COLLABORATIVE RESEARCH SURVEY ON MARINE FISHERIES RESOURCES AND ENVIRONMENT IN THE GULF OF THAILAND 2018

AGE AND GROWTH OF BROWN BANDED BAMBOO SHARK (*Chiloscyllium punctatum*) IN THE GULF OF THAILAND FROM THE SURVEY ON BOARD M.V. SEAFDEC2 IN 2018

Presented by

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Outline

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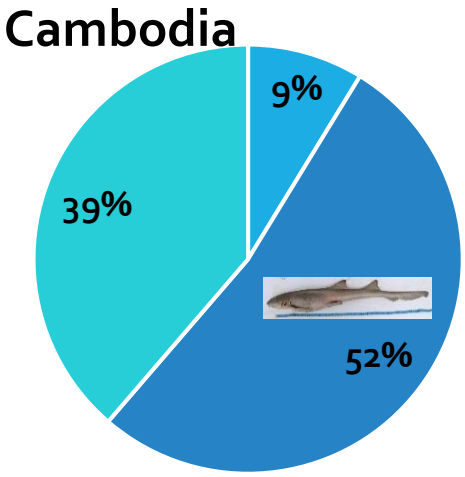
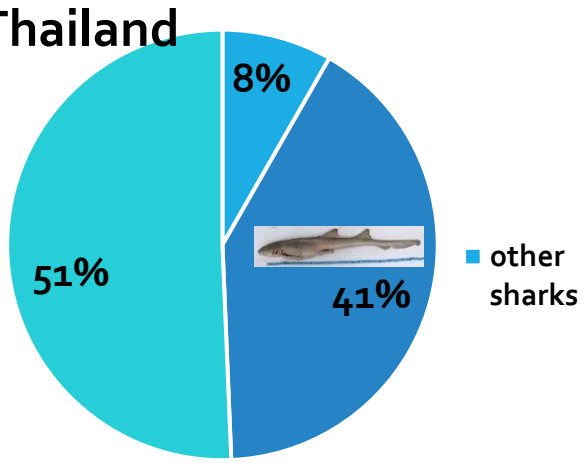
- 2. Objectives
- 3. Materials and Methods
- 4. Results
- 5. Discussions

Introduction

- Brown banded bamboo shark or grey carpet shark (*Chiloscyllium punctatum*) is the wide distribution benthic elasmobranch inhabitant in Southeast Asian waters, especially the Gulf of Thailand sub-region
- In the Gulf of Thailand *C. punctatum* provide high composition of catch in weight compared from other elasmobranch species (SEAFDEC, 2017)

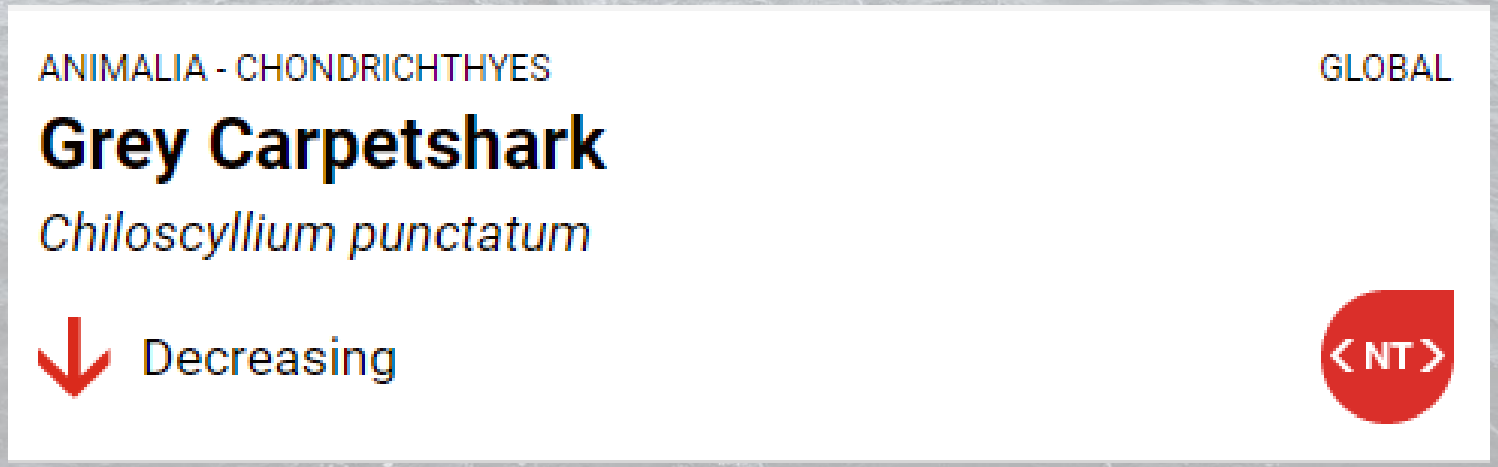
https://www.iucnredlist.org/species/41872/68616745





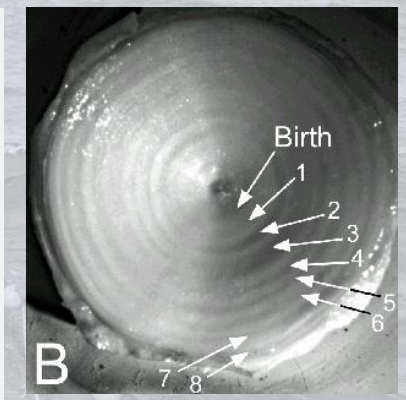
Introduction

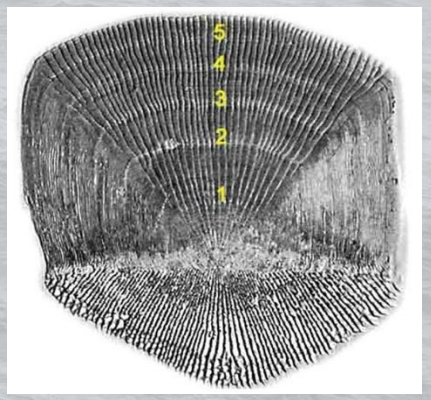
- The *C. punctatum* has been concerned to be declined regarding the decline of landing amount for a decade the current status announced by IUCN red list is **Near Threatened**
- However, the proper stock assessment has not been conduct yet regarding to **limited information** for this species (Dudgeon *et al.*, 2016)

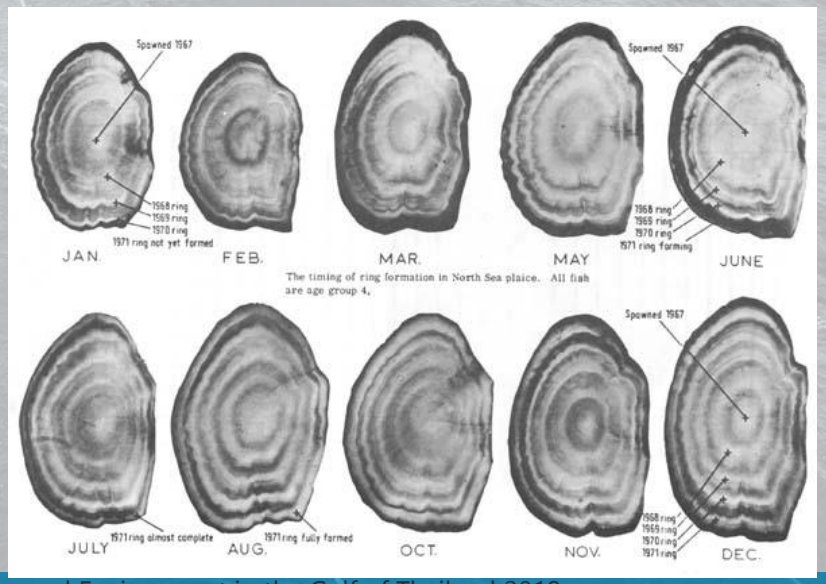


Introduction

- The classical method used for growth parameters estimation is age determination using hard part such as scale, otolith, and vertebrae for vertebrate (Holden and Raitt, 1974)
- For elasmobranches, the absent of otolith causing the challenge for researchers in order to using vertebrae instead
- which the precision of age determination will affect by true age and size of specimen (Campana, 2014; Lechuga *et al.*, 2019)





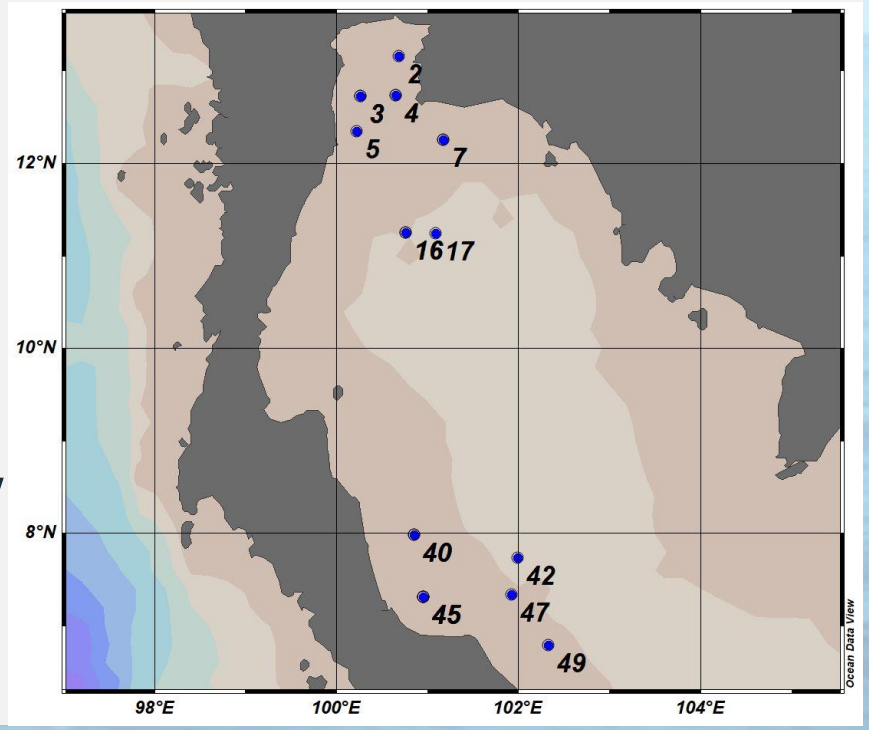


Objectives

- To determine the length-weight relationship of *C. punctatum* in the Gulf of Thailand
- To determine age and growth of *C. punctatum* in the Gulf of Thailand
- To observe the distribution pattern by age of *C. punctatum* in the Gulf of Thailand

Materials and Methods

- Study area
  - M.V. SEAFDEC 2 cruise survey during August – October 2018
  - The specimen collected from 12 stations (station 2 – 7, 16, 17, 40, 42, 45, 47 and 49



- Specimen will be preserved in vessel's freezing chamber and will be cleaning in laboratory
- Species will be identified and measured for total length and individual weight regarding to SEAFDEC's shark SOP (Ali *et al.*, 2017)

Materials and Methods

- The length-weight relationship (Ricker, 1975)

$$W = qL^b$$

where W = individual weight
q = constant
L = total length
b = growth parameter constant

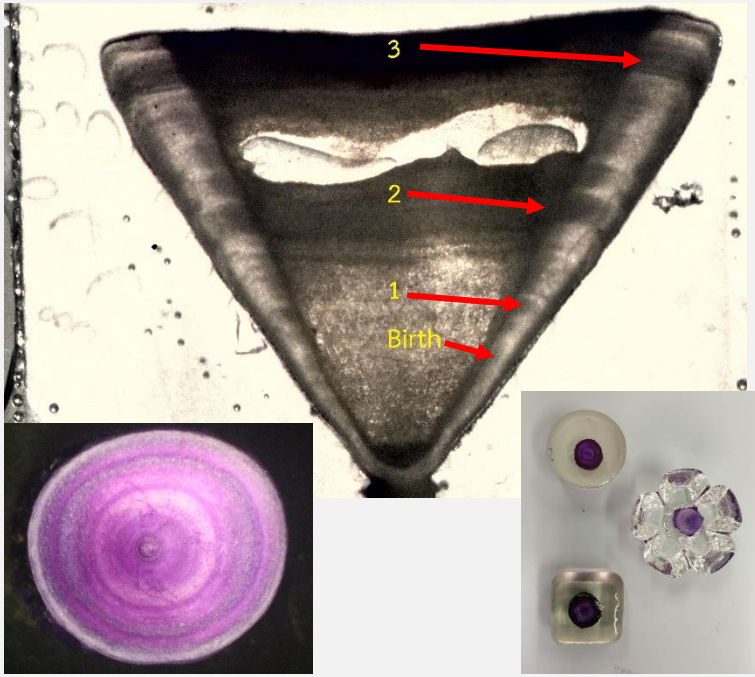
- The condition index

$$C.I. = \frac{W}{CL^n}$$

where $C.I.$ = condition index
W = individual weight
CL^n = estimated weight from Ricker's equation

Materials and Methods

- The 1st – 16th vertebrae will be extracted from specimen
- Vertebrae were soaked in 4 – 6% NaClO for 16 – 75 minutes depend on size of vertebrae, watch by distyle water and dry in room temperature for 3 – 12 hours
- Vertebrae will be dyed in gentian violet and embedded in resin (Başusta *et al*., 2017; Houlihan *et al*., 2017)
- Embedded vertebrae were cut according to Macdonnell *et al*. (2017)
- Annual ring reading under stereo microscope using 3 readers (Campana, 2014)



Materials and Methods

- Coefficient of variation of annual ring from 3 readers

$$C.V. = \frac{S.D.}{\bar{X}} \times 100$$

where	$C.V$	=	coefficient of variation
	$S.D.$	=	standard deviation
	$\bar{X}$	=	average of age reading from 3 readers

Materials and Methods

- The von Bertalanffy's growth equation

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

where
- L_t = length at age t
- L_∞ = average maximum length
- K = growth rate
- t = age of individual
- t_0 = age at length o

- The Ford-Walford age determination

$$L_{t+1} = a + bL_t$$

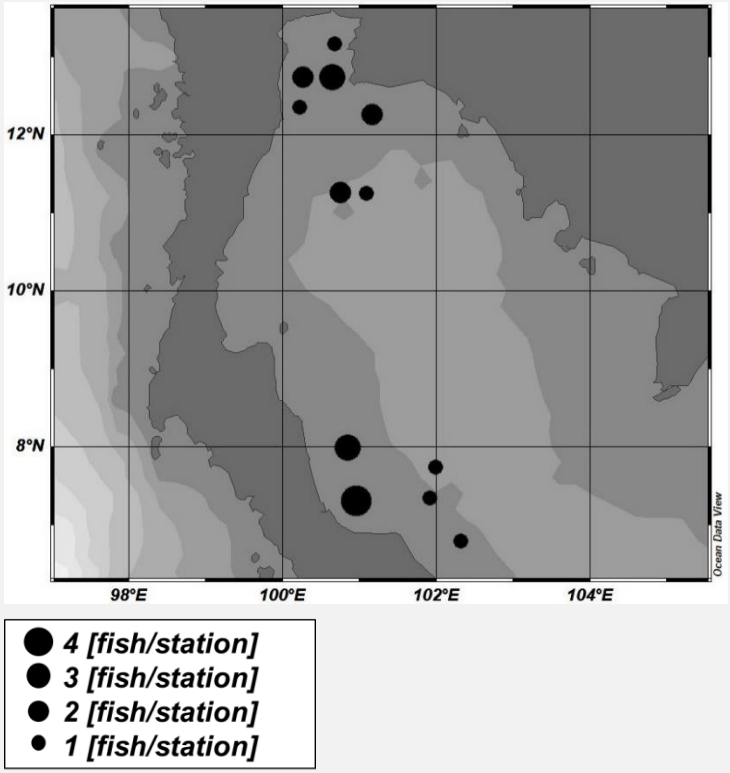
$$L_\infty = \frac{a}{1-b}$$

$$K = -\ln(b)$$

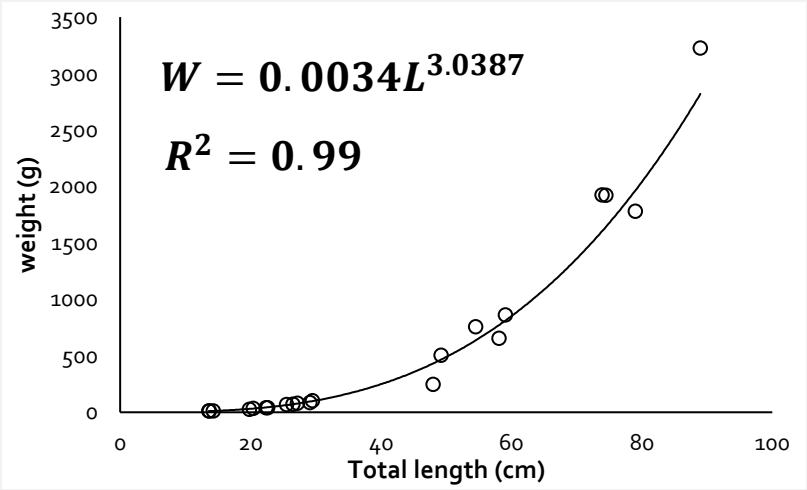
where
- L_{t+1} = length at age t+1
- a = Y-intercept of regression line
- b = slope of regression line
- L_t = length at age t

Results

- The distribution of *C. punatctum*



- The length-weight relationship of *C. punatctum*



- $2.91 \leq b \leq 3.17$
- Significant isometric growth pattern (p-value: <0.001)
- Condition factor 0.56 – 1.19

Results

- Age determination from vertebral annual ring

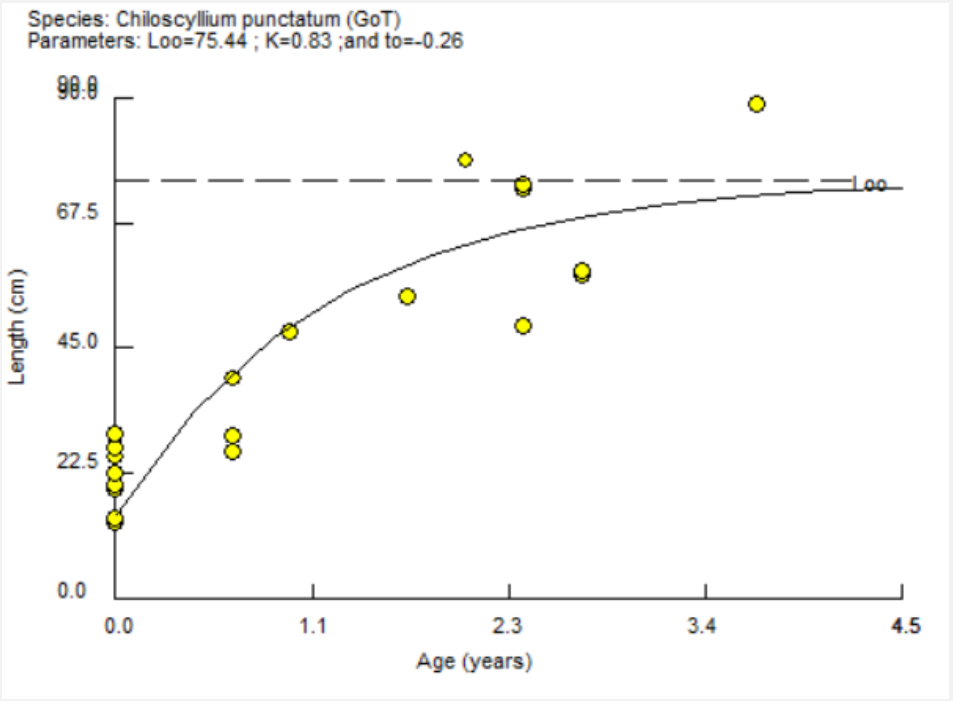
Sample No.	TL (cm)	W (g)	Reading Age (year)			Average Age (year)	Mode	CV	CI
			Reader 1	Reader 2	Reader 3				
1	13.6	11	0	0	0	0	0	0	1.163
2	13.7	11	0	0	0	0	0	0	1.137
3	14.3	11	0	0	0	0	0	0	0.998
4	19.8	26	0	0	0	0	0	0	0.878
5	20.4	34	0	0	0	0	0	0	1.048
6	22.4	40	0	0	0	0	0	0	0.928
7	22.6	39	0	0	0	0	0	0	0.881
8	25.5	67	0	0	0	0	0	0	1.048
9	26.5	69	1	0	1	0.667	1	61.2	0.96
10	27.2	80	0	0	0	0	0	0	1.029
11	29.1	85	1	1	0	0.667	1	61.2	0.89
12	29.5	100	0	0	0	0	0	0	1.005
13	39.7	258	1	1	0	0.667	1	61.2	1.052
14	48	245	1	1	1	1	1	0	0.561
15	49.2	503	2	2	3	2.333	2	17.5	1.068
16	54.5	756	2	1	2	1.667	2	24.5	1.177
17	58.1	654	2	2	4	2.667	2	30.6	0.838
18	59.1	860	2	2	4	2.667	2	30.6	1.046
19	73.9	1926	3	2	2	2.333	2	22.1	1.188
20	74.5	1921	3	2	2	2.333	2	22.1	1.156
21	79	1780	3	2	1	2	-	41.8	0.897
22	89	3226	4	3	4	3.667	4	11.1	1.131
Average								17.5	1.004

Results

- von Bertalanffy's growth parameters estimation
  - t_0 input as -0.26 year (Sukwan and Boonyanet, 2001)

$$L_t = 75.44(1 - e^{-0.83(t+0.26)})$$

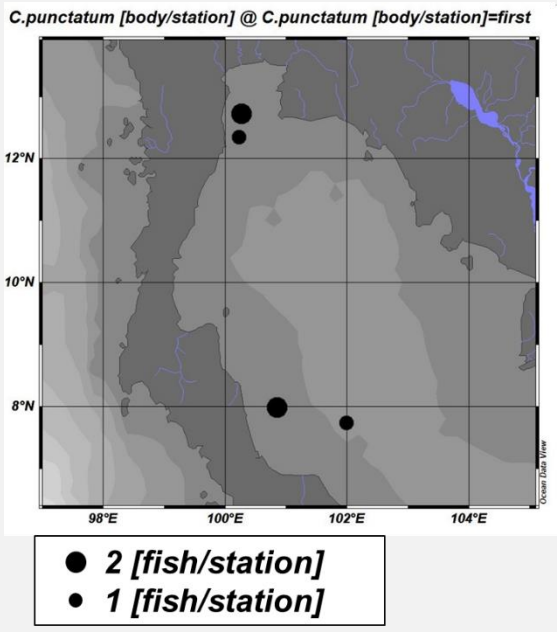
Parameters	Result
L_∞	75.44 cm
K	0.83 /year
t_0	-0.26 year



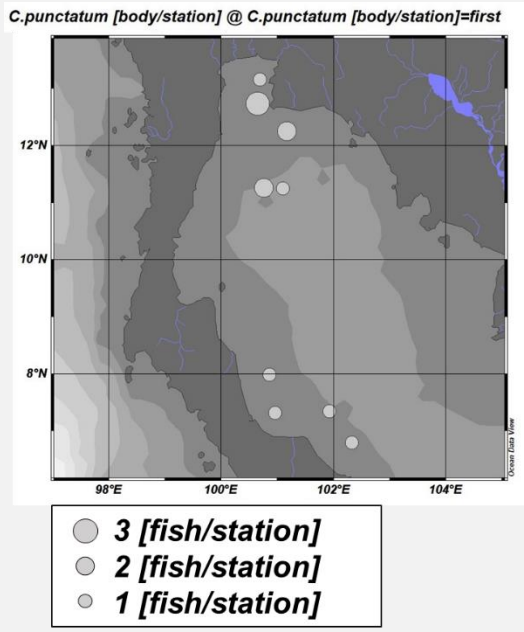
Results

- The distribution pattern of *C. punctatum*
- By condition factor

- ***C.I.* ≤ 1 (black)**
  - 13 sharks
  - C.I. between 0.561 – 0.998



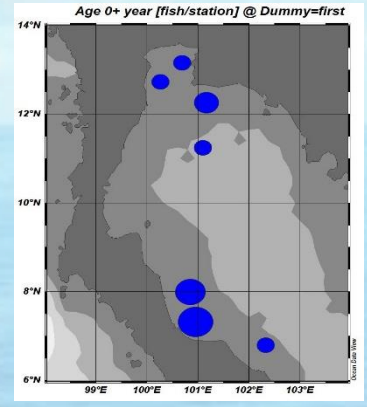
- ***C.I.* ≥ 1 (grey)**
  - 9 sharks
  - C.I. between 1.005 – 1.188

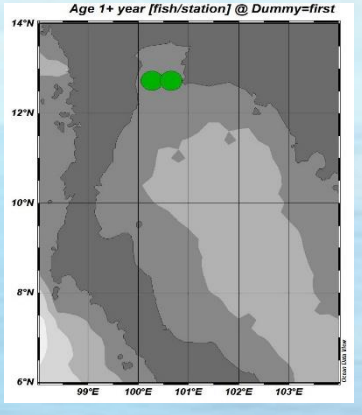


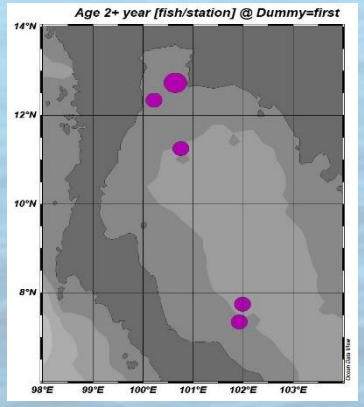
Sample No.	TL (cm)	CI
1	13.6	1.163
2	13.7	1.137
3	14.3	0.998
4	19.8	0.878
5	20.4	1.048
6	22.4	0.928
7	22.6	0.881
8	25.5	1.048
9	26.5	0.96
10	27.2	1.029
11	29.1	0.89
12	29.5	1.005
13	39.7	1.052
14	48	0.561
15	49.2	1.068
16	54.5	1.177
17	58.1	0.838
18	59.1	1.046
19	73.9	1.188
20	74.5	1.156
21	79	0.897
22	89	1.131
Average		1.004

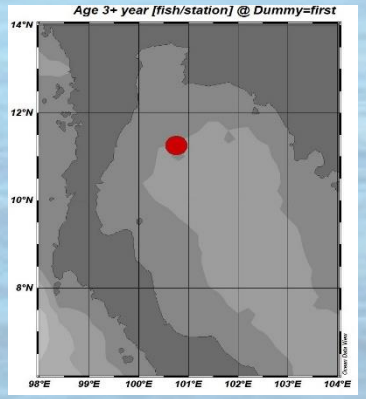
Results

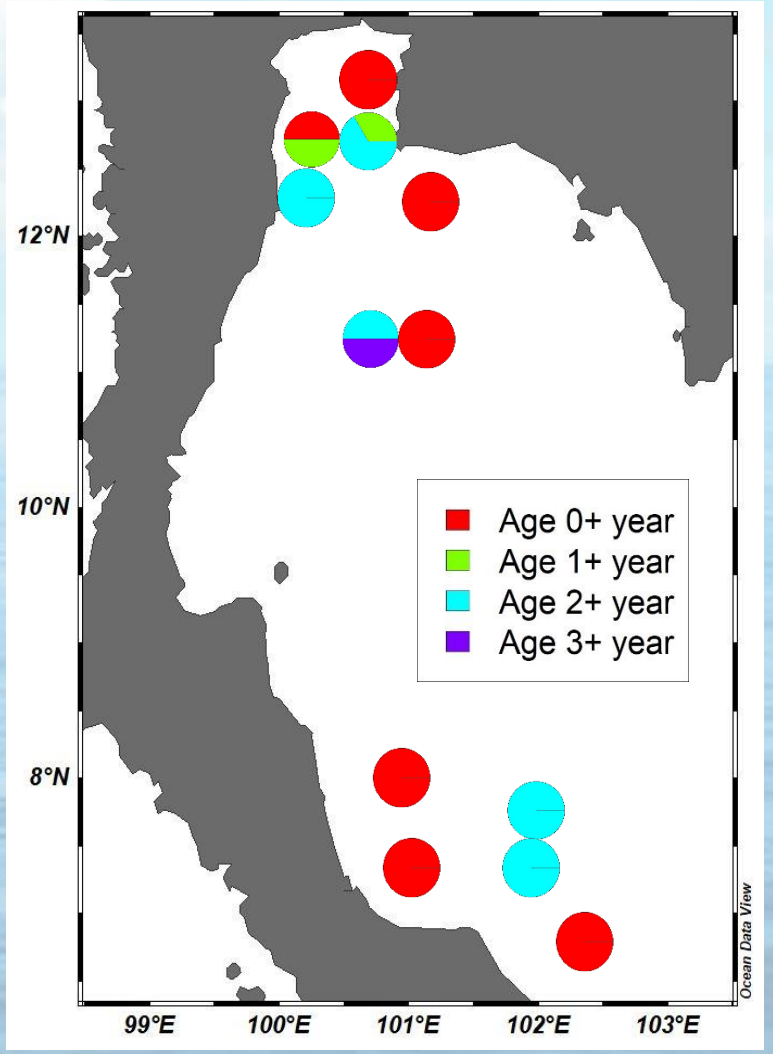
- The distribution pattern of *C. punctatum*
- By Age









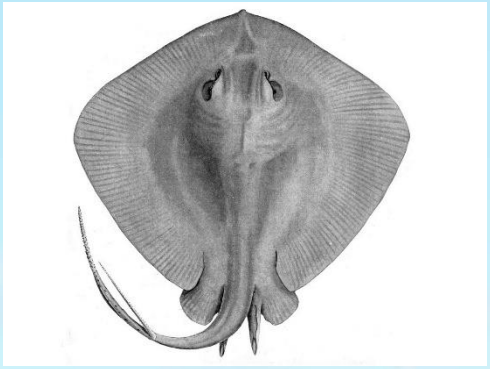


Discussions

- The regression value, *b*, provide the isometric growth pattern at 2.5< b<3.5 (Froese, 2006; Ricker, 1975)
- The growth pattern of *C. punctatum* from this study confirmed to be isometric

- The individual inhabit near estuarine and shoreline show higher Condition Index (*C.I.*) compared to those inhabit farer in the sea
- The study from related species (*C. griseum* and *C. hasseltii*) 2.5 – 4.5 which show the carnivorous behavior which feed on invertebrates, crustacean, cephalopods and teleost (Nur-Farhana *et al.*, 2013)
- The further study on biomass of estuarine should be considered to confirm this hypothesis

Discussions



- The distribution pattern study with age show that the younger individual more likely to inhabit near estuarine or shoreline compared to older individual
- This migratory pattern also presented in other benthic elasmobranch species (Babel, 1967; Otake, 2007)
- The age determination show that the maximum age from this study was approximately 4 years. However, the estimated longevity of *C. punctatum* can reach to 9 – 10 years (Dudgeon et al., 2016)
- The results might related to the migration behavior of older individual into deeper area

Discussions

- The growth parameters information for *C. punctatum* was limited, mostly derived from captive specimen (Dudgeon *et al.*, 2016)
- The L_∞ in this study shown the average maximum length estimated from specimen used
- The involving of larger specimen required in further study

Discussions

- Ali and Lim Pek Khiok (2012) and Dharmadi et al. (2015) report the size at first maturity of *C. punctatum* at 65 – 75 cm TL and
- Chen *et al.* (2007) and Dudgeon *et al.* (2016) report the age at first maturity at 4 years, approximately
- Therefore, this study confirm that the *C. punctatum* age between 2 – 4 years old can reach the size of maturity

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