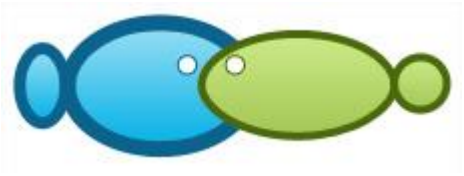

Length-weight relationships and food habits of Bali sardinella (*Sardinella lemuru*) landed in Pengambengan fishing port, Bali, Indonesia

[1]Eka Aprianti, [1,2]Domu Simbolon, [1,2]Am A. Taurusman, [1,2]Ronny I. Wahju, [1,2]Roza Yusfiandayani

[1] Marine Fisheries Technology Study Program, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Sciences, IPB University, Bogor, West Java, Indonesia; [2] Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Sciences, IPB University, Bogor, West Java, Indonesia. Corresponding author: D. Simbolon, domu@apps.ipb.ac.id

Abstract. *Sardinella lemuru* (Bali sardinella) is a species of the Clupeidae family that is mainly caught in the waters of the Bali Strait. *S. lemuru* is usually processed into canned products, boiled salted sardine, and fish meal. The high demand for *S. lemuru* promotes intensive fishing efforts and has been affected by a decline of the stock of *S. lemuru* resources. This research aimed to study the length-weight relationships of the fish body, and the food habits of *S. lemuru* caught in Bali Strait water and landed at Pengambengan fishing port, Bali. This study is expected as scientific input for sustainable use and management of *S. lemuru*. The research was conducted from April to July 2022. The average size of the fish caught was between 18.15 and 19.6 cm, and was categorized as of adult size. The result showed that *S. lemuru* has a negative allometric growth pattern, which means the fish length grows relatively faster than the weight. Several groups of taxa were found in the fish's stomach, i.e., phytoplankton from taxa of Bacillariophyceae, Dinophycea, and Cyanophyceae classes, and likewise zooplankton from the Bivalvia, Ostracoda, Oligotrichea, Branchiopoda, Copepods, Crustacea sub-phylum, and rotifers subclasses. There were variations of the food habits and types of food of *S. lemuru* based on fish size and fishing ground.

Key Words: growth pattern, fish size, food habit variations, zooplankton.

Introduction. Bali sardinella, *Sardinella lemuru*, is a small pelagic fish species with a high economic value from the Clupeidae family. This fish is mainly caught around the waters of the northern part of Bali Strait and southern part of Bali and it belongs to the species of *S. lemuru* Bleeker 1853 (Kartika et al 2017; Wujdi et al 2013). *S. lemuru* is caught using four types of fishing gears: purse seine, gill net, lift net, and traditional seine net. Purse seine has the highest Catch per Unit Effort (CPUE) value compared to the other fishing gears (Anindyas et al 2017). In 2007 it contributed 89%, and in 2016 to 71% of the total catch. The gross tonnage purse seiner ranges from 10-30 GT, with a net length ±338 m and 30 m depth. Meanwhile, a boat measures 5–10 GT, with a net length of ±56 m and a depth of 10 m. In 1998 Bali Sardinella contributed 98% to the total catch of the purse seiner in the Bali Strait (Nugraha et al 2018).

S. lemuru distribution is higher around the Eastern Indian Ocean: Phuket, Thailand, southern coasts of East Java and Bali and Western Australia, and in the Western Pacific: Java Sea, Philippines, Hong Kong, Taiwan Island, southern Japan. *S. lemuru* prefers to live in waters of 22.8–28.6 m depth (extreme depths range from 15 to 100 m), at an average temperature of 27.8°C. Length at first maturity is 14.3 cm, ranging from 14 to 15 cm (Wujdi & Wudianto 2015). *S. lemuru* adults form large schools in coastal waters, especially in upwelling areas, and some are also found in sheltered bays and lagoons. Generally, *S. lemuru* feeds on phytoplankton and zooplankton, mainly copepods (Pauly et al 1996).

Based on data on *S. lemuru* fishery production landed at the PPN Pengambengan, it was recorded that in the last ten years, from 2009 to 2021, the *S. lemuru* fishery production has fluctuated. The year 2009 was the highest production, with total production reaching 30,687 tons year^{-1}, but the following year there was a decline in catches of up to 77 tons year^{-1} in 2017. In the following years, there was a gradual increase in lemuru fishery production to reach 18,101 tons year^{-1} in 2020, and in 2021 lemuru fishery production decreased to a production volume of 12,439 tons year^{-1} (PPN Pengambengan 2022). The current research aimed to investigate the relationship between length-weight relationships and food habits of *S. lemuru* caught and landed at PPN Pengambengan, Bali. The research results can be used as a reference for sustainable use of the gear and management practices in fishing.

Material and Method

Description of the study sites. The research was carried out in the Bali Strait waters, Indonesia, from April to July 2022. The fish samples were collected in the landing site of Pengambengan fishing port, Bali.

Data collection. The *S. lemuru* fishing boats were operating in the waters of the Bali Strait: two boats were equipped with mini Purse seine and two other fiber boats with gill net fishing gear. Selection of the sample used the purposive sampling method, considering that the mini purse seine vessels operating in the waters of the Bali Strait measure <30GT and the gill net vessels measure <10GT. Of a total 54 mini purse seiner based in the PPN Pengambengan, only 10% provided samples for this study. This is because every day there were 5-10 purse seiner landing at Pengambengan fishing port. Likewise, there were 200 units of gill net fishing gear. Every day, gill net fishing gear operates about 5-10 vessels, about 10%, which provided samples. Data on the fishing ground were collected by interview, from the fisher respondents. A random sampling technique was used to select the respondents from the purse seiners and gill net vessels in the fishing port. They were chosen randomly while landing of their catch. During the interview, the fishers were also requested to mark their fishing sites on the Bali Strait Map. Additionally, fishing ground data was collected from GPS Loggers.

Length weight relationships. Fish were measured for total length and standard length using a measuring board with an accuracy of 1 mm and then weighed with a digital scale with an accuracy of 1.0 g. *S. lemuru* samples were divided into 3 size groups, namely juvenile size <11cm total length size, sub-adult size 11-15cm total length and adult with >15cm total length size. Length frequency was analyzed using length data from each total length of fish by determining the number of class intervals, class width and length frequency of each length class, and by making an extended frequency distribution graph, and then by analyzing the distribution of length classes with the Microsoft excel 2016 software. Analysis of the length-weight relationship of the samples aims to determine the growth pattern of the fish in natural habitat (Effendi 1979) as follow:

$$W = aL^b$$

Where:
W - weight (gr);
L - length (mm);
a snd b - constants.

To test the value or do the t-test (partial test) with the hypothesis of:

H_0: The relationship between length and weight is isometric

H_1: The relationship between length and weight is allometric. That is, the pattern of the relationship between length and weight is allometric positive if b>3 (weight is faster than length), and allometric negative, if b<3 (growth in length is faster than growth in weight) (Effendie 1979).

Food habits. The *S. lemuru* samples for gut content were dissected, and the digestive organs were separated from the body and preserved in 5% formalin. To analyze the food habits of *S. lemuru*, the index of preponderance was used. This method combines the frequency of occurrence and the volumetric methods (Khasanah et al 2014). The formula for the index of preponderance (IP) as follows:

$$IP = \frac{Vi \times Oi}{\sum Vi \times Oi} \times 100$$

Where:
IP - index of preponderance (%);
V_i - volume percentage of one type of food (mL);
O_i - percentage of the frequency of occurrence of one type of food (individuals);
$\sum V_i O_i$ - total of all types of food V_i x O_i.

Based on the IP percentage, food can be divided into three groups:
1. main food IP>40%,
2. complementary food IP 4<40%,
3. additional food IP<4%.

Results and Discussion

Length-weight relationships. The distribution length size of *S. lemuru* landed in Pengambengan fishing port during this study (April–July 2022) ranged from 5.5 cm to 20.8 cm (mean 14.14 cm), with the dominant frequency for a length >15 cm, which was about 59%, juvenile size of 27% and sub-adult size of 14% (Table 1).

Table 1

Sardinella lemuru size group

Length size group	*Length size (cm)*	*Total sample (ind)*	*%*
Juvenile size	<11 cm	98	27
Sub-adult size	11-15 cm	52	14
Adult	>15 cm	216	59

The measurements of the total length and weight of landed *S. lemuru* from the Bali Strait fishing ground showed a total length of 5.5–20.8 cm (Figure 1).

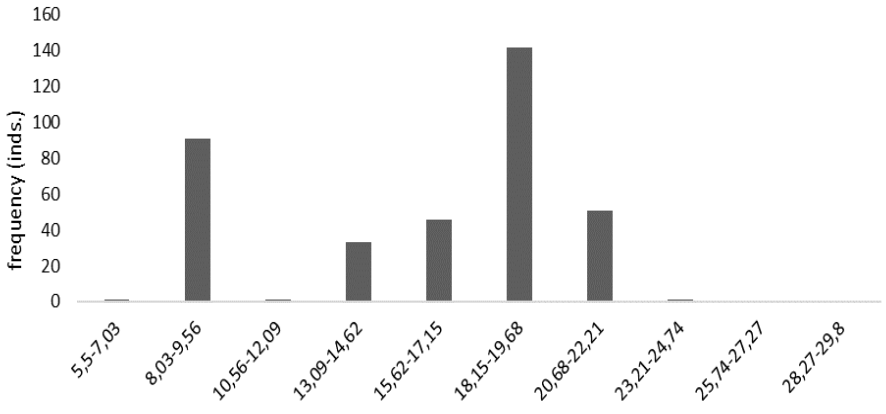

Figure 1. Total length distribution of the *Sardinella lemuru*.

Growth is an increase in size in terms of shape, volume, and size over a certain period. Changes in length frequency are also one of the parameters determining the growth. Total *S. lemuru* specimens' number observed during the study reached 366 (of both sexes). The minimum and maximum lengths of *S. lemuru* observed were 5.5 cm and 20.8 cm, respectively. The highest frequency of length of Bali Sardinella was in the ranges of: 18.15-19.6 cm (142 fish), 8.03-9.56 cm (91 fish), and 20.68-22.2 cm (51 fish).

Compared with the length at the first maturity of *S. lemuru*, which is 16.8 cm, it can be indicated that the specimens caught in April-July are above the length at first maturity. Their size at first maturity decreased to 16.8 cm in 2015 (Wujdi et al 2015). The *S. lemuru* caught in April-July exceeded their length at first maturity. The high percentage of slecimens having a length suitable for catching them will be a severe threat to the *S. lemuru* resource stock, which is the most catched target by the Pengambengan fishers. A large number of juvenile fish was caught due to a low mesh size of the purse seine and to its lack of selectivity related the fish size. Length-weight relationship analysis is used to evaluate the growth pattern of the fish. Based on the length-weight relationship analysis of *S. lemuru*, it is known that the linear regression model between the length and weight of the *S. lemuru* is $y = 0{,}01247x^{2{,}82767}$ (R^2 = 0.96%). The t-test (α=0.05) on the value of b showed that *S. lemuru* had a negative allometric growth pattern of its exponential growth pattern, where the size increase in lengthwas faster than in weight (Figure 2).

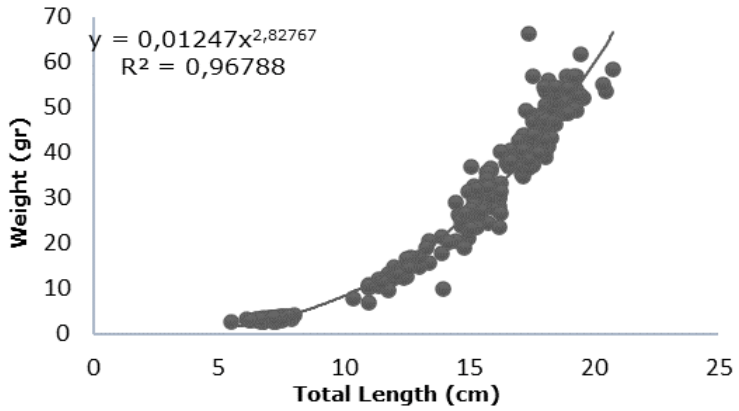

Figure 2. Length-weight relationship.

The length-weight relationship is not always fixed, and the value depends on fishing grounds and sampling time. Different values of *b* in a species are primarily influenced by the level of ontogenic development, species differences, age, gonadal maturity index, and sex, but also by geographical location, environmental conditions, seasons, and stomach fullness (Gani et al 2020; Pertami et al 2020; Laia et al 2021; Nurtira et al 2021; Annisa et al 2021).

Food habits. Based on the results of the analysis of the stomach contents of *S. lemuru* landed in PPN Pengambengan collected in April, several organisms from the classes Bacillariophyceae, Dinophycea, and Cyanophyceae were found, while the zooplankton group was from the classes Bivalvia, Ostracoda, Oligotrichea, Branchiopods and from the copepod subclass, crustacea subphylum, Rotifera phylum. In the research conducted by Sihombing et al (2017), the most abundant phytoplankton and zooplankton species found in the waters of the Bali Strait from March to May were from the Bacillariophyceae class and from the subclass of copepods, respectively. Determination of food habits based on length size groups was conducted to observe the differences in the type and composition of food used by *S. lemuru* in different size groups. The composition of lemuru food based on the length group can be seen in Figure 3.

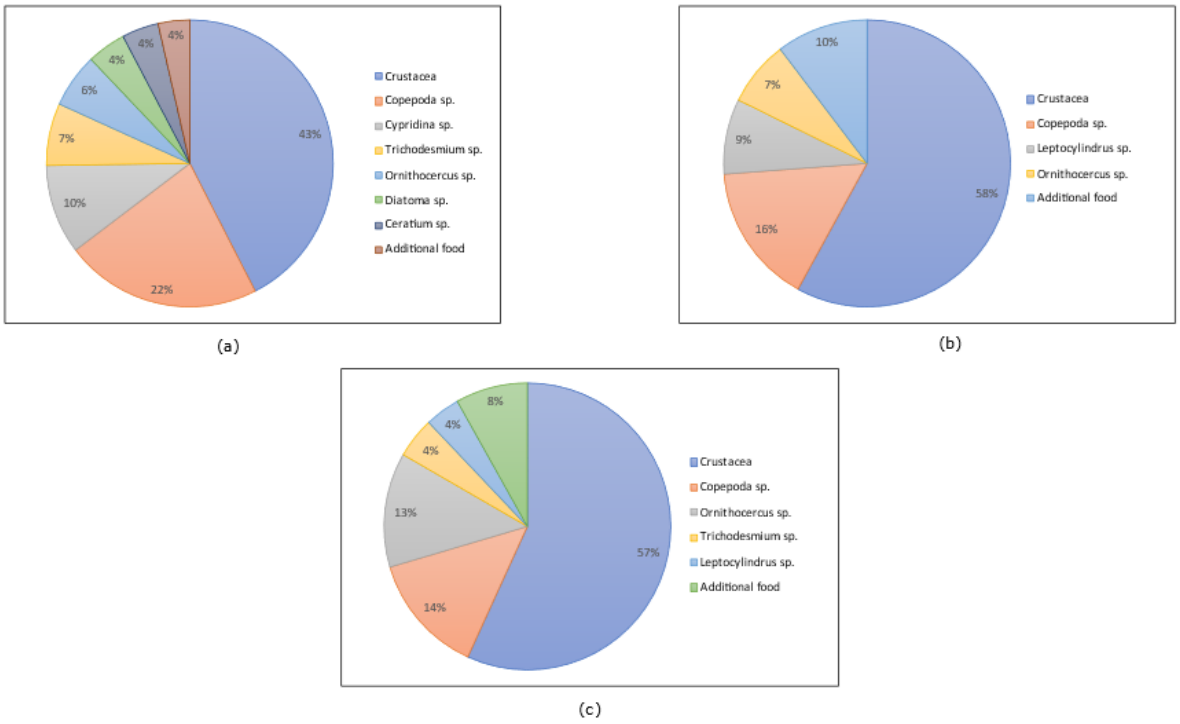

Figure 3. Index of preponderance of *Sardinella lemuru* (a) juvenile size; (b) sub-adult size; (c) adult size.

The juvenile size, due their highest index of preponderance (IP) to a percentage of 43% Crustaceans, which can be classified as the main food. Additional food consisted of 9 other species: *Copepod* (22%), *Cypridina* sp. (10%), *Trichodesmium* sp. (7%), *Ornithocercus* sp. (6%), *Diatoma* sp. (4%), and *Ceratium* sp. (4%) as a complementary food and the species of *Coscinodiscus* sp. (2%), *Navicula* sp. (1%).

The sub-adult sized *S. lemuru* due their highest IP to a percentage of 57% Crustaceans, which are classified as main foods. Complementary food consisted of 18 species: *Copepod* (14%), *Ornithocercus* sp. (13%), *Trichodesmium* sp. (4%), *Leptocylindrus* sp. (4%), *Asterolampra* sp. (0.147%), *Asteromphalus* sp. (0.108%), *Bivalvia* (0.093%), *Ceratium* sp. (1.645%), *Coscinodiscus* sp. (0.944%), *Cypridina* sp. (1.6%), *Diatoma* sp. (0.124%), *Diploneis* sp. (1.952%), *Eutintinnus* sp. (0.124%), *Navicula* sp. (1.055%), *Ostracoda* (0.124%), *Peridinium* sp. (0.147%), *Rotifera* (0.147%).

The adult sized *S. lemuru* due their highest IP to a percentage of 58% Crustaceans, which are classified as the main food. Complementary food consisted of 19 species: *Copepod* (16%), *Leptocylindrus* sp. (8%), *Ornithocercus* sp. (7%) as a complementary food and the species of *Actinocyclus* sp. (0.1743%), *Asteromphalus* sp. (0.1414%), *Ceratium* sp. (1.8543%), *Coscinodiscus* sp. (2.5183%), *Cypridina* sp. (2,6827%), *Diatoma* sp. (0.9791%), *Eutintinnus* sp. (0.2498%), *Evadne* sp. (0.1743%), *Navicula* sp. (0.519%), *Ostracoda* (0.1561%), *Peridinium* sp. (0.1972%), *Pyrocystis* sp. (0.1561%), *Rotifera* (0.1612%), *Tintinnopsis* sp. (0.2828%), *Trichodesmium* sp. (0.1034%).

There are several coordinate points for sampling the food habits of S. *lemuru*, which can be seen in Figure 4 and Table 2.

The variation of feeding habits of *S. lemuru* is influenced by gill filter density, that increases with the fish age. The gill pieces become thick and wide with the fish age. Thus the filtering system of the gills causes variations in the food entering the intestine (Pradini et al 2001; Hendiari et al 2020). The feeding habits is also governed by prey size, fish age, mouth opening size, starving level, and food intake frequency.

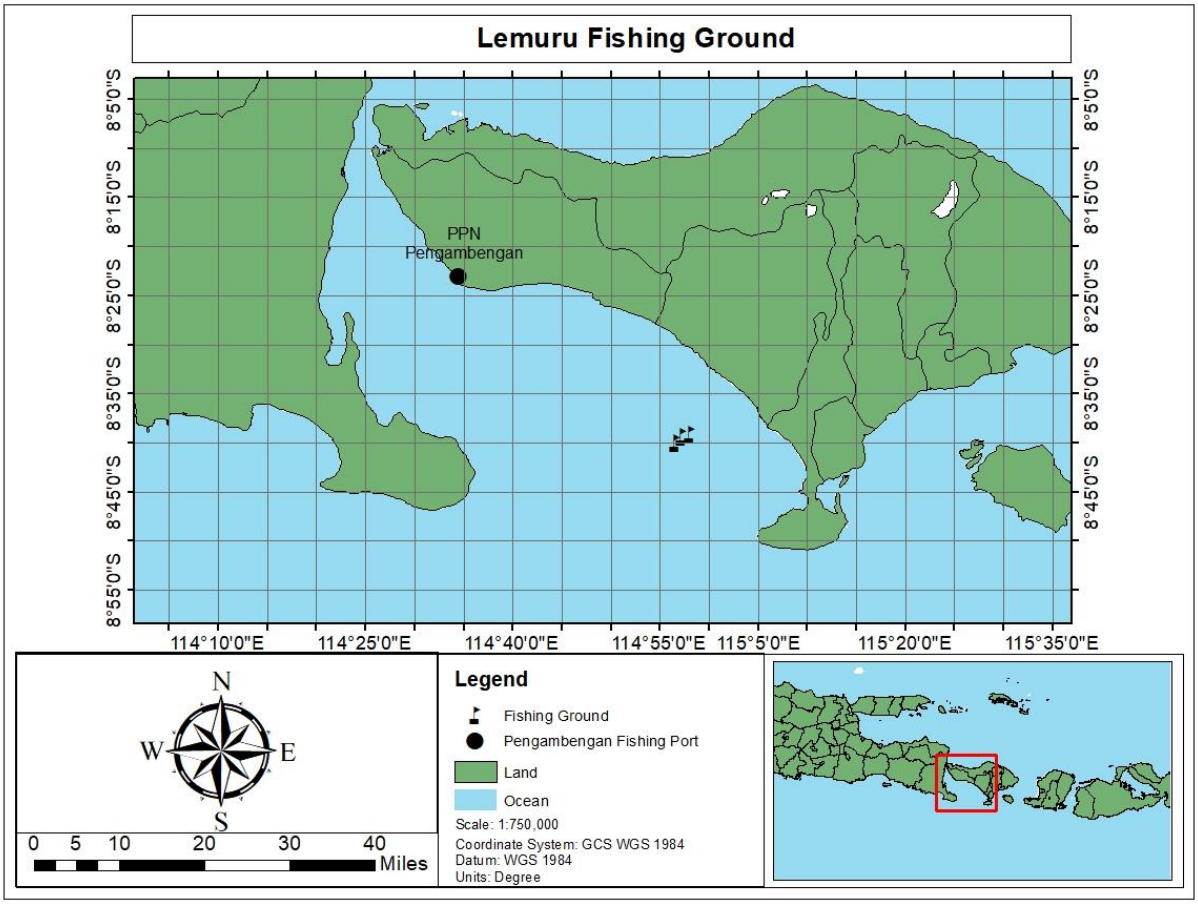

Figure 4. *Sardinella lemuru* fishing ground.

Table 2

Sardinella lemuru food habits by size and fishing ground

Latitude	*Longitude*	*Fish size group*	*Species (taxa)*
-8,667	114,943	Juvenile	-
		Sub-adult	Asterolampraceae (1.05%), *Bivalvia* (0.7), *Ceratium* sp. (2.80), *Copepoda* sp. (18.09%), Crustacea (74%), *Ornithocercus* sp. (1.17%), *Peridinium* sp. (1.05%), *Rotifera* (1.05%)
		Adult	*Actinocyclus* sp. (0.88%), *Ceratium* sp. (0.91%). *Copepoda* sp. (18.39%), *Coscinodiscus* sp. (0.88%), Crustacea (56.85%), *Cypridina* sp. (4.01%), *Evadne* sp. (0.88%), Ornithocercus sp. (13.51%), *Peridinium* sp. (1.12%), *Rotifera* (0.91%), *Tintinnopsis* sp. (1.60%)
-8,656	114,953	Juvenile	*Ceratium* sp. (5.18%), *Copepoda* sp. (18.52%), *Coscinodiscus* sp. (1.61%), Crustacea (43.47%), *Cypridina* sp. (12.61%), *Diatoma* sp. (5.47%), *Navicula* sp. (1.61%), *Ornithocercus* sp. (5.18%), *Trichodesmium* sp. (6.31%)
		Sub-adult	*Asteromphalus* sp. (0.79%), *Ceratium* sp. (2.57%), *Copepoda* sp. (13.57%), *Coscinodiscus* sp. (0.63%), Crustacea (27.30%), *Cypridina* sp. (7.09%), *Diatoma* sp. (0.91%), *Diploneis* sp. (7.01%), *Leptocylindrus* sp. (3.89%), *Navicula* sp. (2.85%), *Ornithocercus* sp. (16.09%), *Trichodesmium* sp. (17.24%)

Latitude	*Longitude*	*Fish size group*	*Species (taxa)*
-8,652	114,968	Adult	*Copepoda* sp. (4.76%), Crustacea (85.71%), *Eutintinnus* sp. (4.76%), *Leptocylindrus* sp. (4.76%)
		Juvenile	*Copepoda* sp. (23.58%), *Coscinodiscus* sp. (9.43%), Crustacea (24.52%), *Leptocylindrus* sp. (14.15%), *Ornithocercus sp.* (9.43%), Parafavella sp. (9.43%), *Trichodesmium* sp. (9.43%)
		Sub-adult	*Copepoda* sp. (5.88%), *Coscinodiscus* sp. (2.20%), Crustacea (40.87%), *Cypridina* sp. (0.75%), *Eutintinnus* sp. (1.18%), *Leptocylindrus* sp. (14.12%), *Navicula* sp. (1.51%), *Ornithocercus* sp. (28.69%), *Ostracoda* (1.18%), *Trichodesmium* sp. (3.57%)
		Adult	*Asteromphalus* sp. (0.76%), *Ceratium* sp. (4.95%), *Copepoda* sp. (13.23%), *Coscinodiscus* sp. (7.40%), Crustacea (22.18%), *Cypridina* sp. (3.24%), *Diatoma s*p. (5.30%), *Leptocylindrus* sp. (31.31%), *Navicula* sp. (2.81%), *Ornithocercus* sp. (6.52%), *Ostracoda* (0.84%), *Trichodesmium* sp. (0.56%)

Phytoplankton is a microalgae containing chlorophyll which is important for photosynthesis process in the water. The biomass of phytoplankton in a water is indicated by the concentration of chlorophyll a (Simbolon et al 2017; Susilo et al 2021; Nugraha et al 2018; Sambah et al 2020; Puspasari et al 2018). Phytoplankton is the lowest level in the marine food chain, being the main food source of *S. lemuru*. The fish also uses zooplankton as additional food. Therefore, the abundance of phytoplankton and zooplankton in water could support the availability of food stocks for the fish. Increasing fitoplankton biomass is strongly related to the abundance of this fish species in the Bali Strait water. The Bali Strait has high nutrient concentration, supporting the phytoplankton biomass. In the food chain, phytoplankton is consumed by groups of small fish such as *S. lemuru* andalso by large fish, forming a potential fishing ground.

Conclusions. The length of *S. lemuru* caught from April to July 2022 ranged from 5.5 to 20.8 cm with the highest number of catches for the 18.15–19.6 cm length size. Most of the catches exceed the allowable catch size (more than Lm=16.8 cm). Length-weight relationships of *S. lemuru* indicated a negative allometric growth pattern. The feeding habits of this fish show preferences for zooplankton for the phylum of Mollusc, Arthropods, Ciliophora and Rotiferes as the main food, and for phytoplankton from the phylum of Ochrophyta, Myzozoa, and Cyanobacteria as additional food.

Acknowledgments. The authors would like to thank to the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia for funding this research with the contract number 3772/IT.3.L1/PT.01.03/P/B/2022.

Conflict of interest. The authors declare no conflict of interest.

References

Anindyas L., Wijayanto D., Jayanto B. B., 2017 [Analysis of catch per unit effort and utilization rates of fishery resource Lemuru (*Sardinella lemuru*) in the Bali Strait]. Indonesian Journal of Capture Fisheries 1(1):1–9. [In Indonesian].

Annisa K. N., Restu I. W., Pratiwi M. A., 2021 [Growth aspects of lemuru (*Sardinella lemuru*) landed in Pengambengan fishing port, Bali]. Current Trends in Aquatic Sciences 4(1):82–88. [In Indonesian].

Effendie M. I., 1979 [Fisheries biology method]. Yayasan Dewi Sri Publisher, Bogor Indonesia, 117 p.

Gani A., Bakri A. A., Adriany D. T., Serdiati N., Nurjirana, Herjayanto M., Nur M., Satria D. H., Opi C. J., Jusmanto, Adam M. I., 2020 [Length-weigth relationship and condition factor of *Sicyopus zosterophorum* (Bleeker, 1856) in Bohi River, Banggai Regency, Central Sulawesi]. National Marine and Fisheries Symposium 7(6):85–92. [In Indonesian].
Hendiari I. G. A. D., Sartimbul A., Arthana I. W., Kartika G. R. A., 2020 [Genetic diversity of lemuru fish (*Sardinella lemuru*) in Indonesia waters]. Aquatic Sciences Journal 7(1):28-36. [In Indonesian].
Kartika G. R. A., Sartimbul A., Widodo W., 2017 [Genetic variance of *Sardinella lemuru* in the Bali Strait water]. Indonesian Journal of Marine Science and Technology 10(1):21. [In Indonesian].
Khasanah R. I., Sartimbul A., Herawati E. Y., 2014 [The composition of the stomach contents of the lemuru fish (*Sardinella lemuru*) in the Bali Strait water]. Proceedings of the National Fisheries Seminar 2(1962):315–322. [In Indonesian].
Laia R. E., Restu I. W., Ayu M., 2021 [Reproductive aspects of Lemuru (*Sardinella lemuru*) landed in Pengambengan fishing port,Bali]. Current Trends in Aquatic Science 4(1):96–101. [In Indonesian].
Nugraha S. W., Ghofar A., Saputra S. W., 2018 [Monitoring Lemuru fisheries on Bali Strait Waters]. Management of Aquatic Resources Journal (MAQUARES) 7(1):130–140. [In Indonesian].
Nurtira I., Restu I. W., Pratiwi M. A., 2021 [Lemuru fish production and growth (*Sardinella lemuru*) landed at PPI Kedonganan, Bali]. Current Trends in Aquatic Science 4(2):141–151. [In Indonesian].
Pauly D., Cabanban A., Torres Jr F. S. B., 1996 [Fishery biology of 40 trawl-caught teleosts of Western Indonesia]. ICLARM, Manila, pp. 135-216.
Pertami N. D., Rahardjo M. F., Damar A., Nurjaya I. W., 2020 [Lemuru fish, the belle of the disappearing Bali Strait fisheries]. Warta Iktiologi 4(1):1–7. [In Indonesian].
Pradini S., Rahardjo M. E., Kaswadji R., 2001 [Food habits of Threadfin Bream, *Sardinella lemuru* in Muncar, Banyuwangi]. Indonesian Journal of Ichthyology 1(1):41–45. [In Indonesian].
Puspasari R., Rachmawati P. F., Susilo E., Wijopriono W., Wiadnyana N. N., 2018 [The impact of environmental changing, food availability and antropogenic pressure on Sardine (*Sardinella lemuru*) CPUE in Bali Strait Water]. Segara Journal 14(2):107–116. [In Indonesian].
Sambah A. B., Oktavia T. D., Kusuma D. W., Iranawati F., Hidayati N., Wijaya A., 2020 [Oceanographic variability and its influence on pelagic fish catch in the Bali Strait]. Berkala Penelitian Hayati 26(1):8–16. [In Indonesian].
Sihombing H. P., Hendrawan I. G., Suteja Y., 2017 [Analysis of the relationship of plankton abundance on the surface to the catch of Lemuru (*Sardinella lemuru*) in the Bali Strait]. Journal of Marine and Aquatic Sciences 4(1):151. [In Indonesian].
Simbolon D., Nurfaqih L., Sala R., 2017 Analysis of oil sardine (*Sardinella lemuru*) fishing grounds in the Bali strait waters, Indonesia. AACL Bioflux 10(4):830–843.
Susilo E., Kresnabayu I. M., Swastan I. G. A., 2021 [Map of Lemuru fishing ground in the Bali Strait]. Journal of Fisheries and Marine Research 5(2):402-409. [In Indonesian].
Wujdi A., Suwarso, Wudianto, 2013 [Biology reproduction and spawning season of Bali Sardinella (*Sardinella lemuru* Bleeker 1853) in the Bali Strait Water]. Bawal 5(1): 49–57. [In Indonesian].

Received: 14 August 2022. Accepted: 14 October 2022. Published online: 28 October 2022.
Authors:
Eka Aprianti, Marine Fisheries Technology Study Program, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, IPB University, IPB Dramaga Campus, Agathis Street, 16128 Bogor, Indonesia, e-mail: ekaaprianti100@gmail.com
Domu Simbolon, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, IPB University, IPB Dramaga Campus, Agathis Street, 16128 Bogor, Indonesia, e-mail: domu@apps.ipb.ac.id
Am Azbas Taurusman, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, IPB University, IPB Dramaga Campus, Agathis Street, 16128 Bogor, Indonesia, e-mail: azbas@ipb.ac.id
Rony Irawan Wahju, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, IPB University, IPB Dramaga Campus, Agathis Street, 16128 Bogor, Indonesia, e-mail: rwahyu06@gmail.com
Roza Yusfiandayani, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, IPB University, IPB Dramaga Campus, Agathis Street, 16128 Bogor, Indonesia, e-mail: ocha_roza@apps.ipb.ac.id

How to cite this article:
Aprianti E., Simbolon D., Taurusman A. A., Wahju R. I., Yusfiandayani R., 2022 Length-weight relationships and food habits of Bali sardinella (*Sardinella lemuru*) landed in Pengambengan fishing port, Bali, Indonesia. AACL Bioflux 15(5):2573-2581.