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BIOLOGICAL ASPECT AND ABUNDANCE OF TRITON EPAULETTE SHARK (*Hemiscyllium henryi*) ENDEMIC TO TRITON BAY, KAIMANA, WEST PAPUA

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ABSTRACT

Walking shark is one of elasmobranch that has been protected by the government of the Republic of Indonesia and can be found in the eastern seawaters of Indonesia. There are six species of walking shark, one of it is Triton Bay Epaulette Shark (*Hemiscyllium henryi*) which is endemic to the coastal waters of Kaimana. There are still lack of information regarding biology abundance and population of *H. henryi*, therefore it is necessary to do a study related to this species. This study aims to determine individual information and abundance of *H. Henryi* in Kaimana coastal waters during the observation in 2022 and 2023 based on density value and potential area. The method used is a census based on the Global Positioning System, through snorkeling and walking along the coastline, as well as observations of total length, wet weight, and sex in *H. henryi* which encountered during census. The total census track is 5.783 meters with a sweep of 2,46 Ha monitoring area. The density or abundance of *H. henryi* in 2022 is 1,2 ind/Ha and in 2023 is 2,4 ind/Ha. Total length of *H. henryi* ranged between 55–88 cm (Mean 70,6 cm ± SD 12,29). The length and weight relationship obtained $W=0{,}0004L^{3{,}4343}$ with R^2 value of 0,9526. The abundance trend of *H. henryi* at the coastal waters of Kaimana in the last two years has multipled by 2 times based on density value determining after being designated as a fully protected fish species.

Keywords: Density; Epaulette Shark; H. henryi; Kaimana; Triton Bay

INTRODUCTION

Hemiscyllidae is a family of small elasmobranchs usually encountered with a total body length (TL) of about 85 cm, most commonly encountered at sizes less than 75 cm, and is grouped into two different genera, namely the genus *Hemiscyllium* and *Chilocyllium* (Allen et al. 2016). Hemiscyllidae are nocturnal animals that are commonly found on the bottom of coral reef, mangrove, seagrass, rocky and sandy waters (Compagno 2002, Allen et al. 2013, Weigmann 2016, Allen Madduppa et al. 2020, Vanderweight et al. 2021). The characteristics of this family are that it has patterns on all parts of its body (body, head, tail, and fins), a small mouth transversely under its eyes, two dorsal fins of the same size, and a long slender tail (Allen et al. 2016, Madduppa et al. 2020).

Hemiscyllium is commonly known as a bamboo shark, epaulette shark, or walking shark because of its habit of foraging on the bottom of the water by crawling using its two pectoral fins to hunt benthic invertebrates, crustaceans or small fish hiding under sand sediments, coral breaks, under seagrasses, rock crevices, and coral crevices (Allen et al, 2013). The potential distribution of the *Hemiscyllium* genus is very limited in certain water areas and tends to be endemic due to its nature living in shallow water environments (Dudgeon et al. 2020) which is supported by the ability of physiological adaptation to overcome hypoxic conditions during low tide periods (Wise et al. 1998). Limitations in migration (Widiarto et al., 2020), and because the reproductive process is oviparous and attaches eggs to the bottom of the water (Compagno 2001, Allen et al. 2016) so that the limiting factor of geography has a very large influence on the distribution of individuals (Dudgeon et al. 2020).

There are 9 species in the genus *Hemiscyllium* found worldwide, including *H. freycineti, H. hallstromi, H. ocellatum, H. strahani, H. tripeculare, H. galei, H. henryi, H. michaeli*, and *H. halmahera* which live spread in the waters of Australia, Papua-New Guinea, Halmahera (Dingerkus & Defino 1983, Compagno 2001, Allen & Erdmann 2008, Allen & Dudgeon 2010, Allen et al. 2016, Dudgeon et al 2020). Eastern Indonesian waters are the distribution area for 6 species of Hemiscyllidae including *H. halmahera* which is endemic to the waters of Halmahera; *H. freycineti* can be found in the waters of Raja Ampat and small islands of the mainland fraction of Southwest Papua; *H. galei* in the waters of Cendrawasih Bay, West Papua; *H. strahani* in the coastal waters of Jayapura, Papua; *H. trispeculare* which is an Australian species but spreads to the waters of the Aru Islands, Maluku; and *H. henryi* which is endemic to the waters of Kaimana, West Papua (Allen et al. 2016, Dudgeon et al, 2020).

Knowledge of biological information for each species in the Hemicyllidae family is still very limited, because the assumption of biological information is studied only on *Chiloscyllium*, H. *ocellatum, H. Halmahera, H. freycineti, H. galei* (Allen et al. 2016, Jutan et al. 2018, Madduppa et al. 2020, Dudgeon et al. 2020, Widiarto et al. 2020, Insani et al. 2022). *H. henryi* or Triton Bay Eupalette Shark was first studied by Gerald Allen and Mark Erdman in 2006 including one sample of male and one sample of female individuals, description of body part patterns and sizes, DNA comparisons between other species, identification markers, distribution habitats, and together with *H. galei* where reported to be two new species of the genus Hemiscyllidae from West Papua, Indonesia. *H. henryi* was named in tribute to Wolcott Henry for his support of Conservation International's marine programs (Allen & Erdmann, 2008).

The limited distribution of the species, vulnerability to habitat degradation in coral, seagrass, and mangrove ecosystems, extractive utilization of traditional fishers, global climate change, and low reproduction of shark species (Prehadi et al. 2015) make *H. henryi* threatened with population decline and extinction so that it is included Vulnerable based on the IUCN Red List of Threatened Species (VanderWright et al. 2021). 2021) The Indonesian government has taken steps to protect the concerns of Hemiscyllium's existence in its natural habitat by determining its protection status as a fully protected fish species listed in the Decree of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia (KepmenKP RI) number 30 of 2023.

The available knowledge and information on *H. henryi* remains quite limited, with prior studies relying on data from only two individual specimens, as documented by Allen and Erdman in 2008. This study aims to expand upon that foundation by providing a more comprehensive understanding of *H. henryi* biology, specifically focusing on the species' growth patterns by examining the relationship between body length and wet weight. Additionally, this research reviews the abundance of *H. henryi* individuals within their restricted habitat in the Triton Bay Waters of Kaimana.

RESEARCH METHODS

Research location

H. henryi is distributed in 6 water locations in the Kaimana-Fakfak Regional Conservation Area including Kaimana Waters, Triton Bay Waters, Aduma Island Waters, Arguni Waters, Adijaya Island Waters, and waters around the Karas coast, with an estimated distribution area of around 1,148 km^2, a depth interval of 0-28 meters below sea level, with an estimated average of 40 individuals per km^2, and there may be as many as 46,000 individuals throughout the distribution range of *H. henryi* (Vanderwright et al. 2021). The Kaimana-Fakfak Regional Conservation Area has been designated in the Decree of the Minister of Marine Affairs and Fisheries Number 25/KEPMEN-KP/2019.

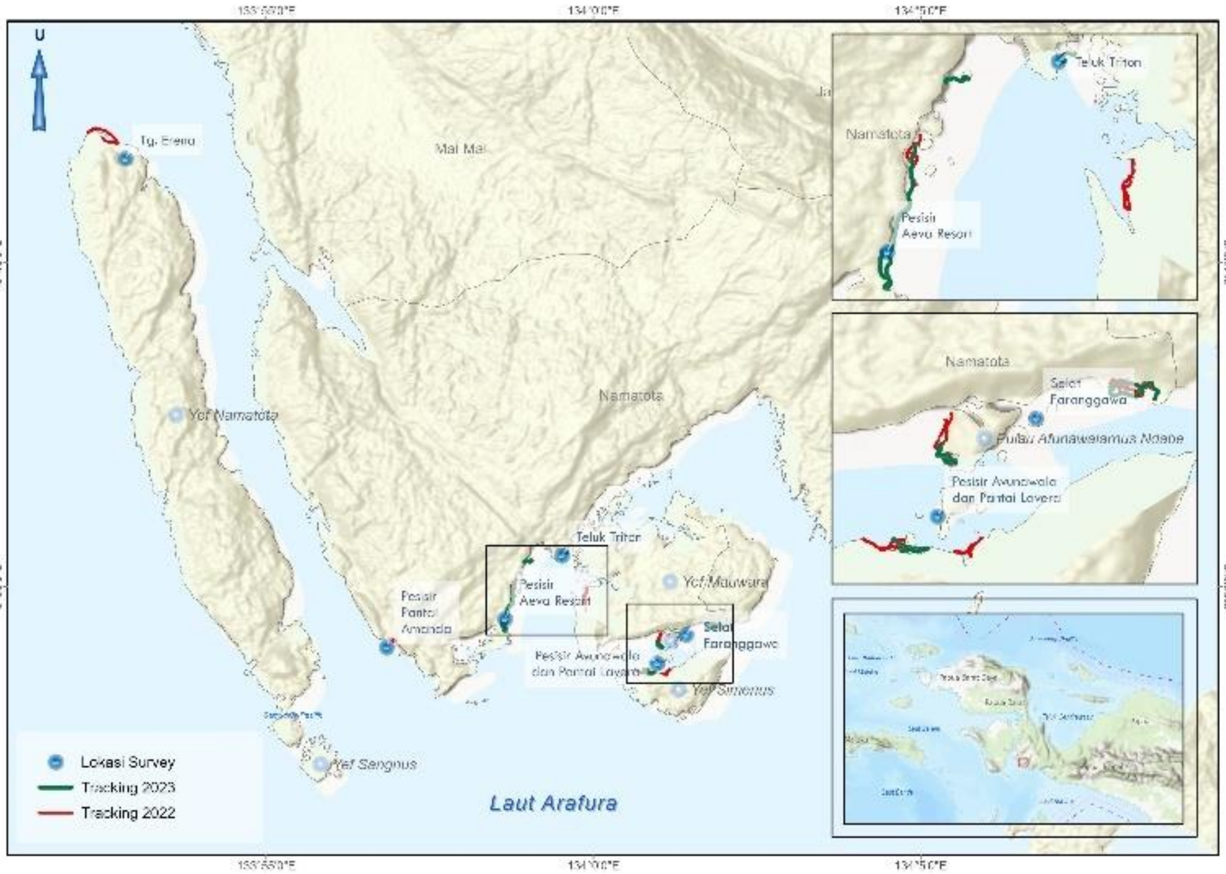

Figure 1 Location Map of H. henryi Monitoring Areas in the Waters of Kaimana Regency, West Papua. Survey locations are shown with blue circles, survey trajectories are shown with green lines (year 2022) and red lines (year 2023)

This research was conducted in the Regional Conservation Area (KKD) of Kaimana Waters, precisely around the Triton Bay Waters of Kaimana, West Papua with a total of 14 observation locations in the last 2 years, where 8 observation locations in April 2022, and 6 observation locations in April 2023, with sandy and rocky coastal characters resulting from geological activities. The observation locations are spread at several points, namely in the Triton Bay area (coastal Mauwara Island and Semisarom Island), coastal Aeva Resort, coastal Amanda Beach in Namatota, coastal Cape Erana, Avunawala Coast, Lavera Coast, and Faranggawa Strait (illustrated in Figure 1).

The target locations for monitoring H. henryi were selected based on the presence of coral reef and seagrass ecosystems within the region. This strategic selection was intended to maximize the likelihood of observing H. henryi individuals while optimizing the area, distance, time, and effort required for monitoring.

Biological Aspect

Pattern Identification Key

The identification of the pattern in question provides a general description of the body pattern unique to *H. henryi*, ensuring that observed individuals are accurately identified as this species, based on the identification key from Allen et al. (2016). This distinctive pattern is consistently observed in each *H. henryi* individual. Observed specimens were captured by hand and documented to study these unique patterns in detail.

Body Length Size Distribution

The body length distribution data is intended to determine the maximum length of *H. henryi*. According to Allen et al. (2016), the maximum recorded length of *H. henryi* is 81.5 cm. In this study, individual specimens were measured for body length using a 100 cm meter scale and documented. Wet weight measurements were also taken using digital scales with an accuracy of 0.01 grams.

Length-weight Relationship

Length and weight relationship analysis was conducted in this study to determine the biological condition of the collected samples in order to carry out management measures that support species sustainability (Froese 2006, Rosli & Isa 2012, Madduppa et al. 2020). The length-weight relationship analysis in *H. henryi* uses the general formula in fish W = $[aL]^b$, where W or body weight indicates wet weight (grams), L or length for body length (cm), a and b indicate constant values obtained from regression values (Effendie 1979). The constant values of a and b from the length-weight relationship analysis were obtained from data processing through Microsoft Excel software.

Estimated Abundance

Monitoring of *H. henryi* individuals in this study was carried out using the monitoring methods listed in the Decree of the Director General of Marine Spatial Management number 67 of 2022 concerning Technical Guidelines for Data Collection of Protected Fish Species and / or Threatened Fish Species in the CITES Appendices, namely the global positioning system (GPS) based census method through snorkeling visual census (SVC) and along the coastline, both of which were carried out at the same coastal location.

SVC is a method of observing the presence of fish in the sea with snorkeling activities and recording the snorkeling range with a GPS floating kit so as to obtain the abundance of the number of individuals per observation area, where the observation distance is 4 meters wide (Ind/Ha) (Sadovy 2006, Widiarto et al 2020). This method is particularly appropriate for fish species whose abundance is rare, and whose individuals are widely distributed in an area (Colin et al 2005). SVC is a development of the conventional Underwater Visual Census (UVC) technique, which generally uses 50 to 150-meter transects that do not allow for documenting and approximating abundance for *H. henryi* species in an area.

The second method used in this study is the monitoring method along the shoreline with an observation distance of 5 meters, where this method has been used to measure the estimated abundance of eupalette sharks *H. ocellatum* on Heron Island, Great Barrier Reef, Australia (Heupel & Bennett 2007) and *H. freycinetti* in the waters of South Misool, Raja Ampat (Widiarto et a.l 2020). Individual monitoring using both methods was conducted at night in coastal and coral reef waters because *H. henryi* tends to emerge at night to forage up to the tidal zone. The formula for *H. henryi* density per unit area for both methods and calculating abundance is as follows:

$$Di = \frac{\sum ni}{di \; x \; wi} \quad \text{...} \; (1)$$

$$Ai = Di \; x \; Wa \quad \text{...} \; (2)$$

Note : D_i = Density of *H.henry* in an area (Ind/Ha); $\sum n_i$ = Number of individuals in the observation area (Ind); d_i = Observation distance with GPS tracking (m); w_i = Observation width (m) (SVC= 4 meters; Beach Walk= 5 meters); Ai = Abundance of *H. henry* (Ind); Wa = Estimated Distribution Area (Ha)

RESULT AND DISCUSSION

Result

Pattern Identification Key

Total samples of Triton Bay walking shark (*H. henryi*) that have been collected are 10 individuals focused on the waters of Triton Bay with 4 different coastal points including (Avunawala Beach coast = 4 ind), (Faranggawa Strait coast = 2 ind), (Lavera Beach coast = 3 ind), and (Aeva Resort coast = 1 ind) more details can be seen in Table 1. Observations on the identification of the main patterns of *H. henryi* species markers were made on several parts of its body. The parts that became the focus of this study in the identification key include the appearance of a black double-circle pattern that almost merges on the back of the head on the right and left sides of the body (post-cephalic marking) of *H. henryi* (Figure 2 a), the appearance of a pattern of two dark-colored saddles on the first dorsal and second dorsal fins (Figure 2 b), the lower pelvic fins tend to be plain or unpatterned (Figure 3 a), and the pattern of addles lined up across the dorsal part of less than 10 (Figure 3.)

Table 1. Individuals of *H. henryi* in 2022 and 2023 Observations In The Coastal Waters of Triton Bay, Kaimana Regency

Sampel ID	Location	Coordinate (lat/log)	Year/ time	Sexuality
Triton-1	Avunawala Beach	3°51.337’ 134°00.913’	2022/ 21:26	- (unrecorded)
Triton-2	Avunawala Beach	3°51.340’ 134°00.835’	2022/ 21:44	Male
Triton-3	Lavera Beach	3°50.874’ 134°00.967’	2022/ 23:05	Female
Triton-4	Faranggawa Strait	3°50.570’ 134°01.750’	2022/ 21:48	Male
Triton-5	Faranggawa Strait	3°50.589’ 134°01.923’	2022/ 22:45	Female
Lavera-1	Lavera Beach	3°50.932’ 134°01.027’	2023/ 21:18	Male
Lavera-3	Lavera Beach	134°00.978’ 3°50.882’	2023/ 22.00	- (juvenile)
Lavera-2	Lavera Beach	3°50.883’ 134°00.987’	2023/ 22:08	Male
Avunawala-1	Avunawala Beach	3°51.331’ 134°00.812'	2023/ 21:24	Male
Avunawala-2	Avunawala Beach	3°51.337’ 134°00.828'	2023/ 22:40	Male
Aeva-1	Aeva Resort Beach	3°49.968' 133°58.782'	2023/ 01:33	Male

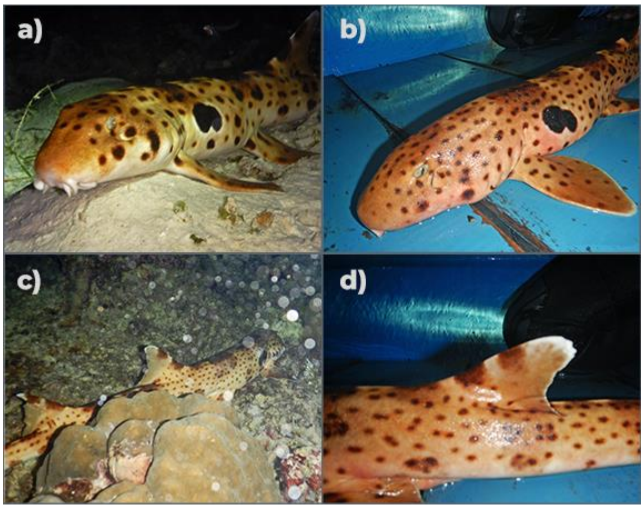

Figure 2. Appearance of the Almost Fused Double-Circle Black Spotted Pattern (Red Circle) On The Back of the Head On The Right And Left Sides of The Body (Post-Cephalic Marking) of *H. henryi*

Note: a. Individual ID Lavera-2; b. Individual ID Aeva-1, and appearance of the dark two-saddle pattern (red circle) on the first dorsal and second dorsal fins; c. Individual ID Lavera-2; d. Individual ID Aeva-1 (photo: Prehadi).

Length Size Distribution

The smallest *H. henry* recorded was 55 cm in body length with a weight of 417 grams (Table 2) with ID Triton-3 located on the coast of Lavera Beach (Table 1) and the longest size was *H. henryi* measuring 88 cm (Table 2) male with a wet weight of about 1795 grams with ID Lavera-2 located on the coast of Lavera (Table 1). The length of *H. henryi* found was quite diverse in the waters of Triton Bay, the average total length of *H. henryi* was 70.6 + 12.29 cm, where the frequency of length was mostly in the size of 66-70 cm. The sex ratio was found to be 2:7 where out of 11 individuals recorded, 2 females and 7 males were found (Table 2) characterized by the presence of clasper (Figure 4), and 2 individuals were not recorded for sex.

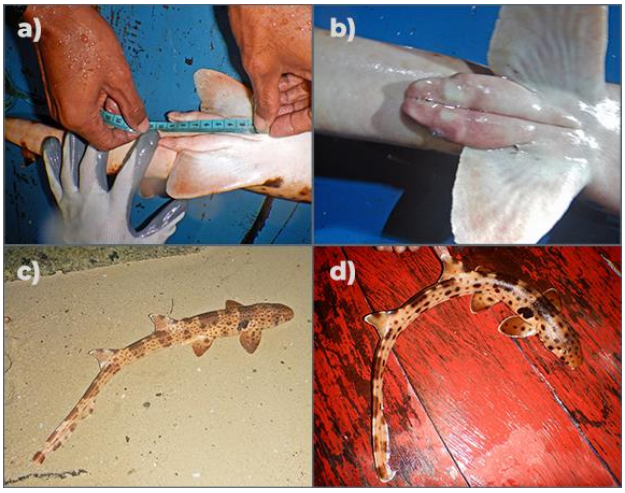

Figure 3. The Pelvic and Clasper Fins are Featureless

Note: a. Individual ID Lavera-2; b. Individual ID Aeva-1) and the dorsal saddle patches are less than 10 in number; c. Individual ID Triton-4; Individual ID Triton-3 (top photo: Prehadi; bottom photo: Rosa (left) and Prehadi (right))

Table 2. Measurement Data of Total Length and Wet Weight of *H. henryi* Individuals

Ind (ke-)	Sampel ID	Sexuality	Total length (cm)	weight (g)
1	Triton-1	-	75	1227.5
2	Triton-2	Male	57	465
3	Triton-3	Female	55	417
4	Triton-4	Male	82	1585
5	Triton-5	Female	66	715
6	Lavera-1	Male	70	775
7	Lavera-2	Male	88	1795
8	Lavera-3	-(juvenil)	-(n/a)	-(n/a)
9	Avunawala-1	Male	69	790
10	Avunawala-2	Male	57	310
11	Aeva-1	Male	87	1605

Length-weight Relationship

Based on the analysis of 10 individuals that were successfully found and recorded their total length and weight during the study period, it was found that the relationship between total length and weight of *H. henryi* in Triton Bay, Kaimana Regency, had a b value of 3.4343 with a coefficient of determination (R2) of 0.9526 and a correlation coefficient (r) of 0.9760. The equation of the length-weight relationship and the value of the correlation coefficient of *H. henryi* can be seen in Table 1, while the graph of the length-weight relationship is presented in Figure 2. The results of the t-test on the b value show that the growth pattern of *H. henryi* in the coastal waters of Triton Bay is isometric.

Table 3. Growth Pattern of *H. henryi* In The Coastal Waters of Triton Bay

n	Equation	r	t_{count}	Growth pattern
10	$0,0004L^{3,4343}$	0,9760	1,6030	Isometric

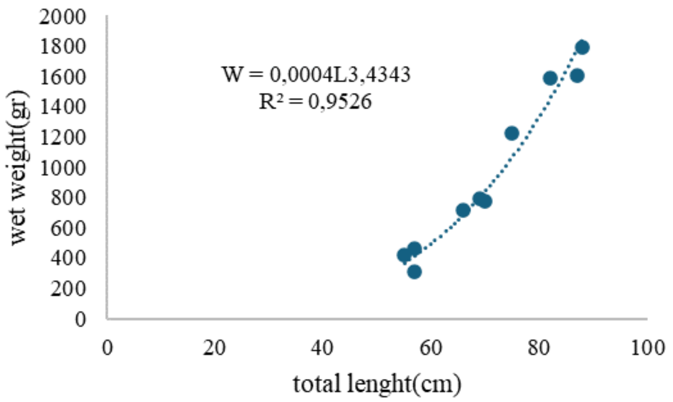

Figure 5. Relationship Between Total Length and Wet Weight of *H. henryi* In Coastal Waters of Triton Bay

Estimated Abundance

The estimated abundance of *H. henry* was obtained from the ratio between the number of individuals recorded in the monitoring activities (Table 1) and the total area of the SVC method and shoreline monitoring (Widiarto et al 2020) in Table 3 for the 2022 monitoring area and Table 4 for the 2023 monitoring area. The total monitoring sweep area for both methods was 6.76 ha (4.3 ha in 2022 and 2.46 ha in 2023) with 11 individuals monitored (5 individuals in 2022 and 6 individuals in 2023).

Table 4. Information on The Track Length and Area of *H. henryi* Observation Area in 2022 at The Kaimana Regency Water Location

Site	Team	Track Coordinate		Track length (m)	Area (Ha)
		Initial Point	Final Point		
Grand Total				9.653	4,3
North Coast of P. Semisarom	Coastal Walk	S 3°51.334’ E 134°00.910’	S 3°51.333’ E 134°00.718’	683	0,342
	Snorkeling	S 3°51.294’ E 134°00.826’	S 3°51.298’ E 134°00.677’	627	0,251
South Coast of P. Mauwara	Coastal Walk	S 3°50.954’ E 134°01.038’	S 3°50.716’ E 134°01.034	710	0,355
	Snorkeling	S 3°50.948’ E 134°01.028’	S 3°50.746’ E 134°01.006’	692	0,277
South Coast of P. Mauwara	Coastal Walk	S 3°51.362’ E 134°01.121’	S 3°51.316’ E 134°01.129’	136	0,068
	Snorkeling	S 3°51.354’ E 134°01.124’	S 3°51.347’ E 134°01.083’	657	0,263
South Coast of P. Mauwara	Coastal Walk	S 3°50.583’ E 134°01.740’	S 3°50.595’ E 134°01.933’	718	0,359
	Snorkeling	S 3°50.593’ E 134°01.749’	S 3°50.607’ E 134°01.926’	990	0,396
Coastal Bay	Coastal Walk	S 3°50.027’ E 133°59.902’	S 3°50.279’ E 133°59.872’	637	0,319
	Snorkeling	S 3°50.106’ E 133°59.882’	S 3°50.255’ E 133°59.855’	470	0,188
Coast of Aeva Resort	Coastal Walk	S 3°49.896’ E 133°58.813’	S 3°50.035’ E 133°85.773’	382	0,191
	Snorkeling	S 3°49.981’ E 133°58.761’	S 3°50.151’ E 133°58.797’	536	0,214
Amanda Beach	Coastal Walk	S 3°50.826’ E 134°56.967’	S 3°50.810’ E 134°56.888’	295	0,148
	Snorkeling	S 3°50.810’ E 133°56.916’	S 3°50.813’ E 133°56.930’	301	0,120
Cape Erana, Northwest of Namatota	Coastal Walk	S 3°43.165’ E 133°52.721’	S 3°43.008’ E 133°52.274’	836	0,418
	Snorkeling	S 3°43.174’ E 133°52.727’	S 3°42.952’ E 133°52.350’	983	0,393

Table 5. Information On The Track Length and Area of *H. henryi* Observation Area in 2023 at the Kaimana Regency Water Location

Site	Team	Track Coordinate		Track length (m)	Area (Ha)
		Initial Point	Final Point		
Grand total				5783	2,46
Aeva Resort West Coast	Coastal Walk	S 3° 50.683’ E 133° 58.633’	S 3° 50.499’ E 133° 58.619’	577	0,29
	Snorkeling	S 3° 50.679’ E 133° 58.639’	S 3° 49.940’ E 133° 58.780’	1900	0,76
Lavera Coast	Coastal Walk	S 3° 50.944’ E 134° 01.055’	S 3° 50.902’ E 134° 00.986’	197	0,10
	Snorkeling	S 3° 50.936’ E 134° 01.054’	S 3° 50.902’ E 134° 00.984’	703	0,28
Avunawala Coast	Coastal Walk	S 3° 51.340' E 134° 00.886’	S 3° 51.335' E 134° 00.824’	418	0,21
	Snorkeling	S 3° 51.336' E 134° 00.892’	S 3° 51.284' E 134° 00.775’	284	0,11
Coastal Faranggawa Strait	Coastal Walk	S 3° 50.623' E 134° 01.889’	S 3° 50.599' E 134° 01.743’	313	0,16
	Snorkeling	S 3° 50.606' E 134° 01.755’	S 3° 50.650' E 134° 01.942’	704	0,28
East Coast of Aeva Resort	Snorkeling	S 3° 49.624' E 133° 58.949’	S 3° 49.611' E 133° 59.040’	381	0,15
	Snorkeling	S 3° 49.519' E 133° 59.543’	S 3° 49.476' E 133° 59.603’	306	0,12

Table 6. Density Values of *H. henryi* Based On Monitoring in 2022 and 2023

Year	Total Number of Individuals	Sweep Area (Ha)	Density (Ind/Ha)
2022	5	4.3	1.2
2023	6	2.46	2.4

The abundance of *H. henryi* in Kaimana Regency waters depends on its density value in the sampling area. The calculation of *H. henryi* density in 2022 monitoring obtained a value of 1.2 ind/Ha and in 2023 obtained a density value of 2.4 ind/Ha (Table 6). These density values interpret that there are about 2.4 ind of *H. henryi* occupying one hectare in the waters of Kaimana Regency, especially the waters of Triton Bay, because all individuals observed were in the coastal area of Triton waters. Abundance also depends on the estimated distribution area of *H. henryi* species, where the estimated distribution area is estimated at 1,148 km^2 or 114,800 Ha (Vanderwright et al. 2021). Based on this area, the abundance of *H. henryi* was 137,760 ind in the waters of Kaimana Regency in 2022, and doubled in 2023 at 275,520 ind.

Discussion

Pattern Identification Key

H. henryi has a relatively slender body shape and tapers back to the caudal fin. Both dorsal fins have almost the same size and pattern of dark-colored saddles and most of the dorsal fin is not spotted, only at the base of the dorsal fin, the pattern of spots on the anterior cross section of the pectoral fin and pelvic fin tends to be few and small. The number of spots on the pectoral fins ranges from 6-18, and the pelvic fins range from 6-10, (Allen et al 2016). The black spot on the back of the head after the gill slits and pectoral fins, looks like two black circles that are incompletely joined, and the white circle around the black spot tends to be thin and faint (Figure 2.a). The pattern of spots on the body of *H. henryi* tends to be small and widely spaced, spreading from the head to the base of the tail (Allen et al 2016).

H. henryi adults have a saddle pattern on the anterior body where this saddle is visible due to the presence of a faint dark color across the body of about 10 lines and is calculated to be arranged from the head to the tip of the tail back. The saddle pattern is clearly visible during the juvenile phase in *H. halmahera* (Jutan et al. 2018) and fades with growth. In contrast to the *Hemiscyllium* species, the saddle stripe pattern across the body of other species tends to be formed and composed of polygons or dark spots, while in *H. henryi* it tends to be a dark line on which there are small black spots.

Figure 4. Comparison of Brown Spot Pattern and Post-Cephalic Ocellatus Between *H. henryi*, Triton Bay, Indonesia (left; photo: Prehadi) and *H. ocellatum*, Magnetic Island, Queensland, Australia (right; photo: A. Lewis (Allen et al. 2016))

Allen et al. 2016 compared all nine *Hemiscyllium* species, and stated that *H. henryi* is most similar to *H. ocellatum,* which is distributed in eastern Australian waters because both have brown spots spreading over their bodies, a small size, a pair of saddle patterns on both dorsal fins. The striking difference between *H. henryi* and *H. ocellatum* is the black circle behind the head or post-cephalic ocellus. *H. henryi* appears to be formed from two circles that join imperfectly, while *H. ocellatum* is a complete circle with a clearly visible white circle on the edge. In addition, the brown spots on H. henryi are smaller and fewer in number than on *H. ocellatum.*

Length-Size Distribution

Data collection on the total length of *H. henryi* in this study can be used to ensure that individuals monitored and recorded are not the same individuals at the same time of monitoring in the same year. Double data collection can occur because *Hemiscyllium*, especially *H. ocellatum*, tends not to show a particular pattern of habitat use or does not stay on one reef or region in the short or long term, which is different from other shark species that tend to show predictable movement patterns over time (Morrissey & Gruber 1993, Heupel et al. 2004, Heupel & Beunet 2007).

The length of *H. henryi* recorded tends to vary, indicating that *H. henryi* populations can still be found in various sizes from juvenile, to adult phases so that the population is considered to be still developing in its natural habitat. Based on total length (TL) growth with age in *H. ocellatum*, it is stated that individuals will measure 15 cm when hatching from eggs after incubation for 130 days, reach a size of about 20 cm after 4 months after hatching, increase TL to about 30 cm after 12-18 months, and TL up to 45-51 cm after 2 years (Allen et al. 2016, Jutan et al. 2018). Based on the above statement, almost all individuals monitored and recorded in the study of *H. henryi* in the coastal waters of Triton Bay were more than 2 years old, and one individual was seen during monitoring as a juvenile. Juvenile individuals were not documented because the samples could not be captured and hid in the rubble massif.

The longest TL size in this study was *H. henryi* with a length of 88 cm, a male found at the Lavera Beach location point, Triton Bay. This is a new record for the maximum TL growth size for the *H. henryi* species, where previously it was known that the maximum TL size of *H. henryi* reached 82 cm (Vanderweight et al 2021), the maximum female TL measured 81.5 cm and the maximum male TL measured 78.3 cm (Allen et al 2016). Based on these findings, it is known that the maximum size of males is larger than the maximum size of females.

Length Weight Relationship

The length-weight relationship of H. henryi in Triton Bay, Kaimana Regency, can be said to be closely related when seen from the high correlation coefficient value. Then the coefficient of determination obtained indicates that about 95% of length growth is related to weight gain. Then with a value of b> 3, the initial hypothesis of the growth pattern of *H. henryi* in the study area is positive allometric, but when tested further with the t-test, the t-count value obtained is smaller than the t-table, so it is concluded that the growth pattern of *H. henryi* in the study site is isometric, or the increase in length and weight is proportional (Akbar et al. 2023). Length-weight relationships of other *Hemiscyllium* species in Eastern Indonesia vary, such as *H. Halmahera* in Morotai, Halmahera, Tidore, Ternate, Maitara, and Guraici are negatively allometric (Akbar et al. 2023; Madduppa et al. 2020), *H. galei* in Doreri Bay is negatively allometric (Insani et al. 2022). The length and weight of the walking shark itself is influenced by the presence of food and the condition of the aquatic environment, which is certainly related to the growth rate and metabolic ability of the species (Akbar et al. 2023). Information on morphometrics, meristics, biological conditions, and populations of a species itself is important as a basis for developing management policies and conservation efforts (Akbar et al. 2023).

Abundance Estimation

The abundance of *H. henryi* in 2023 doubled to 275,520 ind in an estimated distribution area of 114,800 ha, whereas in 2022 the estimated abundance was only 137,760 ind. The increase in abundance occurred due to an increase in the density value of the monitoring results where the density value in 2022 was only 1.2 ind/Ha and became 2.4 ind/Ha in 2023. Possible factors causing the increase in abundance include regulations set by the Government of Indonesia in KP Decree Number 30 of 2023 related to the full protection of running sharks so that extractive utilization is reduced, increased public awareness not to hunt sharks, and differences in monitoring areas in 2022 and 2023. The abundance obtained in 2023 tends to be very large, because previous estimates conveyed that there were only about 46,000 ind in 114,800 Ha of potential *H. henryi* habitation area (Vanderwight et al. 2021).

CONCLUSION

The conclusions of this study indicate that *H. henryi* can be identified by a distinctive pattern of small, evenly spaced brown spots across its body. As individuals grow, the saddle line pattern on the body tends to fade, and the post-cephalic ocellus shows a unique pattern of two partially merged circles. The dorsal fin exhibits a pair of saddle patterns along with brown spots at the base, while the pectoral fins display a few scattered brown spots. The maximum recorded body length for male *H. henryi* reached 88 cm. Additionally, the growth pattern of *H. henryi* in the coastal waters of Triton Bay, Kaimana Regency, is isometric, meaning that length and weight increase proportionally. The abundance of *H. henryi* has increased by 100% from 2022 to 2023.

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