

UKURAN TUBUH & PRODUKTIVITAS

Suhardi, S.Pt., MP., Ph.D



PERTUMBUHAN

Masalah pertumbuhan perlu difahami, mengingat bahwa semua input teknologi baik rekayasa genetika, maupun rekayasa lingkungan harus mengacu pada pemahaman bahwa pertumbuhan ternak memiliki keterbatasan yang sifatnya dikendalikan oleh genetik.

Perbanyak sel (cell multiplication);
Pembesaran sel (cell enlargement); dan
Penambahan materi yang diambil dari lingkungan.



Dimulai pada saat terjadinya pembuahan
Proses hyperplasia (peningkatan jumlah sel)
Proses hypertrophy (peningkatan ukuran sel)

Periode pertumbuhan Prenatal
Periode pertumbuhan Postnatal

—GROWTH



Indikator untuk mengetahui potensi pertumbuhan ternak dapat diukur dari angka presentase growth :

$$\text{GROWTH RATE} = \frac{\text{GAIN (PBB)}}{\text{BERAT HIDUP}} \times 100\%$$

GROWTH RATE

Umumnya growth rate akan menurun sesuai perkembangan umur dan bobot badan

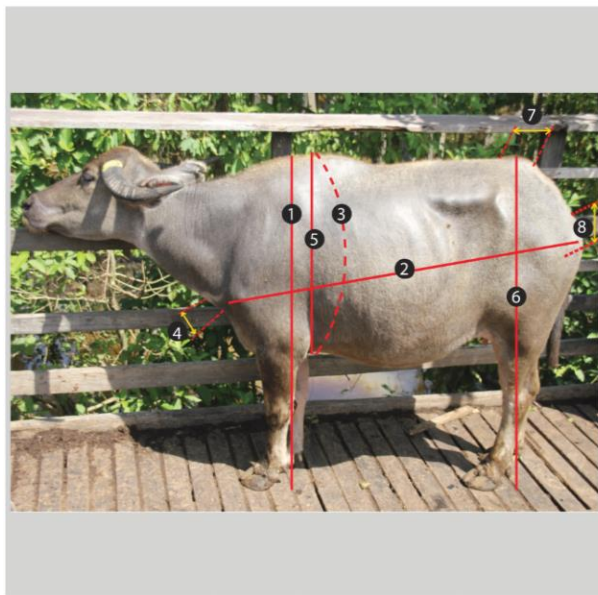


MORFOMETRIK

Morfometrik adalah suatu metode pengukuran bentuk-bentuk luar tubuh yang dijadikan sebagai dasar membandingkan ukuran ternak, seperti lebar, panjang standar, tinggi badan dan lain-lain..

Quantitative Characterization

The morphometric/body size measurement method based on Amano et al. (1981) modified.



Morphometric Variables and Methods of Measuring

Note:

1. Wither Height
2. Body Length
3. Heart Girth
4. Shoulder Width
5. Chest Depth
6. Rump Height
7. Rump Width
8. Rump Length



SUHARDI
60311271

School of Agricultural Technology
Walailak University

Parameters

- 1) Wither height; 2) Body length; 3) Heart girth; 4) Shoulder width; 5) Chest depth; 6) Rump height; 7) Rump width; 8) Rump length and 9) Bodyweight estimation.

Wither height

The highest distance of the shoulder through the spine of scapula perpendicular to the soil, measured by a measuring stick.

Body length

A straight line from the edge of the spinous process bone to the layer of the bone lump (*os ischium*), measured by a measuring stick.

Heart girth

A circularly on the frontmost rib located on the back of the front leg, measured by wrapping a measuring tape on the body of the chest area.

Shoulder width

The distance between the left and right shoulder joints (*os scapula*), measured by a measuring stick.

Chest depth

The distance between the highest point of the shoulder and breastbone, measured by a measuring stick.

Rump height

The highest distance of the hip perpendicular to the ground, measured by a measuring stick.

Rump width

Measured with a measuring stick as the width of the distance between the pelvis (*os coxae*).

Rump length

Measured with a measuring stick as the length of the distance between the two hip joints (*os ischium*).

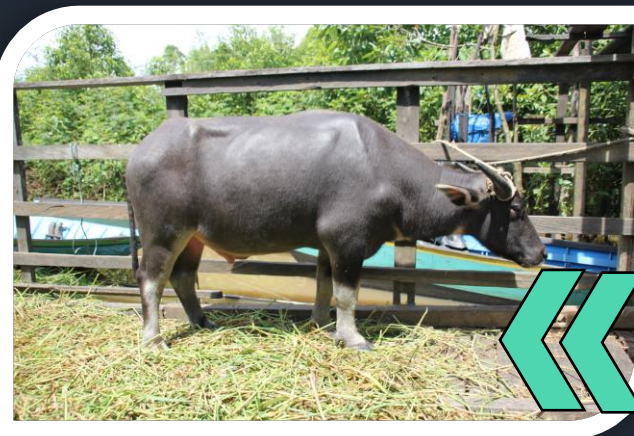
Bodyweight (BW)

Calculated by the following formula, based on heart girth (HG) and rump height (RH) (Galib et al., 2017):

$$BW \text{ (male)} = 3.6435 (HG) + 0.1208(RH) - 265.43$$

$$BW \text{ (female)} = 4.1783 (HG) - 0.3086 (RH) - 305.19$$

References	Quantitative				Qualitative			
	Body Length	Heart Girth	Wither Height	Body Weight	Skin color	Horns pattern	Chevron	Foot color
Gerli et al., 2012	148.33±7.64	203.00±6.56	138.67±4.04	474.20±73.06	-	-	-	-
Araújo de Melo et al., 2018	162.00±5.89	223.00±4.02	148.00±3.87	465.35±63.88	-	-	-	-
Sahu et al., 2017	136.31±1.18	181.68±1.55	141.16±0.92	440.33±28.71	-	-	-	-
Rahman et al., 2015	121.88±5.15	196.50±6.02	118.20±3.16	447.83±42.27	Dark grey	Pampang	Double	Black
Kocaman et al., 2017	159.00±5.89	223.00±9.55	148.50±5.08	596.00±60.31	-	-	-	-
Çelikeloglu et al., 2019	101.75±0.23	120.55±0.32	106.07±0.09	182.24±10.39	-	-	-	-
Krisnandi et al., 2016	112.47± 3.56	163.80±3.55	113.80± 2.20	280.70±18.49	Grey	Tarangga	Single	Dark white
Kusnadi, 2016	119.62±2.34	174.56±2.33	118.14±1.35	337.41±12,18	Grey	Sakki	Single	White
Dudi et al., 2011	122.10±6.40	171.98±5.00	130.02±2.80	-	Dark grey	Tarangga	Double	Grey
Sohel & Amin, 2015	-	-	-	-	Black	Pampang	Double	Grey
IMSYAR, 2010	118.50±3.54	168.00±1.41	125.00±1.41	-	Dark grey	Tarangga	Double	Grey



Male Buffalo



Female Buffalo

References	Quantitative				Qualitative			
	Body Length	Heart Girth	Wither Height	Body Weight	Skin color	Horns pattern	Chevron	Foot color
Gerli et al., 2012	137.28±5.57	188.74±7.76	133.00±4.60	402.98±52.17	-	-	-	-
Araújo de Melo et al., 2018	120.00±2.56	180.00±8.75	126.00±5.92	430.55±21.68	-	-	-	-
Sahu et al., 2017	128.76±0.86	174.11±0.80	136.93±2.44	382.60±16.05	-	-	-	-
Rahman et al., 2015	115.56±4.24	192.06±4.90	112.85±1.65	426.58±31.79	Light grey	Tarangga	Double	Brown
Kocaman et al., 2017	146.25±7.45	208.13±8.94	141.26±7.45	575.00±40.85	-	-	-	-
Çelikeloglu et al., 2019	101.65±0.02	117.99±0.25	107.09±0.36	176.49±10.79	-	-	-	-
Krisnandi et al., 2016	110.10± 5.86	159.47±8.45	110.15±3.47	272.45± 40.11	Grey	Sikki	Single	Grey
Kusnadi, 2016	115.65±5.21	169.12±3.55	115.50±3.22	396.85±24.11	Grey	Sikki	Single	White
Dudi et al., 2011	120.00±2.03	161.33±4.83	118.99±3.20	-	Grey	Sikki	Double	Grey
Sohel & Amin, 2015	-	-	-	-	Dark Grey	Sickle shaped	Double	Grey
IMSYAR, 2010	116.67±2.08	164.42±5.42	126.33±2.52	-	Dark grey	Tarangga	Double	White

Phenotypic characterization

Qualitative Parameters

Quantitative Parameters

01

Observation of qualitative parameters was carried out by visual assessment base on performance of cattle/buffalo

Qualitative includes

- 1) Body appearance; 2) Skin color; 3) Coat color; 4) Horns pattern; 5) Back-line; 6) Chevron; 7) Hair whorls on the head; 8) Hair whorls on the back; 9) Hair whorls on the rump; 10) Foot color.

Body measurements were carried out while animals were in normal standing condition and bodyweight rests on both feet in a balanced condition.

Quantitative consisted of morphometric and body weight, morphometric includes

- 1) Withers height; 2) Body length; 3) Heart girth; 4) Shoulder width; 5) Chest depth; 6) Rump height; 7) Rump width; 8) Rump length and 9) Bodyweight estimation.

02

Quantitative characteristics

Based on the results of this study, the researcher found out morphometric characteristics of buffalo's body size to describe the potential of cattle/buffaloes quantitatively

Table 4.5 Morphometric description of male and female buffalo based on the subpopulation regions

No	Parameters	NK		EK		SK		PT	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	Wither height (cm)								
	Minimum	115.00	116.00	122.00	123.00	130.00	125.00	129.00	135.00
	Maximum	136.00	129.50	139.00	138.00	144.00	140.00	139.00	143.00
	Average	124.38a	122.57a	132.02b	130.00b	136.07c	131.08b	135.05c	139.80d
	SD	5.28	3.35	4.07	3.51	3.18	3.03	3.24	2.70
2.	CV	4.24	2.74	3.08	2.70	2.34	2.31	2.40	1.93
	Body length (cm)								
	Minimum	108.00	110.00	122.00	115.00	127.00	121.00	129.00	133.00
	Maximum	128.00	125.00	139.00	145.00	140.00	135.00	139.00	140.00
	Average	119.13a	117.43a	131.55bc	132.87bcd	134.53de	130.37b	133.95cd	137.15e
3.	SD	4.09	4.28	4.25	6.12	3.31	3.37	3.02	2.19
	CV	3.43	3.65	3.23	4.61	2.46	2.58	2.26	1.59
	Heart girth (cm)								
	Minimum	162.00	162.50	175.00	165.00	180.00	168.00	179.50	184.00
	Maximum	183.00	184.00	190.00	189.00	194.00	191.50	189.50	193.00
4.	Average	170.43a	172.53a	183.28bcd	180.18b	186.43de	182.12bc	185.20cd	189.15e
	SD	5.11	4.89	4.16	5.73	3.72	6.51	3.14	2.56
	CV	3.00	2.84	2.27	3.18	2.00	3.58	1.69	1.35
	Shoulder width (cm)								
	Minimum	29.50	30.00	33.00	31.00	37.00	31.00	40.00	40.00
5.	Maximum	51.00	50.00	51.00	53.00	52.00	57.00	49.50	51.00
	Average	38.98a	40.93ab	43.25abc	42.00ab	45.32bc	42.33ab	45.15bc	47.10c
	SD	6.02	12.33	4.33	4.71	3.93	5.47	3.18	3.18
	CV	15.44	30.13	8.67	11.21	8.67	12.93	7.04	6.75
	Chest depth (cm)								
5.	Minimum	59.00	54.00	63.00	65.00	69.00	67.00	70.50	75.00
	Maximum	82.00	85.00	79.50	85.00	83.00	81.00	80.50	83.00
	Average	69.55ab	68.23a	71.72b	72.13b	76.53c	72.18b	76.90c	78.95c
	SD	6.62	8.71	4.32	3.97	3.89	3.40	3.24	2.54
	CV	9.52	12.77	6.03	5.51	5.09	4.71	4.21	3.22

Quantitative characteristics

Table 4.5 Morphometric description of male and female buffalo based on the subpopulation regions

No	Parameters	NK		EK		SK		PT	
		Male	Female	Male	Female	Male	Female	Male	Female
6.	Rump height (cm)								
	Minimum	113.00	110.00	121.00	120.50	125.50	123.00	127.00	129.00
	Maximum	134.00	128.00	138.00	136.50	141.00	138.00	136.50	138.50
	Average	121.28a	119.32a	129.58bc	127.13b	132.02cd	129.08b	132.25d	135.55e
	SD	5.09	4.42	4.26	3.88	3.78	3.03	3.16	2.96
	CV	4.20	3.71	3.29	3.06	2.86	2.35	2.39	2.18
7.	Rump width (cm)								
	Minimum	30.00	26.00	35.00	33.00	39.00	34.00	43.00	44.00
	Maximum	53.00	63.00	53.00	54.50	55.00	58.00	51.00	54.00
	Average	40.32a	42.48ab	45.20bc	43.75abc	47.67cd	44.27abc	47.70cd	49.95d
	SD	6.30	12.60	4.45	4.76	3.80	5.19	2.87	2.67
	CV	15.62	29.65	9.84	10.89	7.97	11.71	6.02	5.35
8.	Rump length (cm)								
	Minimum	18.00	20.00	23.00	17.00	29.00	29.00	30.50	31.00
	Maximum	44.00	43.00	49.00	43.50	43.00	43.00	39.00	41.00
	Average	28.93a	28.68a	33.30bc	31.75ab	35.87c	34.43bc	34.85bc	36.50c
	SD	6.12	4.81	6.45	5.76	3.66	3.89	3.15	3.75
	CV	21.15	16.79	19.37	18.15	10.19	11.30	9.05	10.27
9.	Bodyweight (kg)								
	Minimum	338.47	339.84	386.80	347.04	405.80	356.34	403.92	421.65
	Maximum	417.52	426.28	443.51	442.38	457.23	455.76	441.50	458.48
	Average	370.19a	378.88a	418.02bcd	408.44b	429.79d	415.91bc	425.32cd	443.30e
	SD	19.22	20.32	15.66	23.30	13.62	27.31	11.79	10.38
	CV	5.19	5.36	3.75	5.70	3.17	6.57	2.77	2.34

The average number accompanied by different superscripts has a significant difference at the level of 5%.

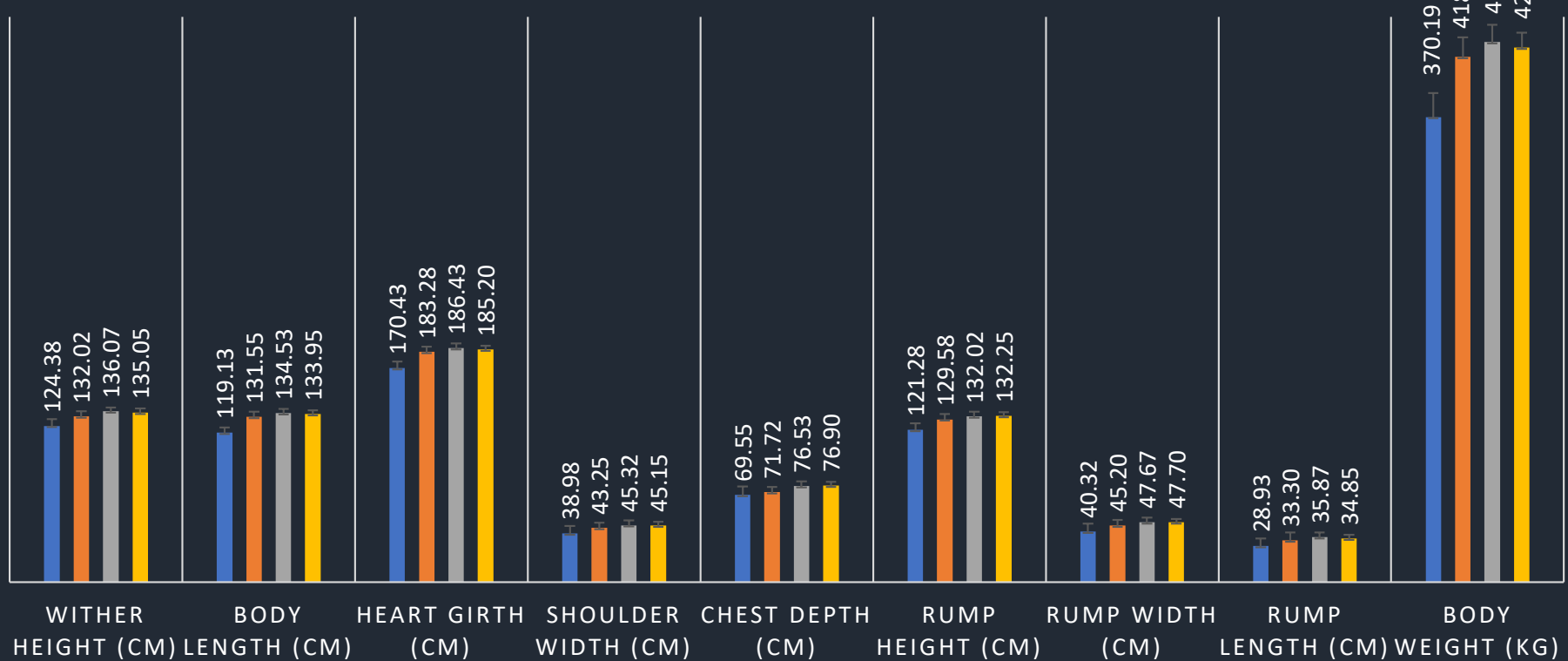
NK: North Kalimantan; EK: East Kalimantan; SK: South Kalimantan; PT: Phatthalung

SD: Standart Deviation

CV: Coefficient of variation

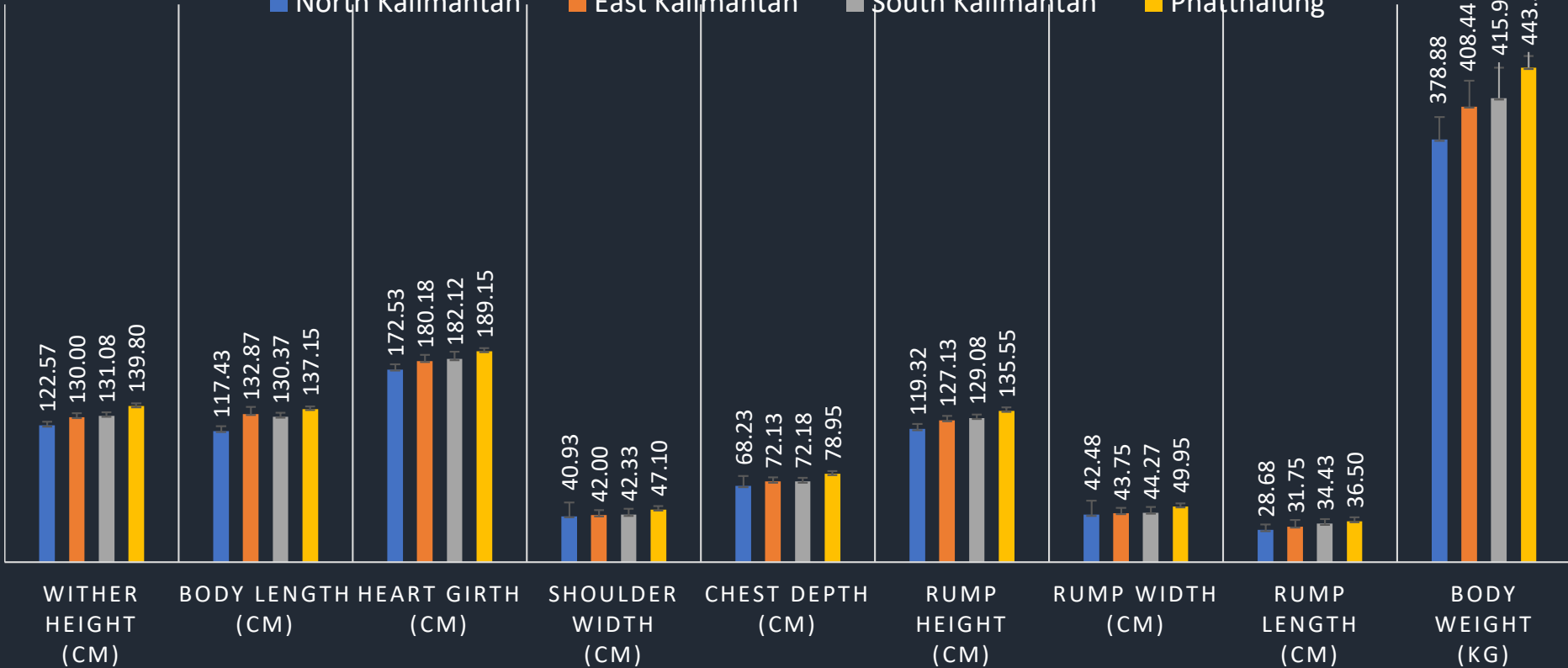
MORPHOMETRIC DESCRIPTION OF MALE BUFFALO BASED ON THE SUBPOPULATION REGION

■ North Kalimantan ■ East Kalimantan ■ South Kalimantan ■ Phatthalung



MORPHOMETRIC DESCRIPTION OF FEMALE BUFFALO BASED ON THE SUBPOPULATION REGION

■ North Kalimantan ■ East Kalimantan ■ South Kalimantan ■ Phatthalung



Morphometric index

The morphometric index can be used as alternatives in assessment livestock as a type indicator (meat type, dairy type or dual purpose) and the following indices were calculated from the mean values of body measurements, according to the method based on Alderson (1999) with the formula:

$$\text{Height slope} = \text{Wither height} - \text{Rump height}$$

$$\text{Length index} = \frac{\text{Body length}}{\text{Wither height}}$$

$$\text{Width slope} = \text{Rump width} - \text{Chest width}$$

$$\text{Depth index} = \frac{\text{Chest depth}}{\text{Wither height}}$$

$$\text{Foreleg length} = \text{Wither height} - \text{Chest depth}$$

$$\text{Balance} = \frac{(\text{Rump length} \times \text{Rump width})}{(\text{Chest depth} \times \text{Chest width})}$$

$$\text{Cumulative index: } \left(\frac{\text{Body weight}}{\text{Average weight}} \right) + \text{length index} + \text{balance}$$

Morphometric characteristics index

The morphometric index is a standard that can be used as an alternative in the animal assessment as an indicator of the type (producing meat, dairy or dual-purpose) and livestock function (Alderson, 1999; Salako et al., 2006).

Table 4.6 Morphometrics index of male and female buffalo based on the subpopulation regions

No	Parameters	NK		EK		SK		PT	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	Height slope								
	Minimum	1.00	0.50	0.50	1.00	0.00	0.50	0.05	0.05
	Maximum	6.50	6.50	5.00	5.00	4.00	4.50	3.00	2.00
	Average	3.11cd	3.25d	2.43bcd	2.87cd	1.82ab	2.32abc	1.80ab	1.45a
	SD	1.45	1.94	1.28	1.29	1.05	0.93	0.86	0.60
	CV	46.55	59.76	52.80	45.10	57.59	40.27	47.57	41.28
2.	Length index								
	Minimum	0.83	0.88	0.97	0.92	0.90	0.93	0.98	0.97
	Maximum	1.08	1.03	1.03	1.10	1.01	1.05	1.01	1.00
	Average	0.96a	0.96a	1.00b	1.02c	0.99b	0.99b	0.99b	0.98ab
	SD	0.06	0.04	0.01	0.04	0.03	0.03	0.01	0.01
	CV	6.25	4.11	1.47	3.78	2.67	3.01	0.91	0.89
3.	Width slope								
	Minimum	0.05	0.00	0.00	0.00	0.00	0.00	1.00	1.50
	Maximum	3.00	4.00	3.00	6.00	4.00	4.00	4.00	5.00
	Average	1.33a	1.55a	1.95abc	1.75ab	2.35bcd	1.93abc	2.55cd	2.85d
	SD	0.71	0.91	0.94	1.23	0.85	0.91	0.93	1.16
	CV	53.34	58.91	48.25	70.29	36.28	46.92	36.33	40.56
4.	Depth index								
	Minimum	0.46	0.42	0.50	0.49	0.50	0.51	0.55	0.52
	Maximum	0.70	0.71	0.57	0.61	0.61	0.62	0.58	0.59
	Average	0.56a	0.56a	0.54a	0.56a	0.56a	0.55a	0.57a	0.56a
	SD	0.06	0.08	0.02	0.03	0.03	0.03	0.01	0.02
	CV	10.82	13.73	3.29	5.68	5.50	5.04	2.01	2.86

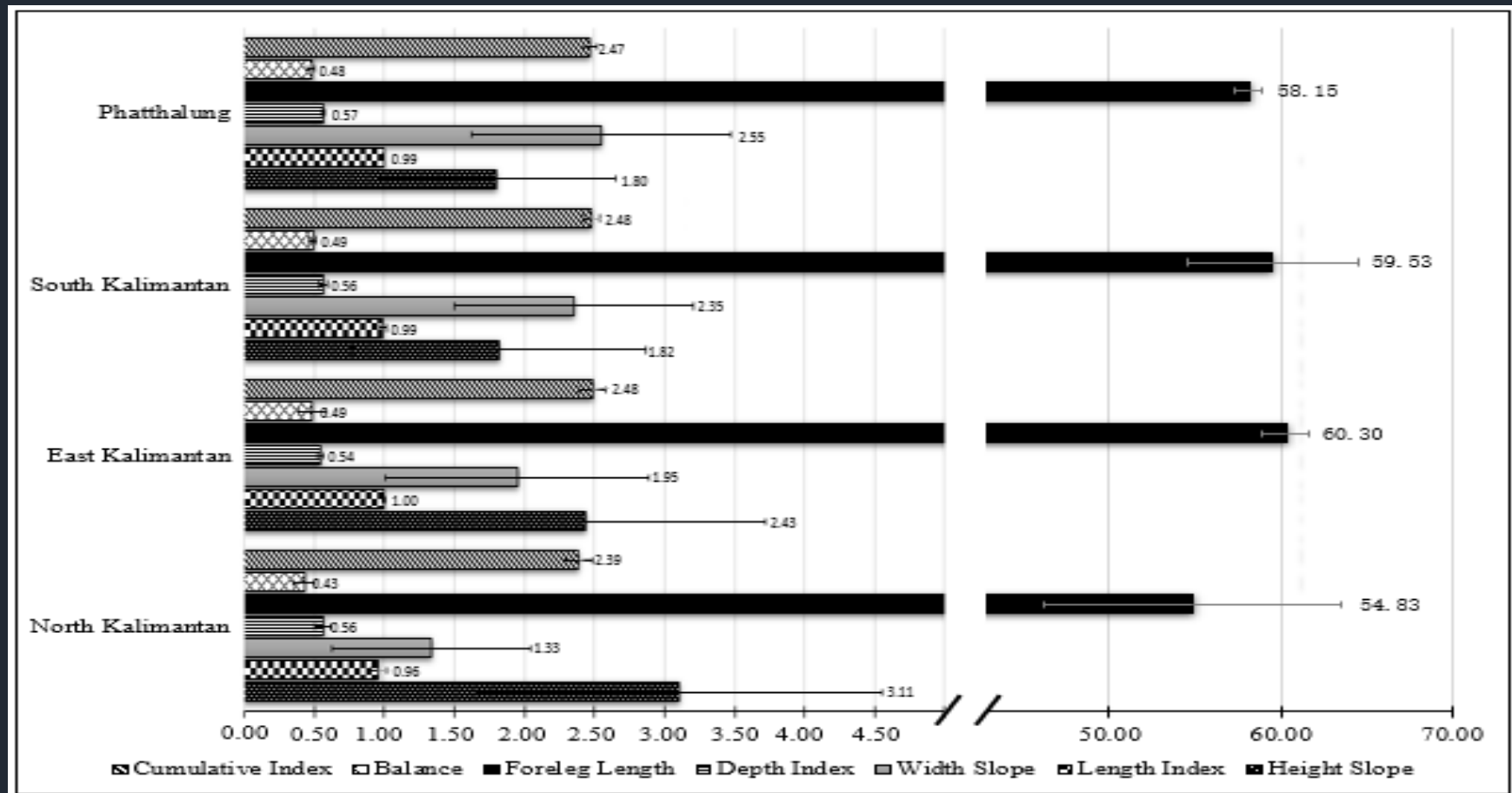
Table 4.6 Morphometrics index of male and female buffalo based on the subpopulation regions

No	Parameters	NK		EK		SK		PT	
		Male	Female	Male	Female	Male	Female	Male	Female
5.	Foreleg length								
	Minimum	34.00	34.00	58.00	50.00	52.00	50.00	57.00	58.00
	Maximum	70.00	75.50	63.00	71.00	72.00	68.00	59.50	68.00
	Average	53.83ab	54.33a	60.30c	57.87abc	59.53c	58.90bc	58.15abc	60.85c
	SD	8.66	10.16	1.39	4.97	4.97	4.33	0.82	2.75
	CV	15.80	18.69	2.30	8.35	8.35	7.35	1.41	4.52
6.	Balance								
	Minimum	0.28	0.27	0.30	0.23	0.45	0.41	0.44	0.43
	Maximum	0.58	0.62	0.73	0.59	0.54	0.62	0.53	0.59
	Average	0.43a	0.44ab	0.49bc	0.46abc	0.49bc	0.50c	0.48abc	0.49bc
	SD	0.08	0.08	0.10	0.08	0.03	0.06	0.03	0.05
	CV	17.52	19.14	20.16	18.45	5.45	11.58	5.85	9.46
7.	Cumulative Index								
	Minimum	2.14	2.19	2.34	2.14	2.30	2.31	2.41	2.40
	Maximum	2.57	2.61	2.71	2.64	2.59	2.67	2.52	2.53
	Average	2.39a	2.40a	2.48b	2.48b	2.48b	2.50b	2.47b	2.47b
	SD	0.09	0.10	0.10	0.11	0.06	0.10	0.05	0.04
	CV	3.90	4.18	3.90	4.18	2.45	4.01	1.86	1.65

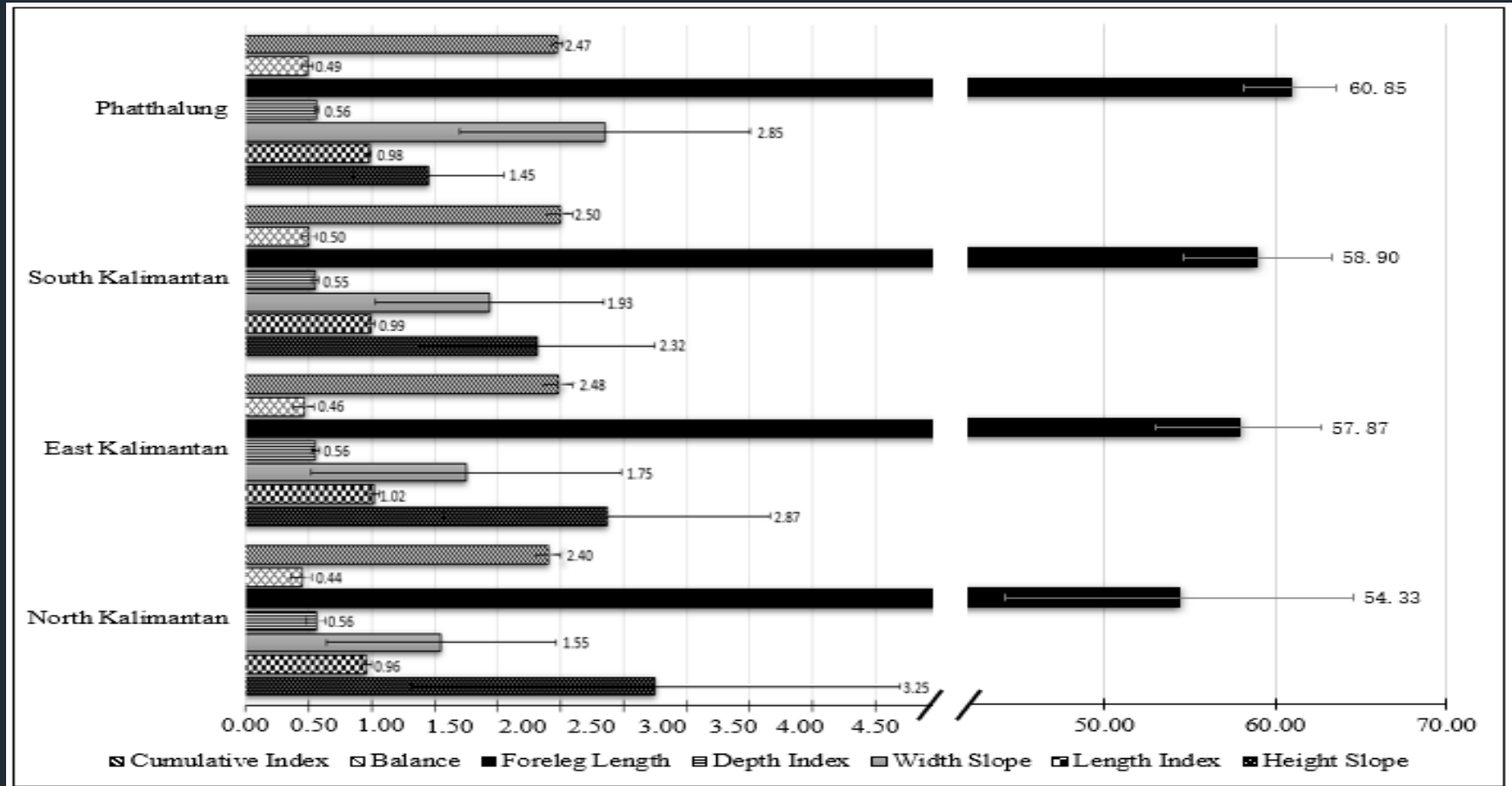
The average number accompanied by different superscripts has a significant difference at the level of 5%.

NK : North Kalimantan; EK : East Kalimantan; SK : South Kalimantan; P : Phatthalung

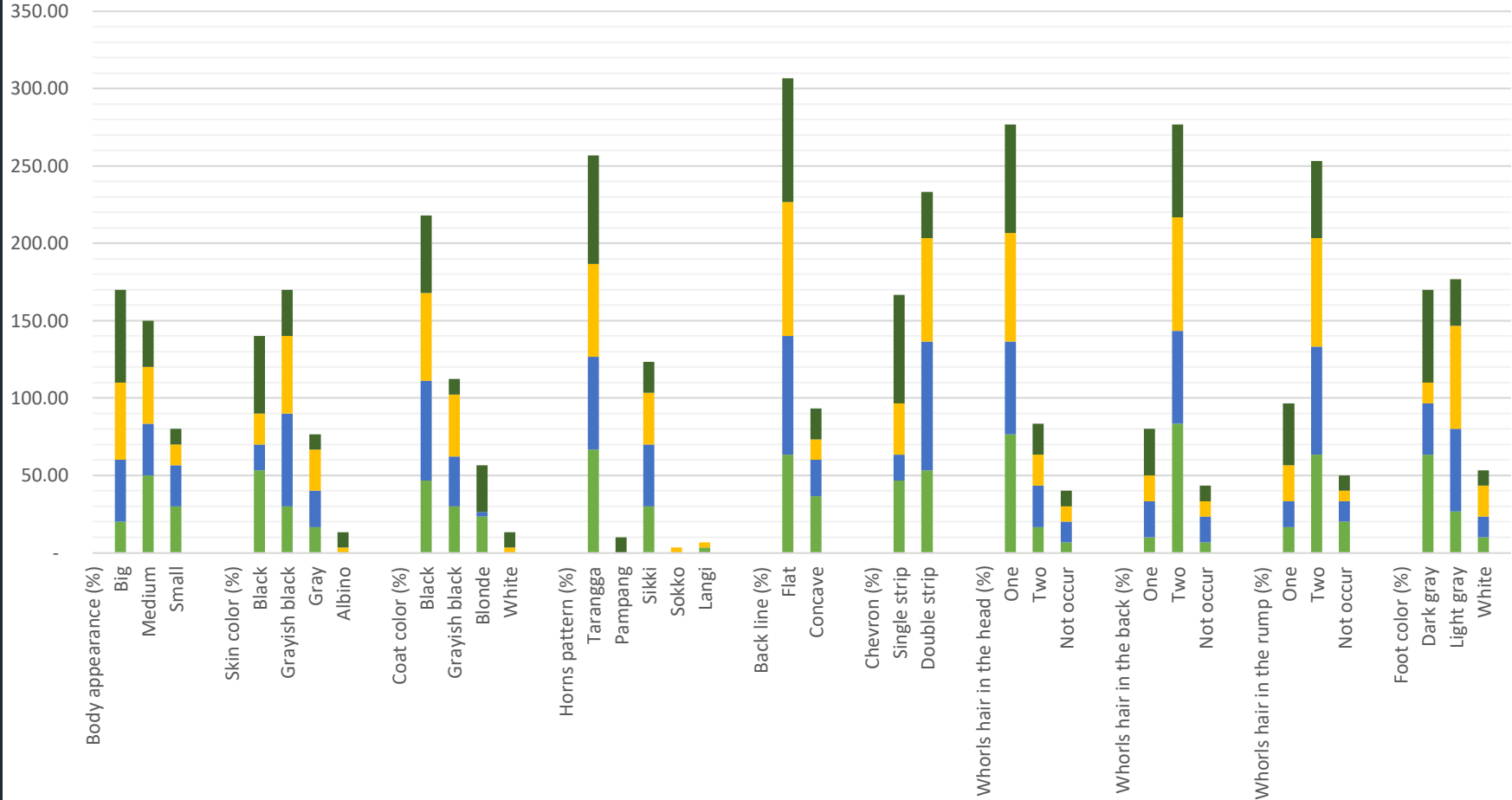
Morphometric index of male buffalo based on the subpopulation regions.



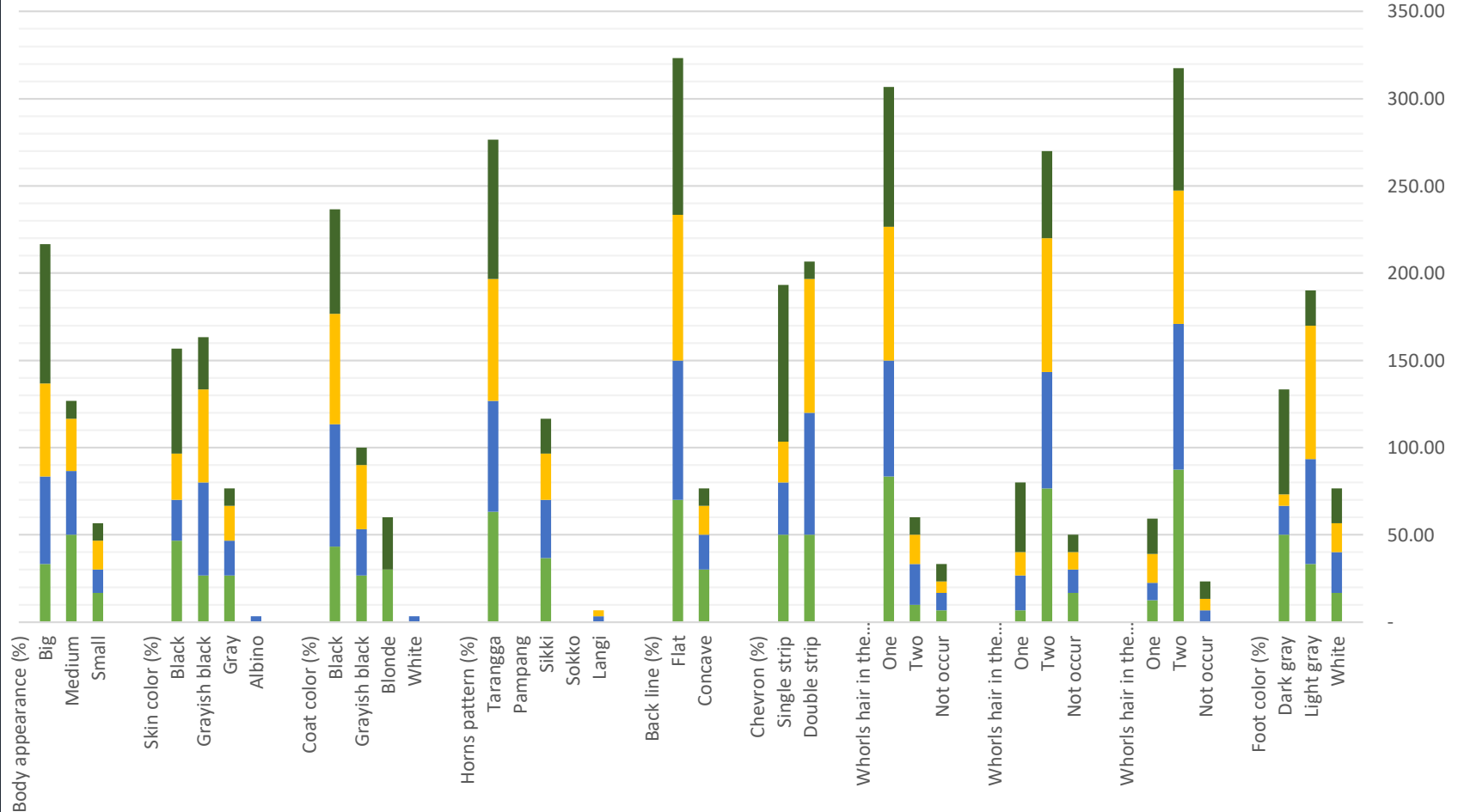
Morphometric index of female buffalo based on the subpopulation regions.



North Kalimantan East Kalimantan South Kalimantan Phatthalung



■ North Kalimantan
 ■ East Kalimantan
 ■ South Kalimantan
 ■ Phatthalung



100.00	33	33	33	100.00
15	50.00	50.00	50.00	16.67
10	33	33	33	10.00
50	16.67	16.67	16.67	5.00
100.00	60.00	60.00	60.00	18.18
50	2	2	2	6.67
100.00	76.67	76.67	76.67	23.33
50	6	6	6	20.00
100.00	20.00	20.00	20.00	6.67





THANKS!

<https://hardianimalscience.wordpress.com/>