Journal of Aquaculture and Fish Health Vol. 14(3) - September 2025
P-ISSN: 2301-7309 / E-ISSN: 2528-0864
doi : 10.20473/jafh.v14i3.72699

Recent Population of Banggai Cardinalfish (*Pterapogon kauderni*) in Kendari Bay – Southeast Sulawesi

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Received : 2025-08-05
Accepted : 2025-07-16

Keywords :
Banggai cardinalfish, Density, Kendari Bay

Abstract

The Banggai Cardinalfish, *Pterapogon kauderni*, has been introduced and spread in Kendari Bay, Southeast Sulawesi. The purpose of this study is to estimate the current fish density and distribution of microhabitats in Kendari Bay. Observations of fish populations used the belt transect method at 5 observation stations, with 4 replications per station. Overall fish density ranged from 82±10 individuals/100 m^2 to 1,509±583 individuals/100 m^2. The fish choose to associate with micorohabitats such as Diadema sp. (69.1%), fire coral from the genus Millepora (16.4%), Sea anemone (10.7%), and seagrass (3.8%). *P. kauderni* was observed coexisting with other fish species in microhabitats such as around seagrass roots and corals, without showing significant aggressive behavior. Considering its ecological adaptations, *P. kauderni* is potentially suitable for aquaculture systems that combine multiple species. With the right domestication approach, this species has great potential for development in a sustainable ornamental aquaculture industry.

INTRODUCTION

The Banggai Cardinalfish (*Pterapogon kauderni*) is a group of marine ornamental fish from the Apogonidae Family, which is known in the international ornamental fish trade as Banggai Cardinal Fish (BCF). BCF is an endemic fish from the Banggai Islands, Central Sulawesi, with 'endangered' status by the IUCN (Ndobe *et al*., 2018). In its natural habitat, this fish can be found at a depth of 4 – 8 m, but is more dominant in shallow waters of less than 1.5 m and lives in association with schools of sea urchins (Arbi *et al*., 2022). This fish has a unique visual appearance that attracts the enthusiasm of foreign ornamental fish lovers, with a rising selling price up to 21-25 USD (Artayasa *et al*., 2022).

The high demand for BCF has driven overexploitation of its natural habitat in the Banggai Islands, causing its population to decline (Ndobe *et al*., 2023). In addition, several studies have reported that the fish has been intentionally introduced to several areas in Indonesia, such as the Lembeh Strait (Mogontha *et al*., 2020), Ambon (Huwae *et al*., 2019; Wibowo *et al*., 2019), Makassar (Moore *et al*., 2020), Bali (Putra and Putra, 2019), and Kendari (Kusumawardhani *et al*.,

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2019; Subhan *et al.*, 2022). This introduction activity can potentially cause a serious problem of invasion of BCF in the future if not mitigated properly.

The invasive potential of BCF has been raised in previous studies. An early study on its invasive potential, in the Lembeh Strait, BCF has succeeded in becoming a permanent population after being released as many as 664 individuals, with the presence of recruits of 475 juveniles within a span of one month (Erdmann and Vagelli, 2001). Another study was conducted in Gilimanuk-Bali, BCF was found at a depth of 0.5 – 2 m, a total of 381 individuals were successfully observed with a density of 0.76 individuals/m^2 (Putra and Putra, 2019). In nature, BCF has a relatively short reproductive cycle of 3 months, fecundity reaches 50 eggs per individual, but the seed survival rate reaches 95.23% (Pompon *et al.*, 2019). High egg survival is closely related to the behavior of BCF, which cares for eggs in the mouth (mouth breeder). There is no pelagic larval phase, and the fish can spawn throughout the year after reaching adulthood at 3.4 cm (Ndobe *et al.*, 2017). In addition, BCF has poor camouflage behavior that uses sea urchins to protect itself from predators.

In 2010, around 7,000-10,000 BCF were imported from the Banggai Islands, Central Sulawesi (Subhan *et al.*, 2022). The fish were initially released around Kendari Bay, such as Sama Jaya Village and Bokori Island, and have since spread to ±20 km from the initial introduction location (Kusumawardhani *et al.*, 2019). This introduction aimed to ease the fishermen, reducing the strenuous navigation across the fierce Banda Sea to get to the Banggai Islands for fishing and to meet the routine demand for small-scale ornamental fish. However, the COVID-19 pandemic between 2020-2021 has caused many ornamental fish exporters in Kendari to stop operating, thus halting the fishing. This pause is expected to increase the BCF fish population in Kendari Bay, as no harvesting has been held for two years.

The purpose of this study was to determine the population structure of *P. kauderni* in Kendari Bay waters in terms of density, size distribution, and microhabitat. The latest information on the distribution and population is very useful and needed as a reference in determining recommendations to the management authority, especially regarding the trade quota and management of BCF nationally. The results of this study provide information and basic data for further monitoring of the existence of BCF in Southeast Sulawesi. Furthermore, the scientific findings of this study may come as a valuable insight for future mitigation strategies for the potential invasiveness of BCF. Additionally, understanding the population structure and microhabitat preferences is also important to support domestication efforts for *P. kauderni* in the context of aquaculture development. The process of domestication can involve a variety of methods, including artificial feed, controlled spawning management, and a cultivation environment that resembles the animal's natural environment. These efforts not only contribute to the sustainability of the ornamental fish trade but also serve as a conservation strategy to reduce pressure on wild populations.

METHODOLOGY

Ethical Approval

There were no animals harmed or improperly treated during this research.

Place and Time

The study was conducted around Kendari Bay, Southeast Sulawesi Province. Data collection was carried out in October – December 2024. The research location was divided into 5 observation stations. The selection of stations was based on information on the presence of BCF obtained from interviewing local fishermen, BCF entrepreneurs, and references from previous literature. The specific sampling locations are presented in Table 1.

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Table 1. Sampling locations and conditions of water substrates.

Site Name	Coordinate		Subtrates Condition
	Latitude	Longitude	
Waworaha	3°53’47.8” S	122°34’40.2”	Seagrass bed, sandy
Samajaya	3°55’31.6” S	122°39’06.4”	Sandy, a lot of Urchin
Bokori Island	3°56’20.1” S	122°39’37.6”	Coral reef
Mata	3°58’08.5” S	122°36’47.2”	Rubble
Tondonggeu	4°00’05.3” S	122°38’31.4”	Coral reef

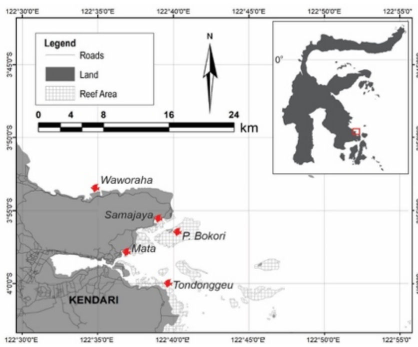

Figure 1. Map of data collection locations, red marks are fish survey points.

Research Materials

The study is an underwater survey activity using SCUBA (Self Contained Underwater Breathing Apparatus) equipment, Slate and underwater writing instruments, an underwater camera (Olympus TG-7, Japan), GPS (Garmin-GPSMap 67, Japan), a roll meter (50 m tape meter), and a Rubber Boat.

Research Design

The data collection method used in this study is a quantitative descriptive method. A total of three locations were selected as sampling stations. The five locations were selected based on initial information obtained from various sources about the presence of BCF in the waters, especially from marine biota traders. In addition, the selection of locations was also based on initial observations conducted in a number of other locations suspected of containing the fish population.

Work Procedure

The fish observation process was carried out underwater with the help of SCUBA diving equipment. BCF observations were carried out using the Underwater Visual Census method by applying the modified Belt Transect method (Hill and Wilkinson, 2004) by drawing a 20-meter transect line parallel to the coastline. The BCF observation area was carried out at a radius of 2.5 m to the right and left of the transect line. So that the area of observation is 20 x 5 = 100 m^2 for each transect. Then, 4 repetitions of the transect were carried out with a gap of 10 m for each station. Schematically, a picture of the observation of BCF in one transect is presented in Figure 2.

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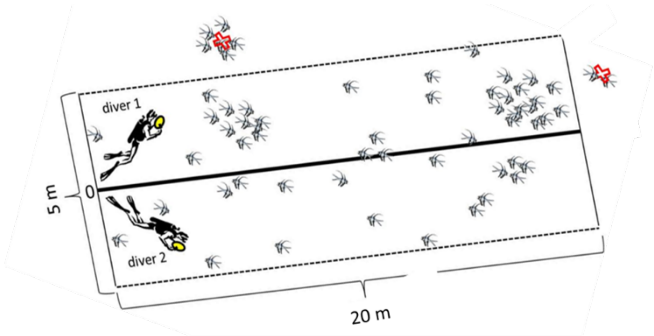

Figure 2. Illustration of fish population observation using the Belt Transect method measuring 20 m x 5 m (Wibowo *et al.*, 2019).

Counting the number of Banggai cardinal fish by 2 divers to count fish on the left and right sides of the transect. To avoid bias against BCF recorded more than once, observers swam at a constant speed and were careful not to count the same fish or group of fish more than once (Hill and Wilkinson, 2004). In addition, framing was also carried out via video, so that it could be more detailed and minimize bias. Furthermore, divers also estimated the length of the fish directly. During the length estimation observation, BCF was classified into 3 body size groups (TL = Total Length), namely the juvenile group consisting of larvae (size <2 cm SL), juveniles (size 2-6 cm TL), and adults (> 6 cm TL) (Arbi *et al.*, 2022). The method for determining fish body length follows the commonly used fish morphometric rules, as presented in Figure 3.

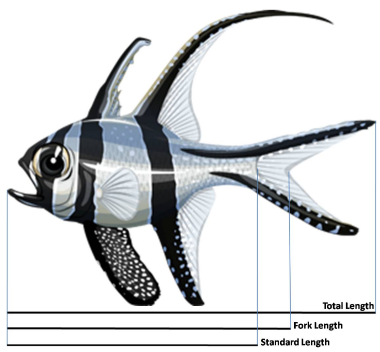

Figure 3. Guideline for measuring fish body length (Standard Length, Fork Length, Total Length).

Some of the data collected include habitat (coral reefs, seagrass beds, or others) and microhabitats (sea urchins, especially Diadema sp., hard corals, soft corals, sea anemones, sponges, seagrass vegetation, or others), abundance (individuals/m^2), and individual size estimates. BCF microhabitat measurements were taken at the same location as BCF density measurements. Microhabitat data obtained in the study include the types of microhabitats used by BCF and the number of individuals or colonies of each available microhabitat. Furthermore, presented in tables and graphs and analyzed descriptively.

Counting the number of BCF fish by 2 divers to count fish on the left and right sides of the transect. Divers count the number of fish directly and the type of microhabitat they occupy. Observers swam at a constant speed and avoided counting the same fish or group of fish more than once to minimize bias against Banggai cardinal fish recorded more than once (Hill and Wilkinson, 2004). Additionally, framing was also carried out via video, allowing for more detailed analysis and minimizing bias. Some of the

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data collected included habitat (coral reefs, seagrass beds, or others) and microhabitats (sea urchins, especially Diadema sp., hard corals, soft corals, sea anemones, sponges, seagrass vegetation, or others), abundance (number of individuals/m^2), and estimation of individual size (TL = Total Length). Generally, BCF lives in association with colonies of sea urchins, sea anemones, branch corals, sponges, and other microhabitats. The determination of the type, number, and area of microhabitats was conducted on the same transect as the measurement of individual density. Microhabitat area measurement refers to the method of measuring coral colonies according to English *et al*. (1997) (Figure 4).

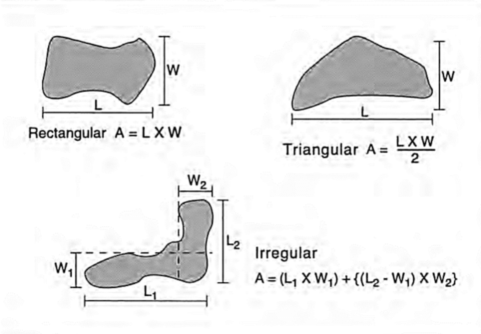

Figure 4. Micro-habitat area measurement method (English *et al*., 1997).

Data Analysis

The density of Banggai cardinal fish individuals per unit area of observation was calculated based on the formula presented by Carlos *et al*. (2014):

$$D = \frac{c}{A}$$

Description :

D =Individual compactness or density (individuals/100 m^2)

C =Number of individuals counted in the transect

A =Area observed (100 m^2)

The difference in density levels at each observation location was then calculated using one-way analysis of variance (ANOVA) with the help of AnalyStat software. Furthermore, if the suspicion of a difference in the average density of each location is proven, it is continued with a significant difference test (Fisher's LSD test). Furthermore, the microhabitat data obtained in the study include the type of microhabitat used by BCF and the number of individuals or colonies of each available microhabitat. Furthermore, it is presented in tables and graphs and analyzed descriptively.

RESULTS AND DISCUSSIONS

A total of 9,380 BCF individuals were counted during the study period. The location with the highest density was in Samajaya Village with a value of 1,509±583 individuals/100 m^2. The location with the lowest density was in Waworaha Village with a density of 82±10 individuals/100 m^2. Other locations have BCF densities such as Bokori Island (357±172 individuals/100 m^2), Tondonggeu Village (307±44 individuals/100 m^2), and Mata Village (92±22 individuals/100 m^2 (Figure 1).

The high density of BCF on the coast of Samajaya Village is because this area is the initial introduction location in Kendari Bay. Overall, the average density value is in the range of 82-1,509 individuals/100 m^2. As a comparison, the census results in the waters of the Banggai Islands obtained 4-30 individuals/4,800 m^2 (Vagelli, 2011), when compared to the density of fish in Kendari Bay is clearly less. This fish has also been introduced to Ambon Bay with a density of 5-42 individuals/100 m^2 (Huwae *et al*., 2019). However, in some of the largest numbers of fish in one group that have ever been recorded, it can reach 500 individuals associated with *Enhalus acoroides* (Vagelli, 2011). The behavior of BCF that live in groups in microhabitats, such as sea urchins, anemones, and branch corals, forms small groups with varying numbers. Generally, each group is composed of 1 – 6 individuals with an appearance percentage of 60-80% (Arbi, 2022).

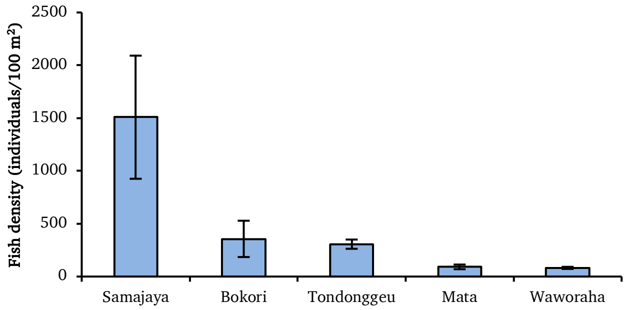

Figure 5. Average density (x±sd) of *P. kauderni* at each observation station.

Table 2. Results of the real difference test (Fisher's LSD test) of density values based on observation location.

	(1) Samajaya	(2) Bokori	(3) Tondonggeu	(4) Mata	(5) Waworaha
(1) Samajaya	-				
(2) Bokori	0.0091*	-			
(3) Tondonggeu	0.0063*	0.5934	-		
(4) Mata	0.0028*	0.0223	0.0001*	-	
(5) Waworaha	0.0027*	0.0189	0.00005*	0.4642	-

Note : The "*" shows significantly different values.

The results of one-way analysis of variance (one-way-ANOVA, F(0.05;2;7) = 3.0556) obtained a statistical probability value of P <0.05. Based on this value, the assumption that there is at least one average value of the samples from the five observation locations that is larger or smaller is true. Furthermore, based on the follow-up test or significant difference test (Fisher's LSD test), the significant differences in the average samples of each observation station are presented in Table 2. The results of the significant difference test show a significant difference between the average BCF density in Samajaya Village and other stations, respectively (P1-2 = 0 0.009), (P1-3 = 0.0063), (P1-4 = 0.028), (P1-5 = 0.0027). Furthermore, significant differences in BCF density are also shown at the locations of Mata Village and Waworaha Village against Tondonggeu Village (P3-4 = 0.0001) and (P3-5 = 0.0000). Meanwhile, in other areas, if the values are (P2-3, P2-4, P2-5, and P4-5), the comparison of average density is not so significant.

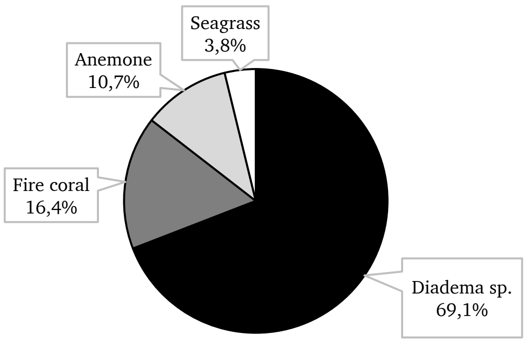

Figure 6. Percentage of BCF density based on microhabitat types of sea urchin (*Diadema* sp.), fire coral, sea anemone, and seagrass.

A microhabitat is a small or limited part of a larger habitat, and its nature is different from its surroundings. The BCF population found was at a depth of 4 – 7.5

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m and was generally found at a depth of 5 m. Most fish were found associated with sea urchins, Diadema sp. (69.1%), while others were associated with fire coral from the genus *Millepora* (16.4%), Sea anemone (10.7%), and seagrass (3.8%) (Figure 6).

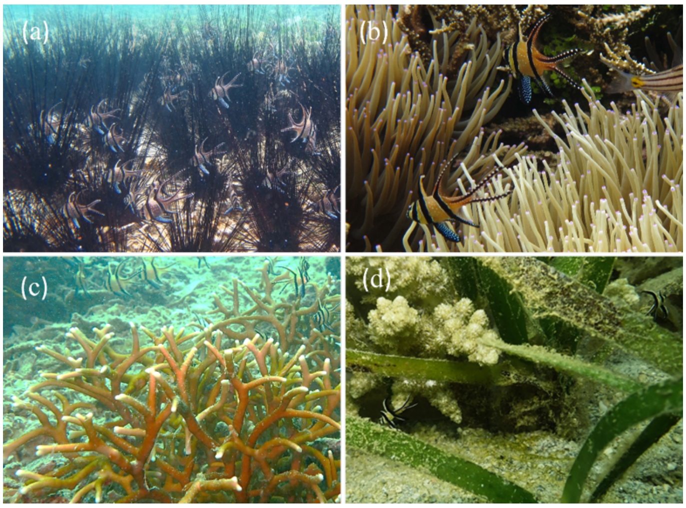

Figure 7. Banggai Cardinalfish (BCF) is associated with several microhabitat variations in the waters of Bokori Island: (a) Sea urchin, *Diadema* sp., (b) Anemone, (c) Fire Coral, *Millepor*a sp., and (d) seagrass, *Enhalus acoroides*.

BCF are known to have minimal movement and poor camouflage methods, which make them very vulnerable to predators. Therefore, these fish utilize anemones, sea urchins, and branch corals as shelters as well as microhabitats. The BCF microhabitats found include anemones, fire corals, and sea urchins found at depths of 4-7.5 m (Figure 7). Initially, *P. kauderni* were found in shallower waters of 1.5 – 2 m and lived in association with schools of sea urchins. The cleaning of sea urchins by the management of Bokori Island tourism for the safety of tourists caused the fish to move to other, deeper microhabitats. The highest concentration of fish was found in the anemone type, with a percentage of 10.17% of the total density. This finding is quite different from several previous studies, where sea urchins (*Diadema setosum*) have been known to be the most common species as a microhabitat for BCF (Carlos *et al.*, 2014; Huwae *et al.*, 2019; Kusumawardhani *et al.*, 2019; Moore *et al.*, 2020; Ndobe *et al.*, 2019). As a comparison, observations in their original habitat in the Banggai Islands showed that the concentration of fish in the branching coral microhabitat reached 37-44%, sea urchins 32-40% and 21-24% in anemones (Vagelli, 2011). Several BCF groups containing 6-104 individuals made minimal movements while taking shelter above the anemone. The type of anemone that is a microhabitat for BCF is *Heteractis crispa*, where the anemone also lives in association with the *Amphiprion ocellaris* fish, with 2-5 individuals. Another type of anemone is *Entacmaea quadricolor*, where there is an associated fish, *Premnas biaculeatus*, with 1-3 individuals. Although there are other fish associated with the anemone, BCF can live peacefully with the associated fish.

Fire corals are the second most preferred microhabitat inhabited by BCF. Fire corals from the genus *Millepora* are known to have nematocyst cells, which are stinging cells commonly found in Hydrozoa animals, such as jellyfish (García-Arredondo *et al.*, 2012; Radwan and Aboul-Dahab, 2004). A recent study in the waters of Luwuk, Central Sulawesi, Hydrozoa from the type Cassiope adromeda are the main choice for the recruit and juvenile phases of BCF in this symbiotic relationship (Arbi and Faricha, 2021). Fire corals can be a comfortable area for shelter, although BCF must share space with other fish such as

Chrysiptera hemicyanea (Pomacentridae), *Dascyllus aruanus* (Pomacentridae), and *Cheilodipterus isostigmus* (Apogonidae). As far as observed, the BCF can coexist with these species.

In terms of size distribution, small BCF or the larger recruit category (<2.5 cm TL (Total Length) are relatively more commonly found in sea urchin (*Diadema* sp.) microhabitats, with several parents (>5 cm TL) found together with other juveniles. More mature fish tend to hover above the sea urchin, where smaller fish take shelter from predators. The hovering behavior of adult fish is to anticipate predators, and when one approaches, they will simultaneously take shelter in the gaps between the sea urchins. The types of predatory fish that often target young recruits and juveniles are the Scorpanidae, Serranidae, Cirrhitidae, and Labridae families (Kusumawardhani *et al.*, 2019; Ndobe *et al.*, 2013).

CONCLUSION

The population density of BCF in Kendari Bay and its surroundings can be categorized as quite high when compared to other areas in Indonesia. The distribution of larger fish body lengths is more dominant in the Diadema sp. Microhabitat, compared to other microhabitats such as fire coral and sea urchins. Overall, BCF can coexist with other species such as Amphiprion ocellaris, Premnas biaculeatus, Chrysiptera hemicyanea, Dascyllus aruanus, and Cheilodipterus isostigmus. The invasive potential of this animal has not been clearly seen because the fish can coexist with other types of fish without disturbing each other in the same or adjacent microhabitat.

CONFLICT OF INTEREST

We declare that there is no conflict of interest in the writing and publishing of the manuscript among all authors.

AUTHOR CONTRIBUTION

We declare that there is no conflict of interest in the writing and publishing of the manuscript among all authors.

ACKNOWLEDGMENTS

The authors are grateful to BPI (The Indonesian Education Scholarship Program), PPAPT (Center for Higher Education Funding and Assessment) Ministry of Higher Education, Science, and Technology of Republic Indonesia, PUSLAPDIK (Educational Financing Service Center) of the Ministry of Education, Culture, Research and Technology Republic of Indonesia, and LPDP (Educational Fund Management Institution), Ministry of Finance of the Republic of Indonesia for funding this research.

REFERENCES

Arbi, U.Y., 2022. Endemisme spesies biota perairan: Studi kasus pada ikan capungan Banggai (*Pterapogon kauderni*). *Oseana*, *47*(1), pp.1-11. https://doi.org/10.14203/oseana.2022.Vol.47No.1.110

Arbi, U.Y. and Faricha, A., 2021. New host record of microhabitat preferences of the Banggai cardinalfish (*Pterapogon kauderni*) in the introduced habitat in Luwuk waters, Sulawesi. *IOP Conference Series: Earth and Environmental Science*, *944*, 012018. https://doi.org/10.1088/1755-1315/944/1/012018

Arbi, U.Y., Ndobe, S. and Dirhamsyah, 2022. Ikan Capungan Banggai (*Pterapogon kauderni*) sebuah catatan bioekologi dan introduksi. Balai Pustaka, Jakarta.

Artayasa, I.K.S., Manabanti, M.S., Sari, D.E. and Ndobe, S., 2022. Growth and survival of Banggai cardinalfish (*Pterapogon kauderni*, Koumans 1933) reared with artificial microhabitat. *IOP Conference Series: Earth and Environmental Science*, *1075*, 012009. https://doi.org/10.1088/1755-1315/1075/1/012009

Carlos, N.S.T., Rondonuwu, A.B. and Watung, V.N.R., 2014. Distribusi dan Kelimpahan *Pterapogon kauderni* Koumans, 1933 (Apogonidae) di Selat Lembeh Bagian Timur, Kota Bitung.

Cite this document Subhan, Prayitno, S.B., Sabdaningsih, A. and Asriyana, 2025. Recent Population of Banggai Cardinalfish (*Pterapogon kauderni*) in Kendari Bay – Southeast Sulawesi. *Journal of Aquaculture and Fish Health*, *14*(3), pp.465-474.

Platax Scientific Journal, *2*(3), pp.121–126. https://doi.org/10.35800/jip.2.3.2014.9124

English, S., Wilkinson, C. and Baker, V., 1997. Survey Manual for Tropical Marine Resources, 2nd edition. AIMS, Townsville.

Erdmann, M.V. and Vagelli, A., 2001. Banggai cardinalfish invade Lembeh Strait. *Coral Reefs*, *20*(3), pp.252–253. https://doi.org/10.1007/S003380100174

García-Arredondo, A., Rojas, A., Iglesias-Prieto, R., Zepeda-Rodriguez, A. and Palma-Tirado, L., 2012. Structure of nematocysts isolated from the fire corals *Millepora alcicornis* and *Millepora complanata* (Cnidaria: Hydrozoa). *Journal of Venomous Animals and Toxins Including Tropical Diseases*, *18*, pp.109-115. https://doi.org/10.1590/S1678-91992012000100014

Hill, J. and Wilkinson, C.L.I.V.E., 2004. Methods for ecological monitoring of coral reefs. *Australian Institute of Marine Science, Townsville, 117*. https://doi.org/10.1017/CBO9781107415324.004

Huwae, R., Patty, S.I., Arbi, U.Y. and Hehuwat, J., 2019. Studi pendahuluan terhadap populasi ikan banggai cardinal (*Pterapogon kauderni*, Koumans 1933) di Perairan Teluk Ambon Dalam. *Jurnal Ilmu Kelautan Kepulauan*, *2*(1), pp.22-31. https://doi.org/10.33387/jikk.v2i1.1192

Kusumawardhani, N.R., Arbi, U.Y. and Aunurohim, 2019. Analisis Preferensi Habitat Ikan Capungan Banggai (*Pterapogon kauderni*) di Lokasi Introduksi Perairan Kendari, Sulawesi Tenggara. *Prosiding: Implementasi Hasil Riset Sumber Daya Laut Dan Pesisir Dalam Peningkatan Daya Saing Indonesia,* pp.47–59. https://prosidingseminakel.hangtuah.ac.id/index.php/jurnal/article/view/58

Mogontha, L., Bataragoa, N.E. and Rondonuwu, A.B., 2020. Aspek Reproduksi Ikan Capungan Banggai Pterapogon kauderni Koumans, 1933 di Selat Lembeh. *Jurnal Perikanan Dan Kelautan Tropis*, *11*(1), pp.33-40. https://ejournal.unsrat.ac.id/v3/index.php/JPKT/article/view/28734/29096

Moore, A.M., Yasir, I., Ambo-Rappe, R., Ndobe, S. and Jompa, J., 2020, September. Microhabitat preference of the Banggai Cardinalfish (*Pterapogon kauderni*): a behavioural experimental approach. *IOP Conference Series: Earth and Environmental Science*, *564*, 012019. https://doi.org/10.1088/1755-1315/564/1/012019

Ndobe, S., Jompa, J. and Moore, A., 2018. A tale of two urchins-Implications for in-situ breeding of the endangered Banggai cardinalfish (*Pterapogon kauderni*). *Aquacultura Indonesiana*, *19*(2), pp.65-75. https://doi.org/10.21534/ai.v19i2.110

Ndobe, S., Moore, A., Nasmia, Madinawati and Serdiati, N., 2013. The Banggai cardinalfish: an overview of local research (2007-2009). *Galaxea, Journal of Coral Reef Studies*, *15*(Supplement), pp.243–252. https://doi.org/10.3755/galaxea.15.243

Ndobe, S., Moore, A., Yasir, I. and Jompa, J., 2019. Banggai cardinalfish conservation: priorities, opportunities, and risks. *IOP Conference Series: Earth and Environmental Science*, *253*, 012033. https://doi.org/10.1088/1755-1315/253/1/012033.

Ndobe, S., Moore, A.M. and Jompa, J., 2017. Status of and threats to microhabitats of the endangered endemic Banggai Cardinalfish (*Pterapogon kauderni*). *Coastal and Ocean Journal (COJ)*, *1*(2), pp.73-82.

https://doi.org/10.29244/coj.1.2.73-82

Ndobe, S., Serdiati, N., Gani, A., Walalangi, J.Y. and Moore, A.M., 2023. Banggai cardinalfish (*Pterapogon kauderni*) monitoring in Bokan Kepulauan (2017-2021) highlights the need for the "BCF Garden" approach. *IOP Conference Series: Earth and Environmental Science*, *1137*, 012059. https://doi.org/10.1088/1755-1315/1137/1/012059

Pompon, N., Ndobe, S., Mansyur, K. and Tis'In, M., 2019. Growth and survival of juvenile Banggai cardinalfish (*Pterapogon kauderni*) reared under different salinities in recirculating aquaria equipped with protein skimmers. *IOP Conference Series: Earth and Environmental Science*, *253*, 012002. https://doi.org/10.1088/1755-1315/253/1/012002

Putra, I.N.G. and Putra, I.D.N.N., 2019. Recent Invasion of the Endemic Banggai Cardinalfish, *Pterapogon kauderni* at The Strait of Bali: Assessment of the Habitat Type and Population Structure. *LMU KELAUTAN: Indonesian Journal of Marine Sciences*, *24*(1), pp.15-22. https://doi.org/10.14710/ik.ijms.24.1.15-22

Radwan, F.F. and Aboul-Dahab, H.M., 2004. Milleporin-1, a new phospholipase A2 active protein from the fire coral Millepora platyphylla nematocysts. *Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology*, *139*(4), pp.267-272. https://doi.org/10.1016/j.cca.2004.12.002

Subhan, Rais, M., Pratikino, A.G. and Erawan, M.T.F., 2022. Struktur populasi ikan endemik banggai cardinalfish (Pterapogon kauderni) yang diintroduksi di perairan Pulau Bokori–Sulawesi Tenggara. *Jurnal Kelautan: Indonesian Journal of Marine Science and Technology*, *15*(1), pp.15-22. https://doi.org/10.21107/jk.v15i1.13576

Vagelli, A.A., 2011. *The Banggai cardinalfish: natural history, conservation, and culture of Pterapogon kauderni*. John Wiley & Sons., New Jersey. https://doi.org/10.1002/9781119950387

Wibowo, K., Arbi, U.Y. and Vimono, I.B., 2019. The introduced Banggai cardinal fish (*Pterapogon kauderni*) population in Ambon Island, Indonesia. *IOP conference series: Earth and environmental science*, *370*, 012041. https://doi.org/10.1088/1755-1315/370/1/012041

Cite this document Subhan, Prayitno, S.B., Sabdaningsih, A. and Asriyana, 2025. Recent Population of Banggai Cardinalfish (*Pterapogon kauderni*) in Kendari Bay – Southeast Sulawesi. *Journal of Aquaculture and Fish Health*, *14*(3), pp.465-474.