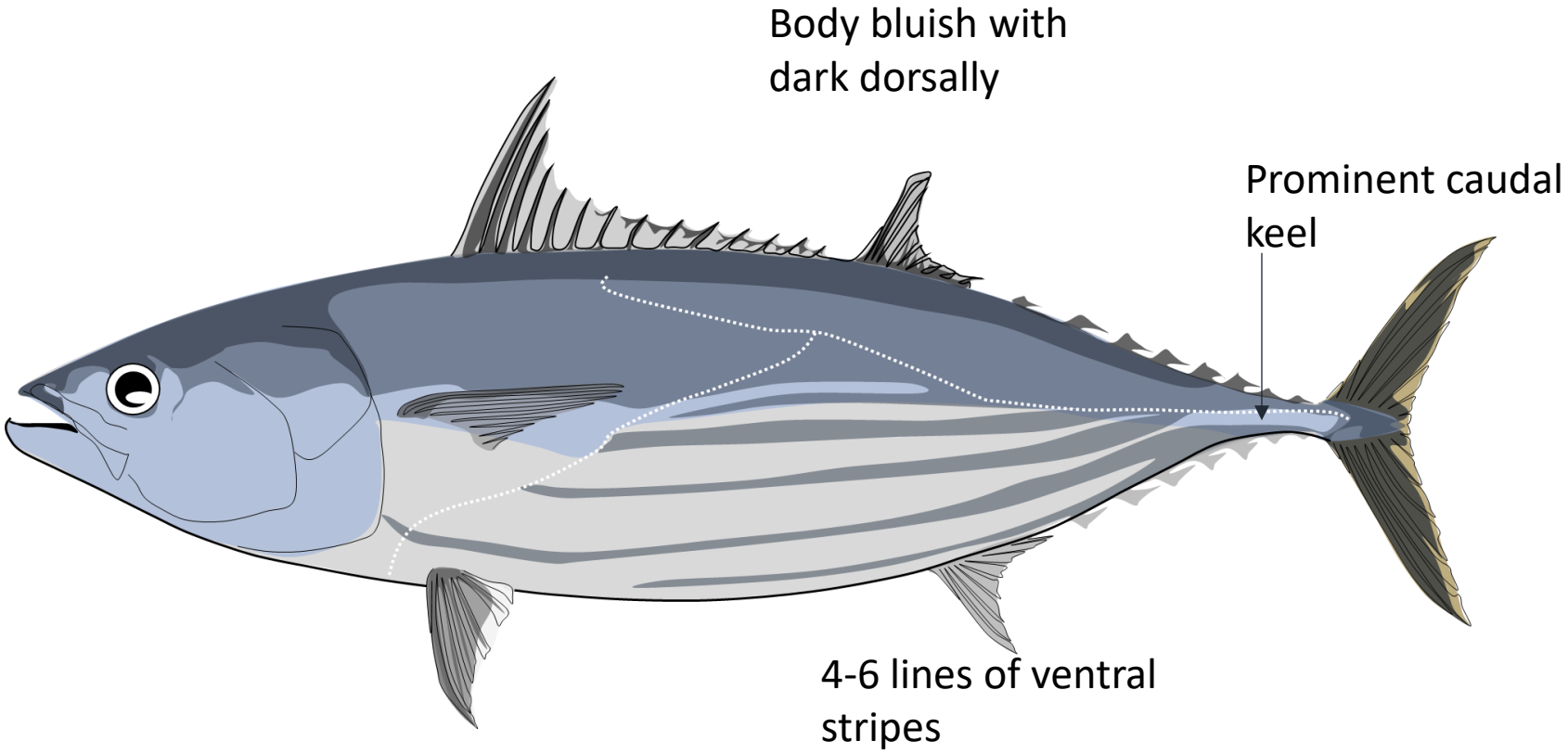
P1 and the edge of coreslet do not overlap

Euthynnus affinis

Max 240 cm FL,
Common 30-180



Katsuwonus pelamis **Max 110 cm FL, Common 80 or below**



Genus *Thunnus*

Thunnus

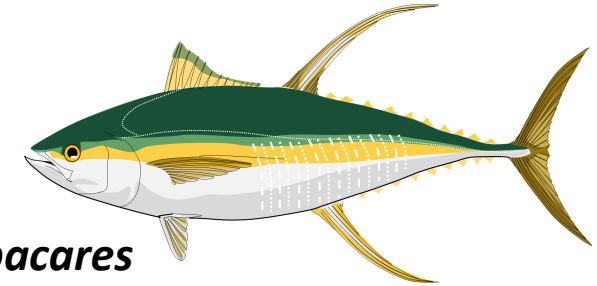
P1 elongate, beyond D2

Thunnus alalunga

P1 end before D2, less than 80% of head length (HL)

D2 and A-fin are very elongate

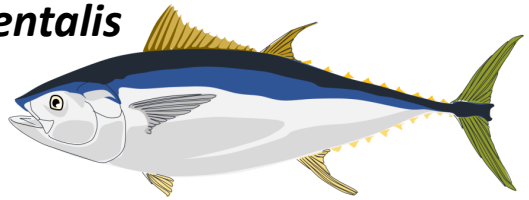
Thunnus albacares



D2 and A-fin are not elongate

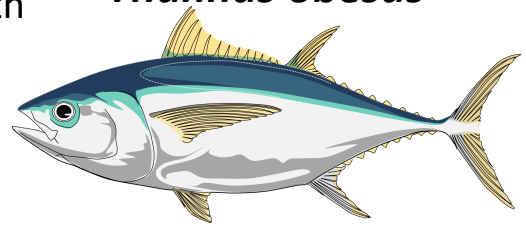
P1 end less than 80% of HL

Thunnus orientalis

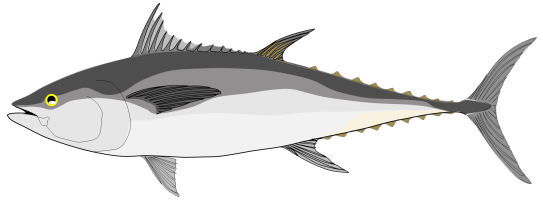


P1 reaching the anterior edge of D2, great body depth

Thunnus obesus



Thunnus tonggol



P1 short, less than half of BL, body slender

Thunnus alalunga)

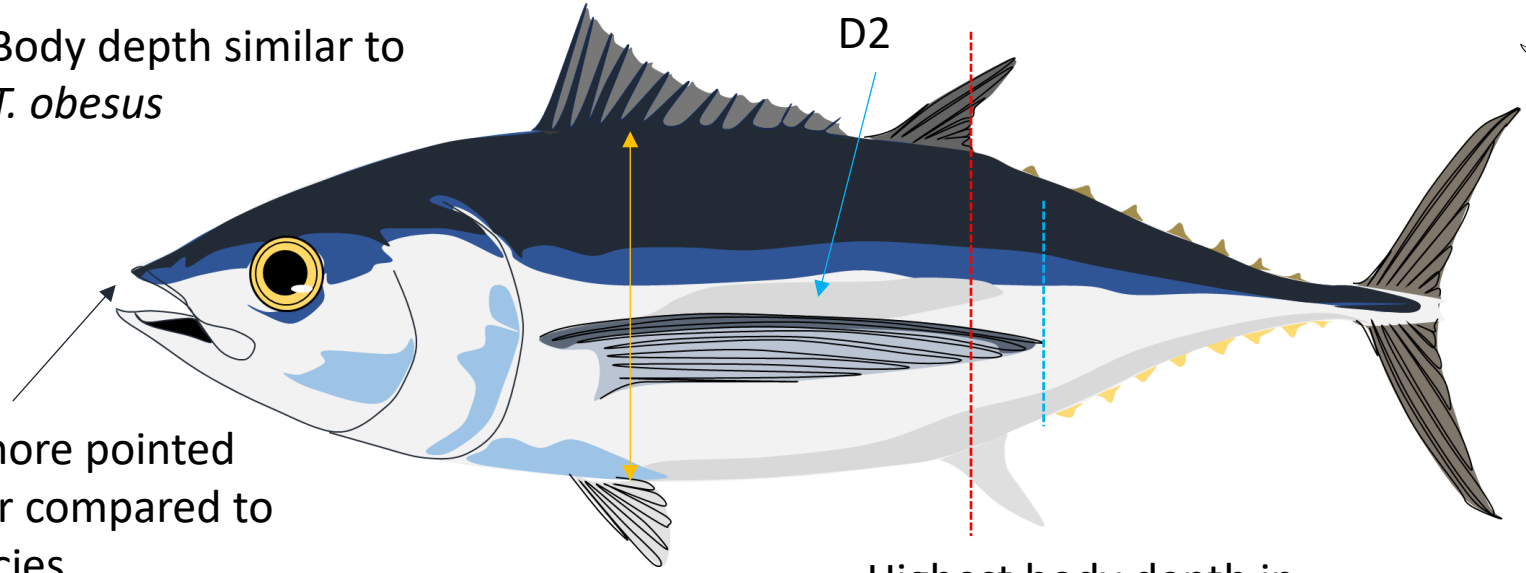
Max 140 cm FL,
Common 40-100

https://fishider.org/en/guide/osteichthyes/scombridae/thunnus/thunnus-alalunga

- Characteristics

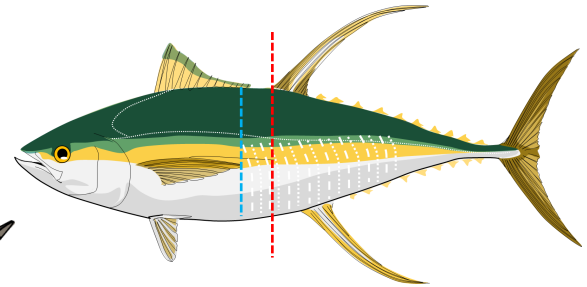
Body depth similar to *T. obesus*

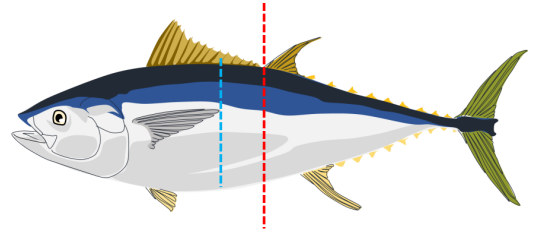
Extremely elongate P1, reach over anterior of D2

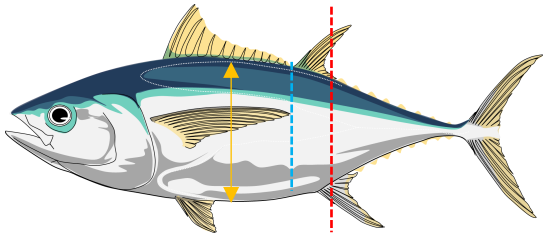


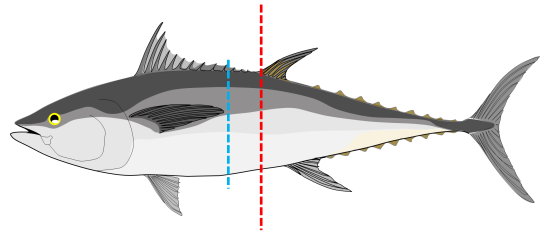
Snout is more pointed and longer compared to other species

Highest body depth in the middle of the body or posterior



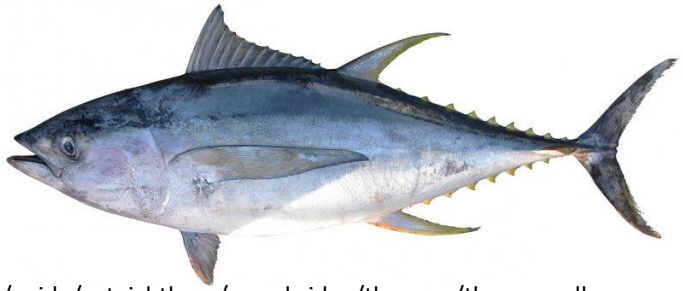






Thunnus albacares

Max 240 cm FL,
Common 30-180

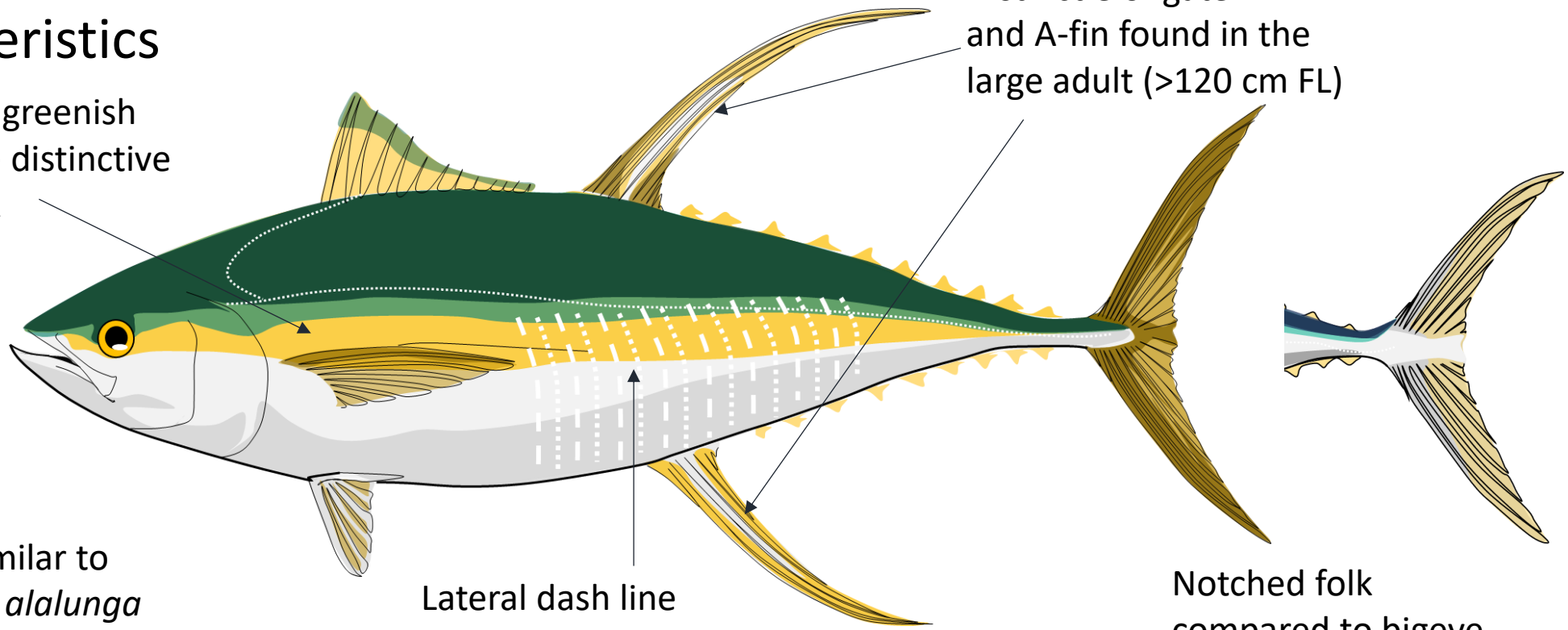


https://fishider.org/en/guide/osteichthyes/scombridae/thunnus/thunnus-albacares

- Characteristics

Thin blue or greenish line with the distinctive golden mark

Distinct elongate D2 and A-fin found in the large adult (>120 cm FL)



Juveniles are similar to *T. obesus* and *T. alalunga* as they are usually found in the same area

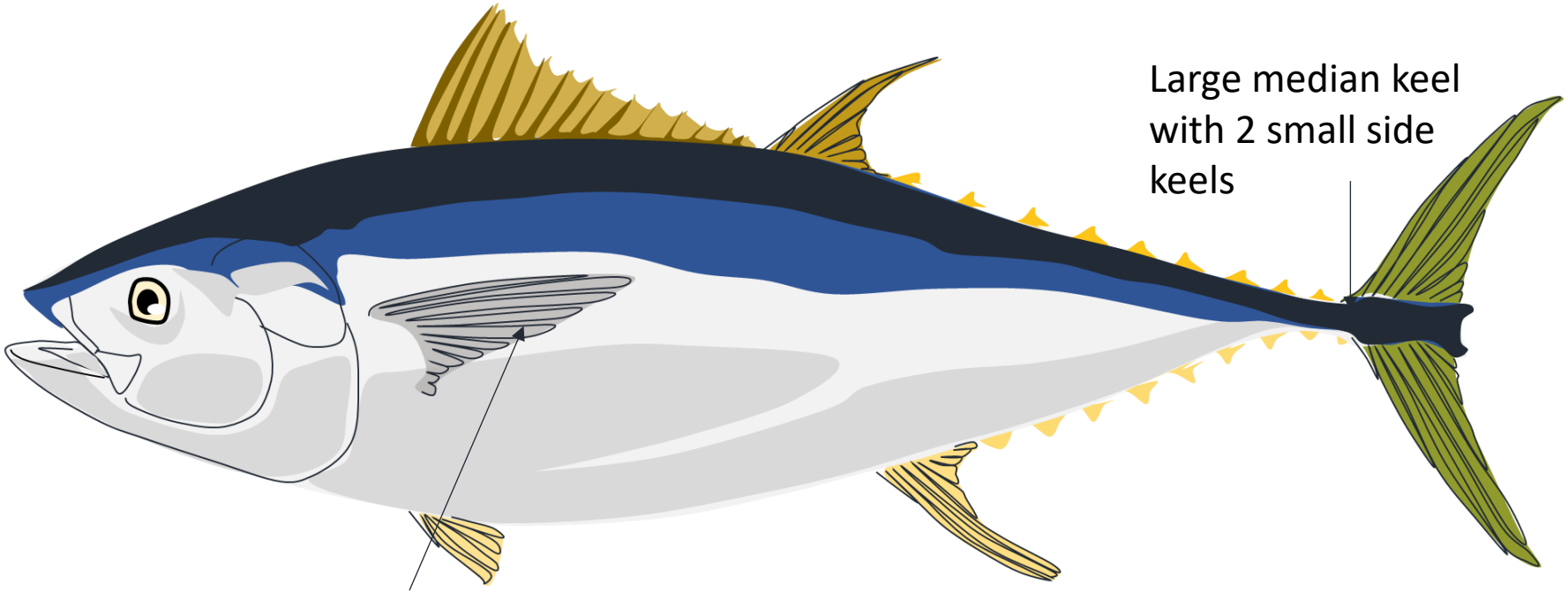
Lateral dash line present

Notched folk compared to bigeye

Thunnus orientalis

Max 300 cm FL,
Common up to 200

https://fishider.org/en/guide/osteichthyes/scombridae/thunnus/thunnus-orientalis



Thunnus obesus

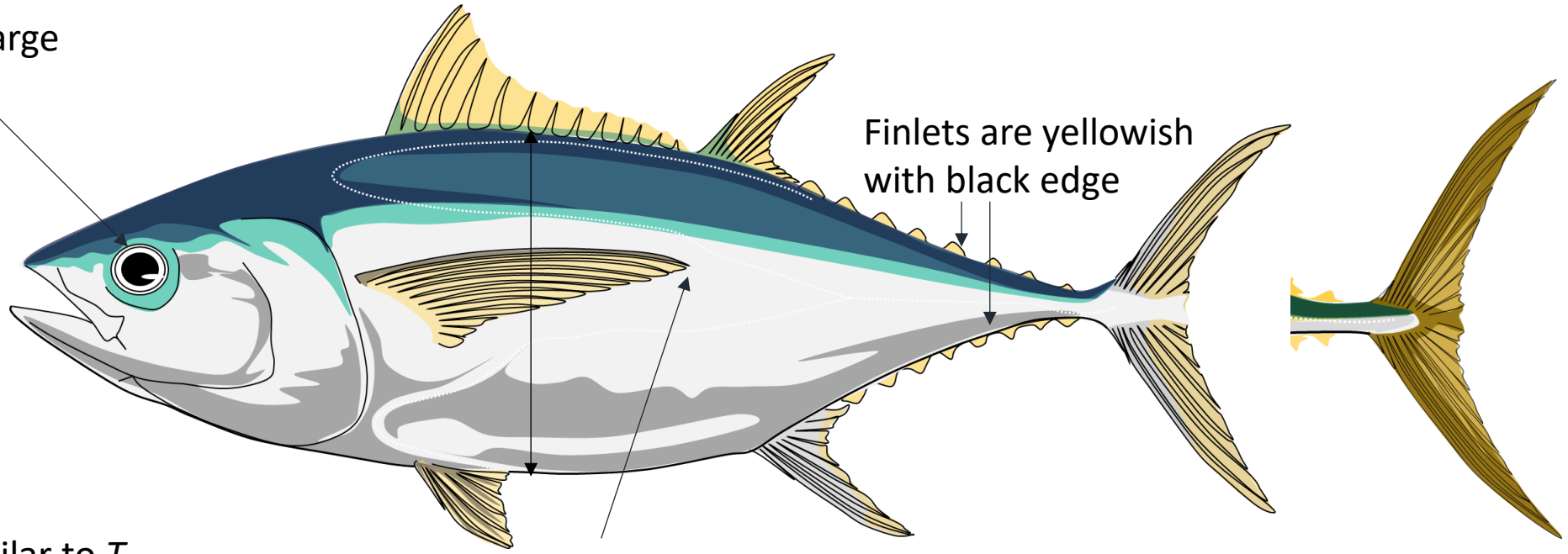
Max 250 cm FL,
Common 30-180

https://fishider.org/en/guide/osteichthyes/scombridae/thunnus/thunnus-obesus

Largest body depth

Eyes relatively large

Finlets are yellowish with black edge



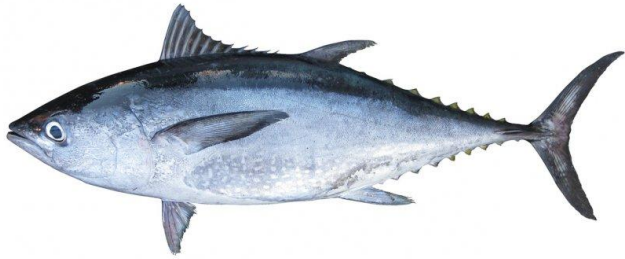
Juveniles are similar to *T. albacares* and *T. alalunga* as they are usually found in the same area

Pointy P1, longer beyond the anterior region of D2

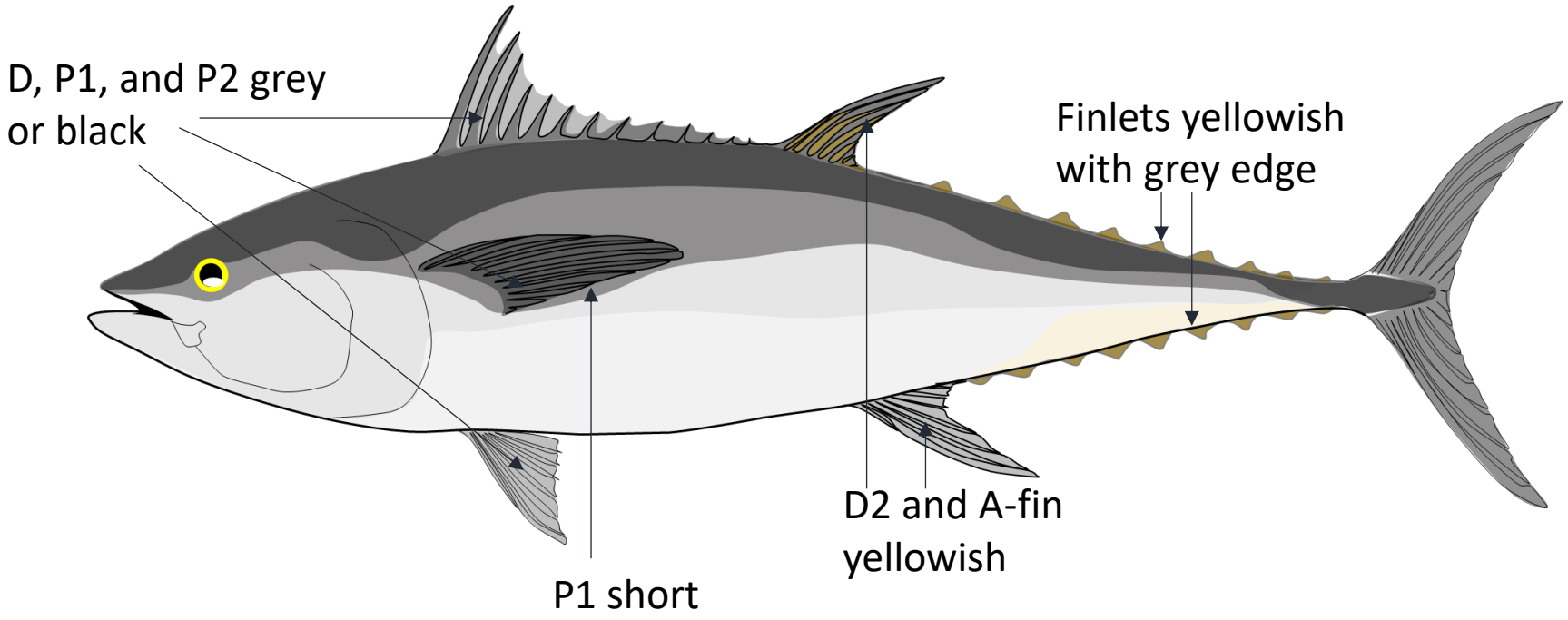
Smooth folk without a notch compared to yellowfin

Thunnus tonggol

Max 145 cm FL,
Common 40-70

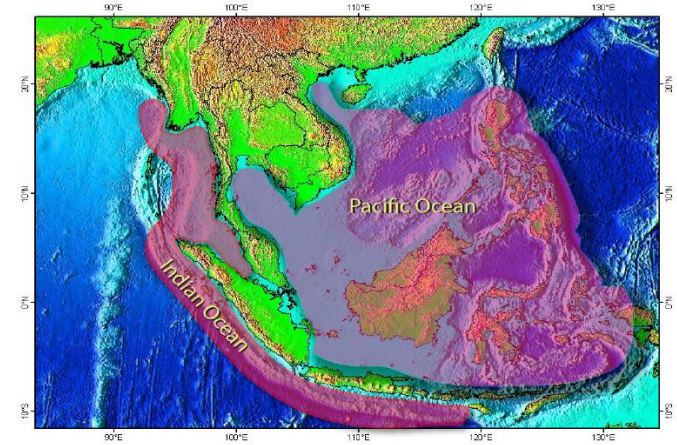


https://fishider.org/en/guide/osteichthyes/scombridae/thunnus/thunnus-tonggol

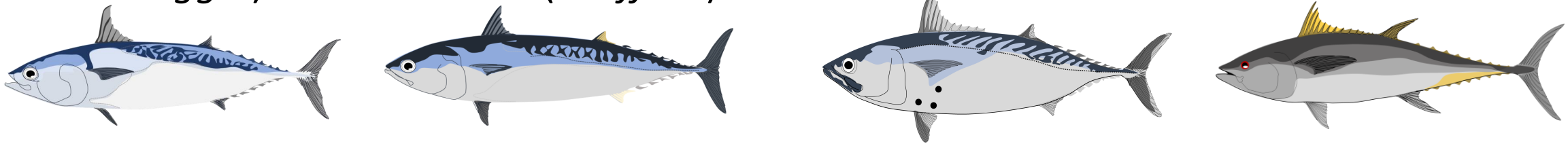


The Southeast Asian Important Tuna Groups

- The neritic tunas
  - A group of small tuna and tuna-like species
  - Migrate around coastal line of continent, highly migratory
  - Moderately-high economical value
  - Conducted the stock assessment in SEAFDEC area (the South China Sea (area 71) and the Andaman Sea (area 57))
  - Stock assessment focused mainly on longtail tuna (*T. tonggol*) and kawakawa (*E. affinis*)



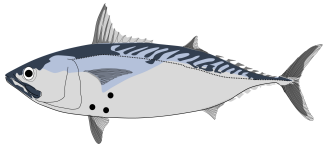
Map 1 Two areas (Pacific Ocean side and Indian Ocean side in the SE Asian waters) used for stock and risk assessments of KAW and LOT.

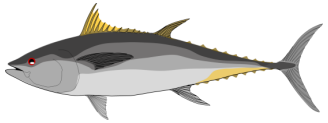


Auxis thazard *Auxis rochei* *Euthynnus affinis* *Thunnus tonggol*

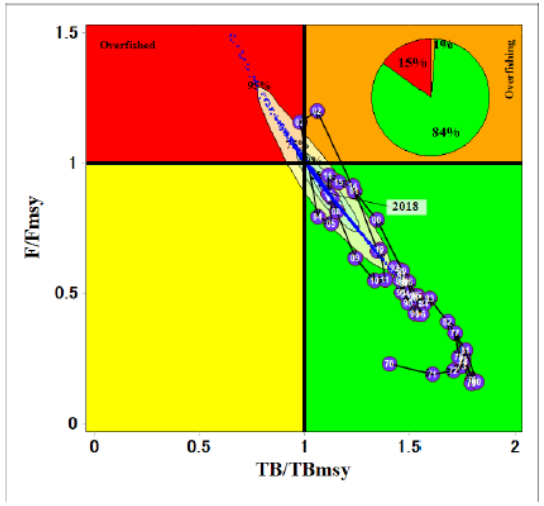
The Southeast Asian Important Tuna Groups

- The neritic tunas **(published in 2020)**
  - SEAFDEC stock assessment of the longtail (*T. tonggol*) and kawakawa (*E. affinis*)

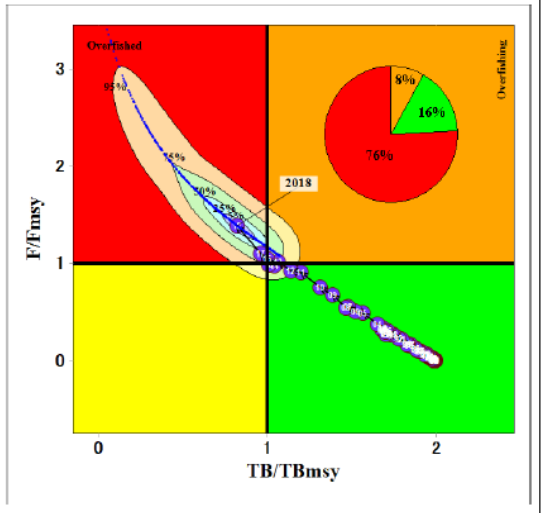




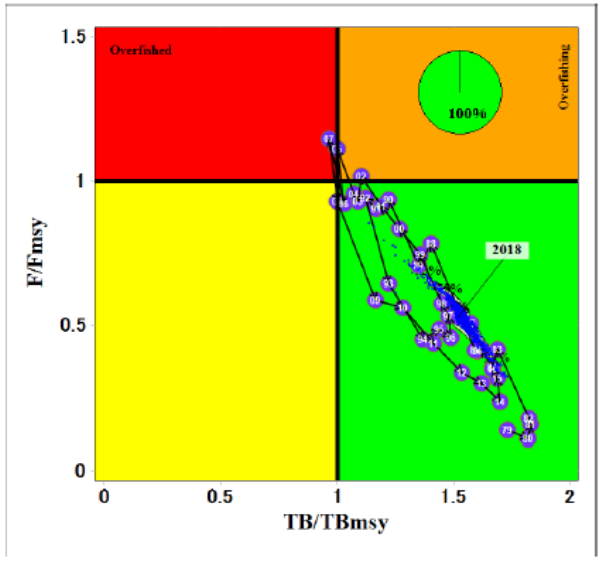
Kawakawa (Pacific Ocean side)
(TB/TBmsy, F/Fmsy) = (1.12, 0.88)
MSY=201, catch=205 and TAC=164



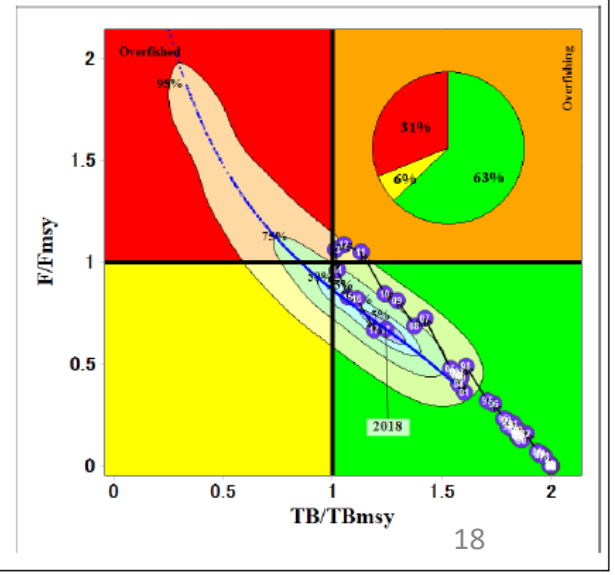
Kawakawa (Indian Ocean side)
(TB/TBmsy, F/Fmsy) = (0.82, 1.39)
MSY=56, catch=62 and TAC=25



Longtail tuna (Pacific Ocean side)
(TB/TBmsy, F/Fmsy) = (1.52, 0.53)
MSY=167, catch=124 and TAC=167



Longtail tuna (Indian Ocean side)
(TB/TBmsy, F/Fmsy) = (1.24, 0.67)
MSY=40, catch=33 and TAC=40



The Southeast Asian Important Tuna Groups

- The neritic tunas
  - IOTC stock assessment of kawakawa (*E. affinis*)

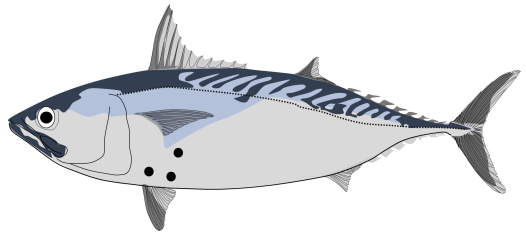
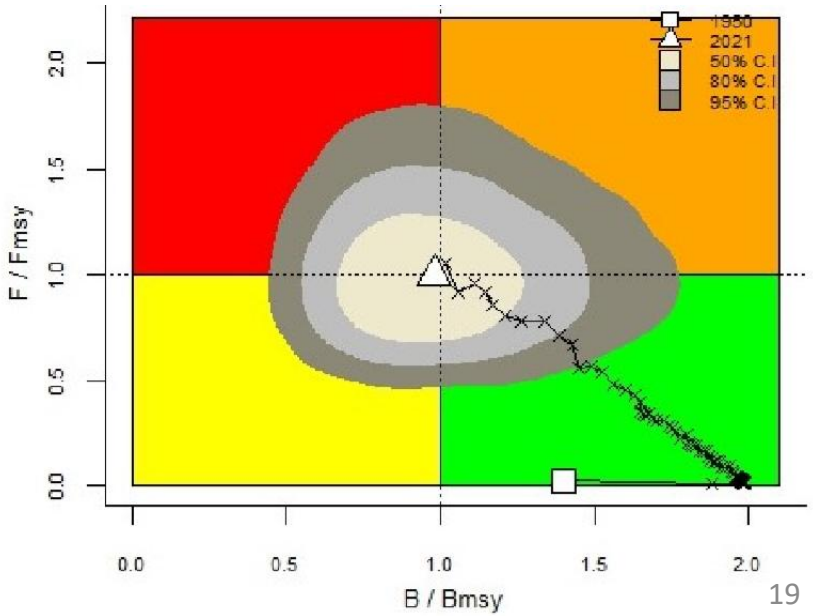


TABLE 1. Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch 2023[2] (t)	152,828	27%
	Mean annual catch 2019-2023 (t)	156,428	
	MSY (t) (80% CI)	154,000 (122,000 – 193,000)	
	F_{MSY} (80% CI)	0.60 (0.48 – 0.74)	
	B_{MSY} (t) (80% CI)	258,000 (185 – 359)	
	$F_{current}/F_{MSY}$ (80% CI)	0.98 (0.82–2.20)	
	$B_{current}/B_{MSY}$ (80% CI)	0.99 (0.45 – 1.20)	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2023: 67.6%;
[3]2021 is the final year that data were available for this assessment.



IOTC, 2024 (https://iotc.org/sites/default/files/content/Stock_status/2024/Engish/IOTC-2024-SC27-ES08_KAWE.pdf)

The Southeast Asian Important Tuna Groups

- The neritic tunas
  - IOTC stock assessment of longtail tuna (*T. tonggol*)

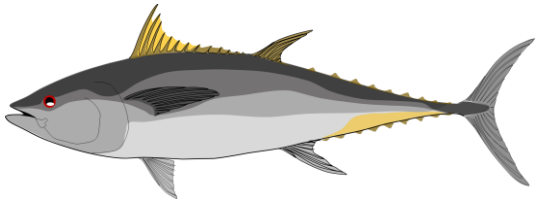
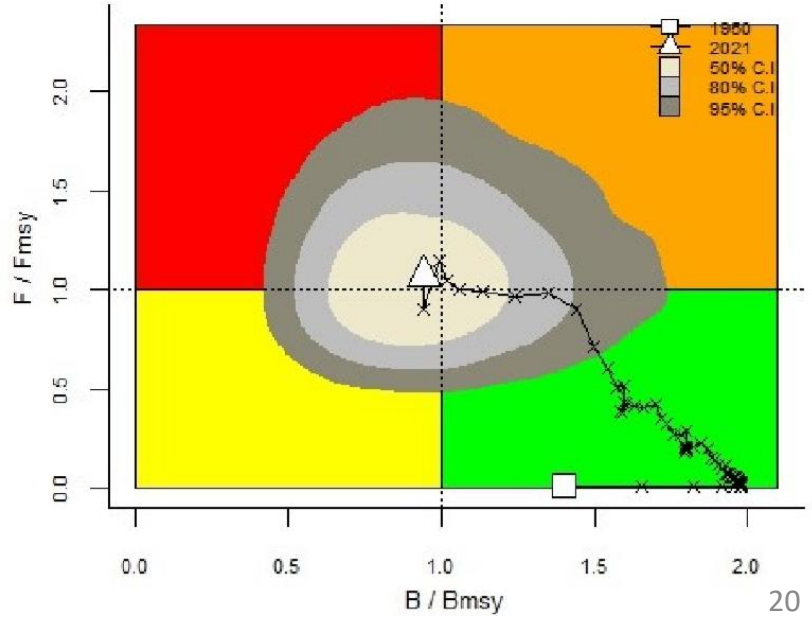


TABLE 1. Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch 2023[2] (t)	137,884	35%
	Mean annual catch (2019-2023) (t)	130,973	
	MSY (t) (80% CI)	133,000 (108000 –165000)	
	F_{MSY} (80% CI)	0.31 (0.22 – 0.44)	
	B_{MSY} (t) (80% CI)	433,000 (272,000 – 690,000)	
	$F_{current}/F_{MSY}$ (80% CI)	1.05 (0.84 – 2.31)	
	$B_{current}/B_{MSY}$ (80% CI)	0.96 (0.44 – 1.19)	

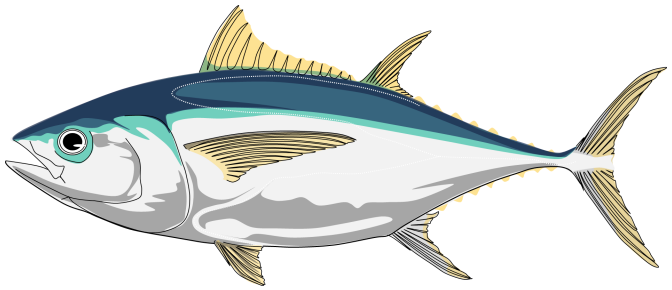
[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2023: 46%;
[3]2021 is the final year that data were available for this assessment



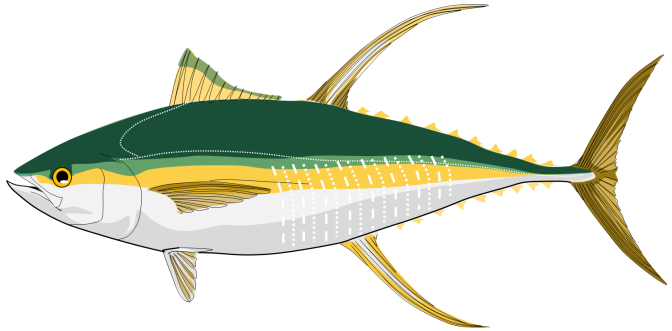
IOTC, 2024 (https://iotc.org/sites/default/files/content/Stock_status/2024/Engish/IOTC-2024-SC27-ES09_LOTE.pdf)

The Southeast Asian Important Tuna Groups

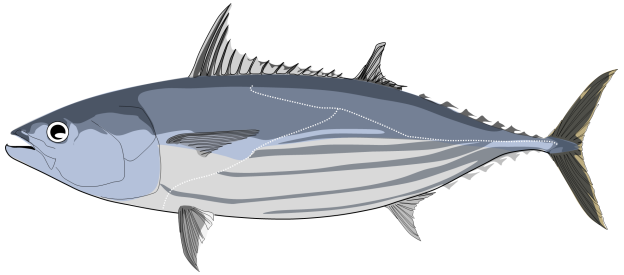
- The Sulu and Sulawesi Seas stocks of concern
  - A group of highly migratory tuna species
  - High market values
  - High fishing pressure on the stocks
  - Three species were concerned;



Thunnus obesus



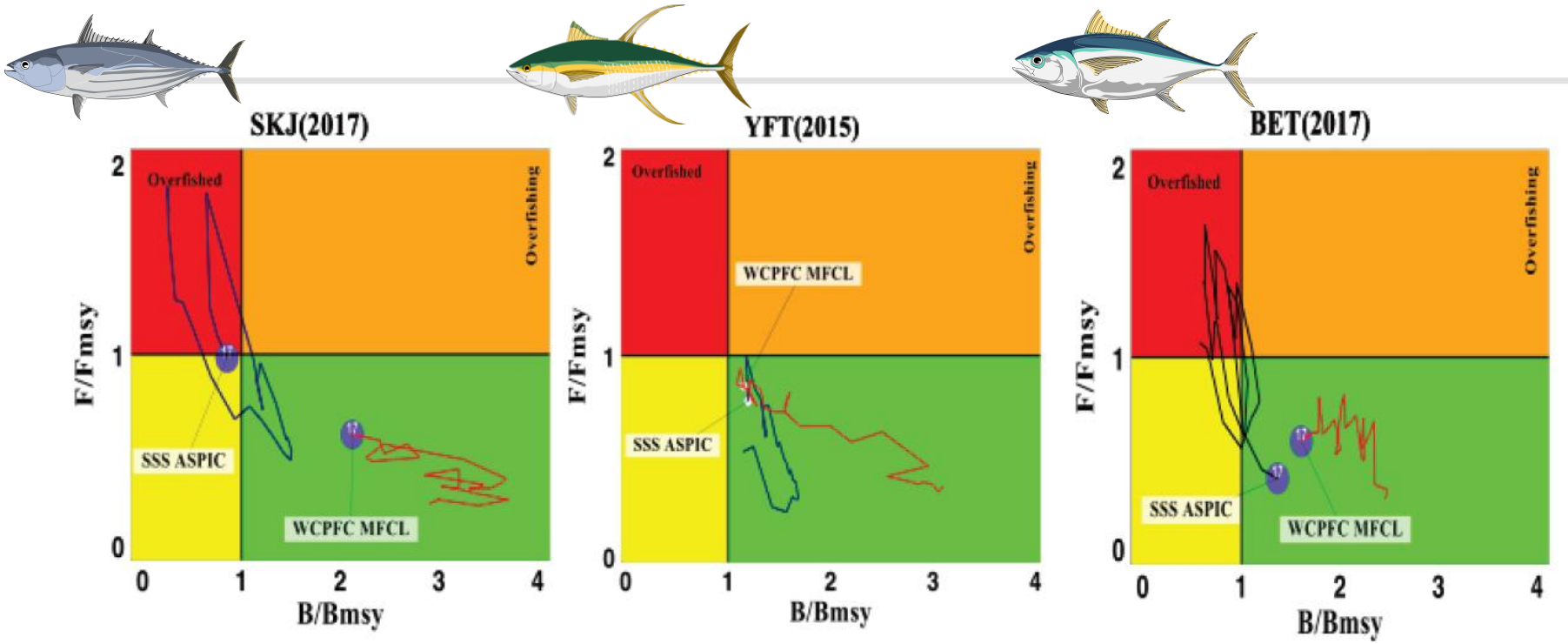
Thunnus albacares



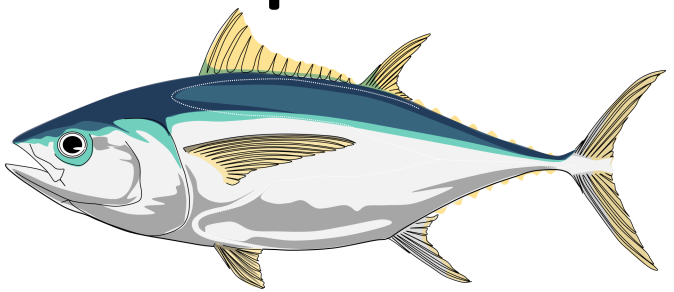
Katsuwonus pelamis

The Southeast Asian Important Tuna Groups

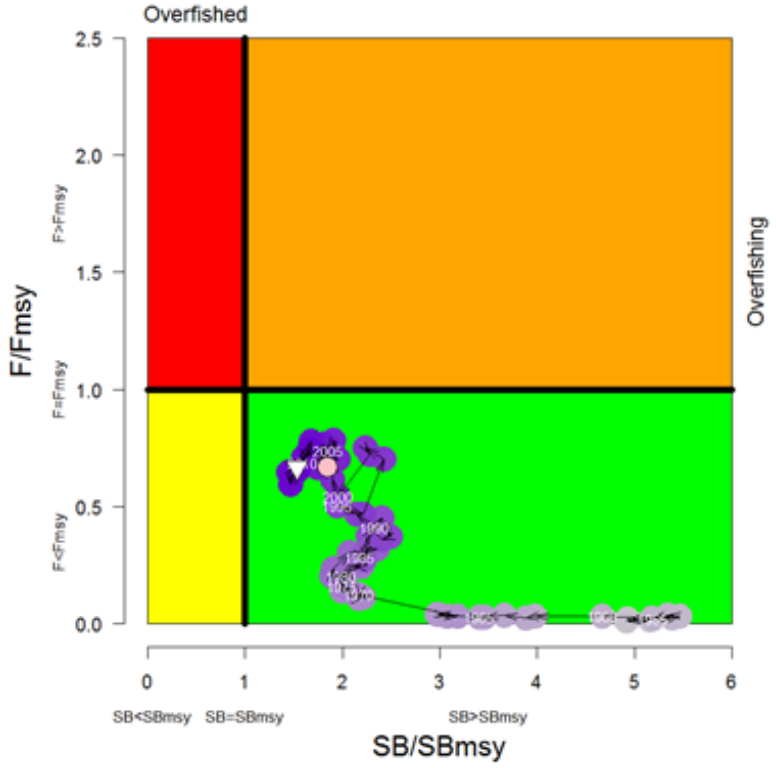
- The Sulu and Sulawesi Seas stocks of concern
  - SEAFDEC's SSSs WS **(results from 2015-2017)**



The Southeast Asian Important Tuna Groups



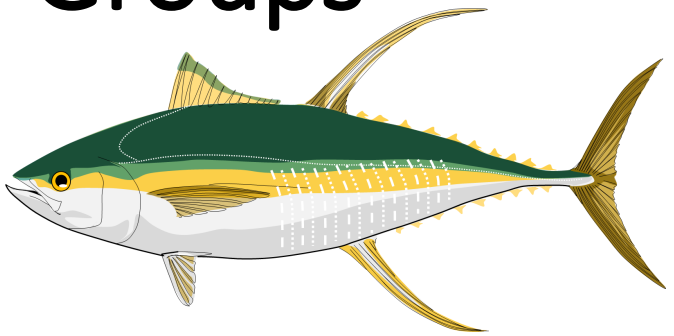
- The Sulu and Sulawesi Seas stocks of concern
  - Bigeye tuna (*Thunnus obesus*) WCPFC's SA



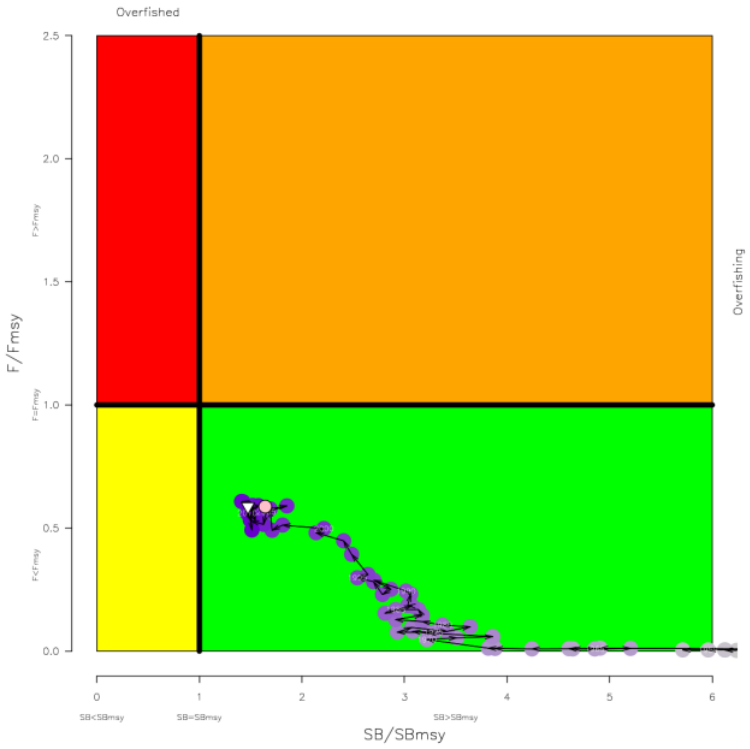
	Mean	Median	Min	10th %ile	90th %ile	Max
C_{latest}	149,178	153,137	130,903	131,597	156,113	157,725
MSY	156,765	158,040	124,120	137,644	180,656	204,040
$Y_{Frecent}$	150,382	148,920	118,000	133,400	168,656	187,240
F_{mult}	1.21	1.20	0.57	0.76	1.63	1.85
F_{MSY}	0.05	0.05	0.04	0.04	0.05	0.06
F_{recent}/F_{MSY}	0.89	0.83	0.54	0.61	1.32	1.76
SB_{MSY}	457,162	454,100	219,500	285,530	598,210	710,000
SB_0	1,730,410	1,763,000	1,009,000	1,279,300	2,148,200	2,509,000
SB_{MSY}/SB_0	0.26	0.26	0.22	0.24	0.29	0.29
$SB_{F=0}$	1,915,184	1,953,841	1,317,336	1,584,593	2,170,899	2,460,411
$SB_{MSY}/SB_{F=0}$	0.24	0.24	0.17	0.18	0.27	0.29
SB_{latest}/SB_0	0.37	0.40	0.11	0.19	0.49	0.53
$SB_{latest}/SB_{F=0}$	0.34	0.37	0.08	0.15	0.46	0.49
SB_{latest}/SB_{MSY}	1.42	1.45	0.42	0.86	1.97	2.12
$SB_{recent}/SB_{F=0}$	0.30	0.32	0.08	0.15	0.41	0.44
SB_{recent}/SB_{MSY}	1.21	1.23	0.32	0.63	1.66	1.86

WCPFC, 2024 (https://www.wcpfc.int/doc/01/bigeye-tuna)

The Southeast Asian Important Tuna Groups



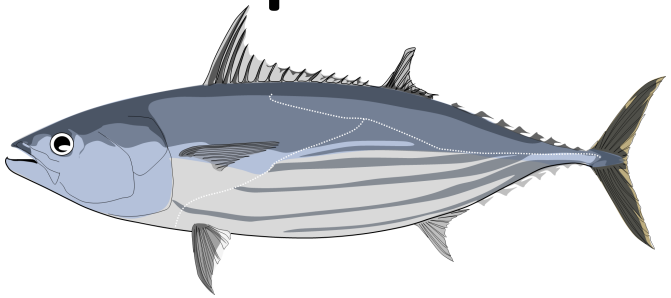
- The Sulu and Sulawesi Seas stocks of concern
  - Yellowfin tuna (*Thunnus albacares*) WCPFC's SA



	Mean	Median	Min	10th %ile	90th %ile	Max
C_{latest}	611,982	612,592	606,762	607,517	614,237	614,801
MSY	670,658	670,800	539,200	601,480	735,280	795,200
$Y_{Frecent}$	646,075	643,400	534,400	586,120	717,880	739,600
F_{mult}	1.34	1.36	0.88	1.03	1.61	1.86
F_{MSY}	0.12	0.12	0.07	0.10	0.14	0.16
F_{recent}/F_{MSY}	0.77	0.74	0.54	0.62	0.97	1.13
SB_{MSY}	544,762	581,400	186,800	253,320	786,260	946,800
SB_0	2,199,750	2,290,000	1,197,000	1,366,600	2,784,500	3,256,000
SB_{MSY}/SB_0	0.24	0.24	0.15	0.18	0.28	0.34
$SB_{F=0}$	2,083,477	2,178,220	1,193,336	1,351,946	2,643,390	2,845,244
$SB_{MSY}/SB_{F=0}$	0.25	0.26	0.16	0.19	0.30	0.35
SB_{latest}/SB_0	0.33	0.34	0.18	0.23	0.42	0.45
$SB_{latest}/SB_{F=0}$	0.35	0.37	0.16	0.22	0.46	0.50
SB_{latest}/SB_{MSY}	1.40	1.39	0.80	1.02	1.80	1.91
$SB_{recent}/SB_{F=0}$	0.32	0.33	0.15	0.20	0.41	0.46
SB_{recent}/SB_{MSY}	1.40	1.41	0.81	1.05	1.71	1.93

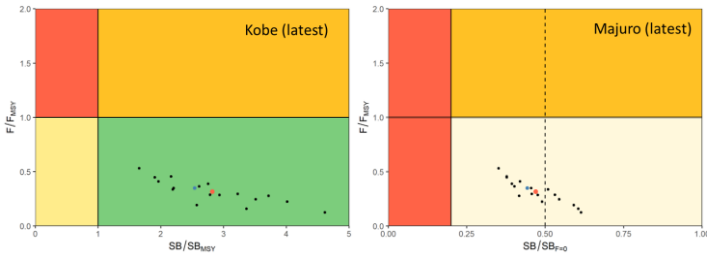
WCPFC, 2024 (https://www.wcpfc.int/doc/02/yellowfin-tuna)

The Southeast Asian Important Tuna Groups



- The Sulu and Sulawesi Seas stocks of concern
  - Skipjack tuna (*Katsuwonus pelamis*) WCPFC's SA

- All model scenarios suggested a relatively low chance of overfishing
- Therefore, no suggested management was applied to the stock via the Kobe Plot or the Majuro plot



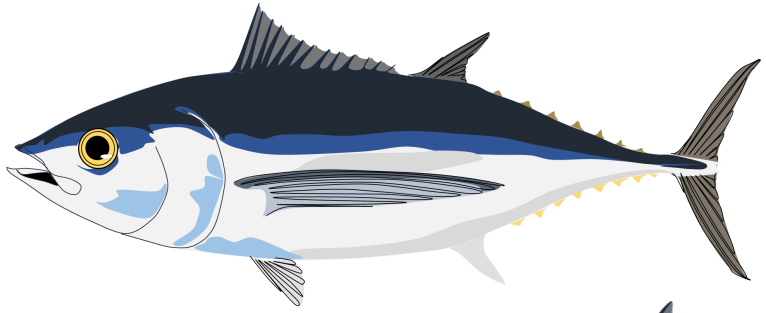
	Mean	Median	Minimum	10th %ile	90th %ile	Maximum
C_{latest}	1,755,328	1,755,693	1,749,846	1,753,471	1,757,057	1,757,083
$Y_{Frecent}$	1,877,914	1,864,040	1,679,600	1,737,702	2,043,556	2,135,200
f_{mult}	2.282	2.258	1.472	1.757	2.957	3.705
F_{MSY}	0.223	0.222	0.180	0.189	0.264	0.270
MSY	2,296,566	2,294,024	1,953,600	1,995,987	2,767,083	2,825,600
F_{recent}/F_{MSY}	0.461	0.447	0.270	0.343	0.600	0.679
$SB_{F=0}$	6,220,675	6,299,363	5,247,095	5,580,942	6,913,431	7,349,557
SB_{MSY}	1,100,947	1,064,400	631,900	723,742	1,544,060	1,688,000
$SB_{MSY}/SB_{F=0}$	0.175	0.176	0.117	0.131	0.225	0.23
$SB_{latest}/SB_{F=0}$	0.414	0.415	0.325	0.36	0.487	0.525
SB_{latest}/SB_{MSY}	2.468	2.382	1.551	1.779	3.356	3.925
$SB_{recent}/SB_{F=0}$	0.440	0.440	0.336	0.372	0.530	0.551
SB_{recent}/SB_{MSY}	2.623	2.579	1.601	1.892	3.613	4.139

WCPFC, 2023 (https://www.wcpfc.int/doc/03/skipjack-tuna)

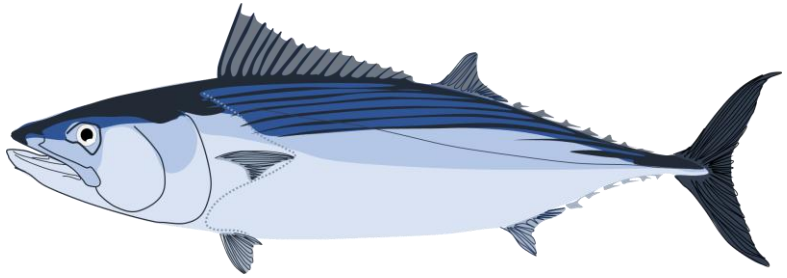
Conclusions

- There’s a diversity of Thunnini in the SEA, which causes difficulties in ID.
- The characteristics can be seen by various sources, including the shape of the liver; however, the characteristics that can be seen at first glance are the most important.
- The most important characteristics are: 1) body shape, size of P1, and size of D2 and A-fin.
- The stock status of them varies among regions; thus, it should be managed closely.

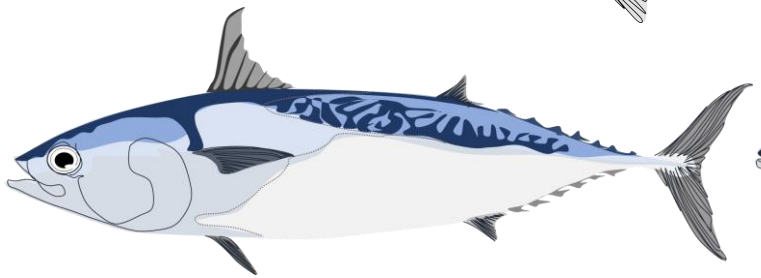
Thank you!!!



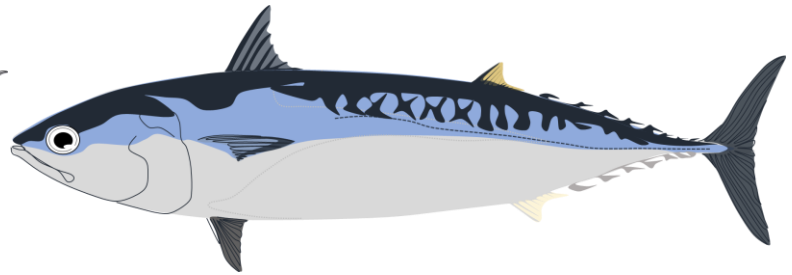
Thunnus alalunga



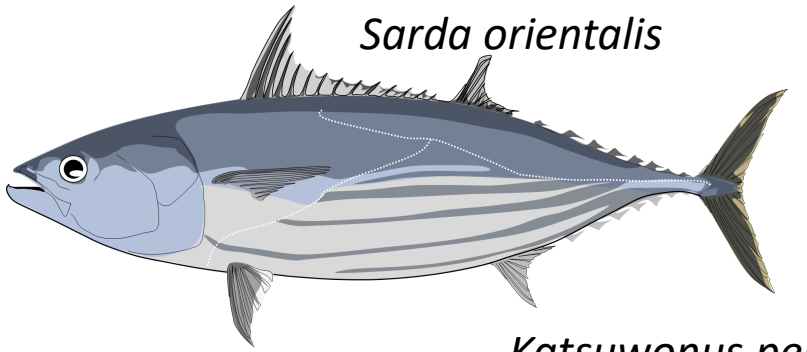
Sarda orientalis



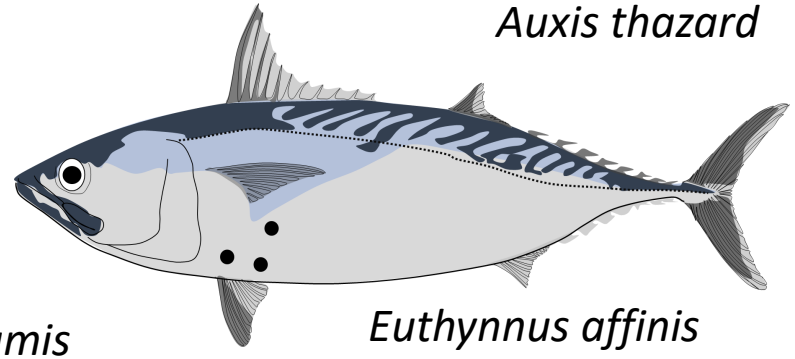
Auxis thazard



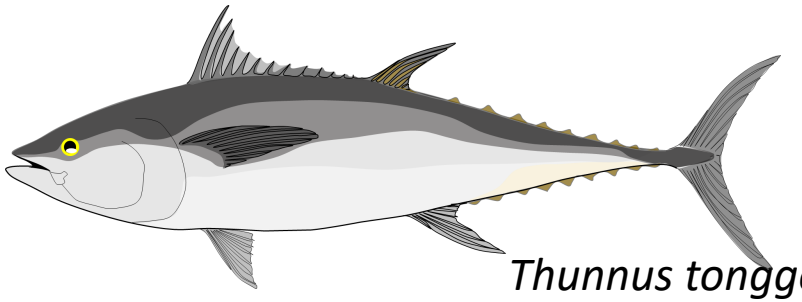
Auxis rochei



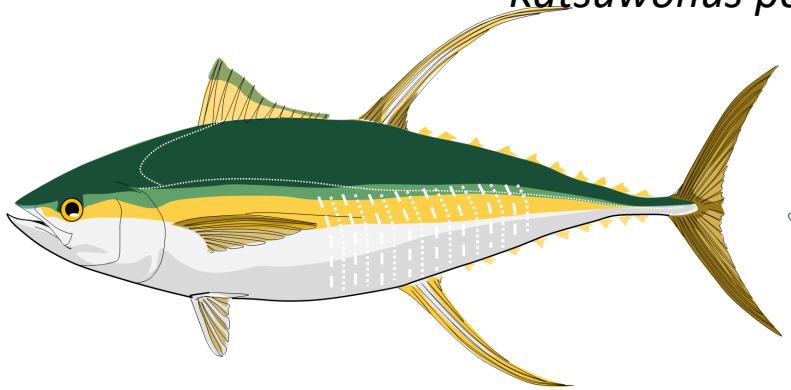
Katsuwonus pelamis



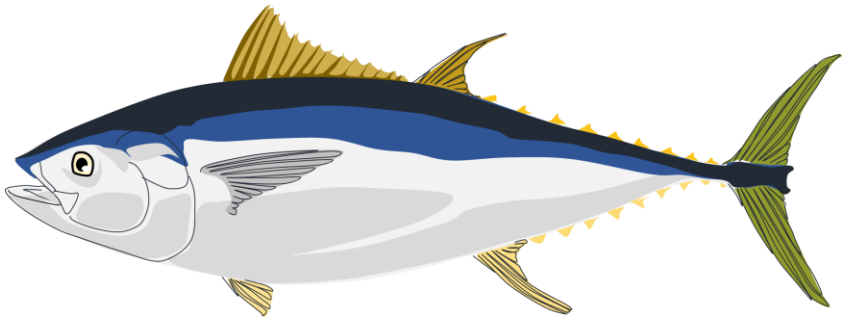
Euthynnus affinis



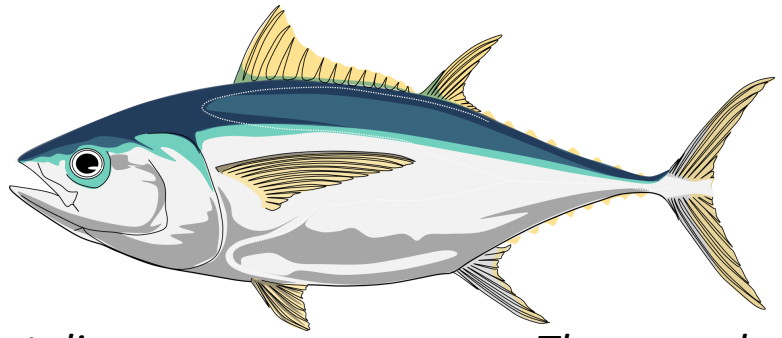
Thunnus tonggol



Thunnus albacares



Thunnus orientalis



Thunnus obesus