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Development of popular scientific books on the diversity of the Cyprinidae family in the Lake Sari Embun Area, Tanah Laut Regency

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Abstract
Sari Embun Lake is one of the areas in Tanah Laut Regency with various fish species that have potential as supporting material for local potential-based animal ecology courses. This study aims to describe the diversity of the Cyprinidae family found in the Lake Sari Embun area of Tanah Laut Regency, the process of developing a popular scientific book (PSB) on the diversity of the Cyprinidae family in the Lake Sari Embun area of Tanah Laut Regency, and the feasibility of the developed PSB, including its validity and readability. The research method used is research and development through the Plomp model. The results showed six fish species from the Cyprinidae family, namely seluang langkai (*Rasbora argyrotaenia*), puyau sangin (*Cyclocheilichthys armatus*), adungan fish (*Hampala macrolepidota*), white lampam fish (*Barbodes gonionotus*), red lampam fish (*Barbodes schwanenfeldii*), and babuluhan fish (*Osteochilus hasselti*), with a diversity index of 1.42 (medium diversity category). The PSB development process has the following characteristics: attractive appearance featuring original research images; the material described is data based on research results. The PSB validity results have a score of 3.67 with a very valid category, and the readability test results are 93.06% with very good criteria. Based on the test results, the PSB product for the diversity of the Cyprinidae family in the Sari Embun Lake area in Tanah Laut Regency is procedurally feasible for use as supporting material for the animal ecology course.

Keyword: cyprinidae diversity; feasibility; popular science book; development research

Abstrak. *Danau Sari Embun merupakan salah satu kawasan di Kabupaten Tanah Laut yang memiliki keanekaragaman jenis ikan yang berpotensi sebagai bahan pendukung mata kuliah ekologi hewan berbasis potensi lokal. Penelitian ini bertujuan untuk mendeskripsikan keanekaragaman famili Cyprinidae yang terdapat di kawasan Danau Sari Embun Kabupaten Tanah Laut, proses pengembangan buku ilmiah populer (BIP) keanekaragaman famili Cyprinidae di kawasan Danau Sari Embun Kabupaten Tanah Laut, dan kelayakan BIP yang dikembangkan, meliputi kevalidan dan keterbacaan. Metode penelitian yang digunakan adalah penelitian dan pengembangan melalui model Plomp. Hasil penelitian menunjukkan enam spesies ikan dari famili Cyprinidae, yaitu seluang langkai (Rasbora argyrotaenia), puyau sangin (Cyclocheilichthys armatus), ikan adungan (Hampala macrolepidota), ikan lampam putih (Barbodes gonionotus), ikan lampam merah (Barbodes schwanenfeldii), dan ikan babuluhan (Osteochilus hasselti), dengan indeks keanekaragaman 1,42 (kategori keanekaragaman sedang). Proses pengembangan BIP memiliki karakteristik sebagai berikut: tampilan yang menarik dengan menampilkan gambar-gambar asli hasil penelitian; materi yang dijelaskan merupakan data berdasarkan hasil penelitian. Hasil validitas BIP memiliki skor 3,67 dengan kategori sangat valid, dan hasil uji keterbacaan sebesar 93,06% dengan kriteria sangat baik. Berdasarkan hasil uji coba tersebut, maka produk BIP keanekaragaman famili Cyprinidae di kawasan Danau Sari Embun Kabupaten Tanah Laut secara procedural layak digunakan sebagai bahan ajar pendukung pada mata kuliah ekologi hewan. Kata kunci: keanekaragaman cyprinidae; kelayakan; buku ilmiah popular; penelitian pengembangan*

INTRODUCTION

The development of PSBs is the process of making textbooks in the form of books written from the results of scientific studies but not bound by the rules of scientific writing so that the text is interesting and easy to understand by the general public. (menggunakan bahasa populer). According to Setiawan (2017), popular science books are one type of book that contains science, presents facts, and is written in an easy and interesting language. According to Fitriansyah et al. (2018), it is stated that a PSB is one of the writings whose creation is based on the principles of scientific methods but is presented with simple sentences and presented in an interesting way so as to make it easier for the reader to understand a scientific work that is generally considered difficult to understand by the public.

The PSB on diversity is one of the educational materials that contains factual information presented in an easy-to-understand and interesting language about biodiversity. The family Cyprinidae is a species of fish in the Cyprinidae family. According to Syafei (2017), biodiversity is the totality of genes, species, and ecosystems present within a region. According to Ludwig & Reynold (1988), the fish diversity index is a single value that reflects the characterization of the relationship of individual abundance between species within a fish resource community. According to Mahrudin et al. (2021), the fish of the Cyprinidae family are primary freshwater fish, where they evolve in freshwater. So it can be explained that most of the fish live in the family Cyprinidae, are very dominant in fresh water, and are less able to adapt to salinity in sea water.

South Kalimantan is one of the regions that has various types of habitats that are wide and diverse, including rivers, swamps, and tropical rainforests, and one of them is a lake. One of the lakes in South Kalimantan is Lake Sari Embun. Sari Embun Lake is located in Bentok Darat Village, Bati-Bati District, Tanah Laut Regency. The location of the lake is in the rubber plantation area of PT. Bridgestone, South Kalimantan. Geographically located between -3.575137 LS-3°34'30.49248'' LS and 114.871781 E-14°52'18.4098'' E, it has a land area of 50 ha and a circumference of 2000 meters. The history of Lake Sari Embun, based on interviews with local residents, began with rice fields, which were then flooded, expanded, and dug deeper to accommodate water in the river. Based on this description, this lake area has a lot of diversity that can be developed as a learning resource based on local content.

The Animal Ecology course is intended for students of the Biology Education Study Program at Lambung Mangkurat University and must be taken. When learning is directly guided to the field, such as through practice on the theory obtained, the Animal Ecology course is delivered only using a conceptual approach and a contextual approach. Based on the results of a survey conducted on students in PSBs, namely regarding the difficulty of diversity material, the data obtained stated that diversity material is quite difficult material, and they also find it quite difficult to understand the concept of diversity through learning resources and methods used and applied by lecturers. So, basically, students need PSB as existing learning support materials.

Some studies related to the diversity of the Cyprinidae family have been conducted by Septian et al. (2020), who found 187 individuals belonging to 15 species; Mahrudin et al. (2021), who found 8 genera; and Cahyono et al. (2018), who found 10 types. Based on the results of the study, it can be seen that the Cyprinidae fish family studied is found in various aquatic habitats. This is the basis for research on the diversity of the Cyprinidae family. In other studies related to PSB, among others, it has also been carried out by Latifah et al. (2020), showing that the PSB that has been developed is contextual with very high validity. Putri et al. (2020), showing that the PSB criteria are very valid for improving students' science process skills, According to Utami et al. (2021), research on the development of learning media in the form of PSBs on mangrove diversity based on contextual learning on the material biodiversity in high schools in general from the results of validation and trials was declared very good and suitable for use. Junaidi (2021), a PSB on the diversity of dragonfly species (case study in the Tabanio Coastal Forest), obtained valid, practical, and effective results, and Saputra (2022), a PSB product that has been developed, received an average score of 44.5 with a percentage of 89% and is included in the "Very Feasible" category.

Based on the description above and several relevant studies, the researcher is interested in researching the diversity of the Cyprinidae family in the Sari Embun Lake area and its potential as teaching material in the form of a PSB as a support for animal ecology courses. The results of this research are expected to contribute to the science of biology, especially animal ecology and its learning.

RESEARCH METHODS

This study uses a descriptive research approach, namely the Research and Development method through the Akker et al. (2013) Plomp model, which has been developed by Mahanal & Zubaidah (2017) and consists of 5 phases: 1) the initial investigation phase; 2) the design phase; 3) the realization or construction phase; 4) the test, evaluation, and revision phases; and 5) the implementation phase. The research procedure consists of five phases of the Plomp Model. Briefly, it can be seen in the research scheme as Figure 1.

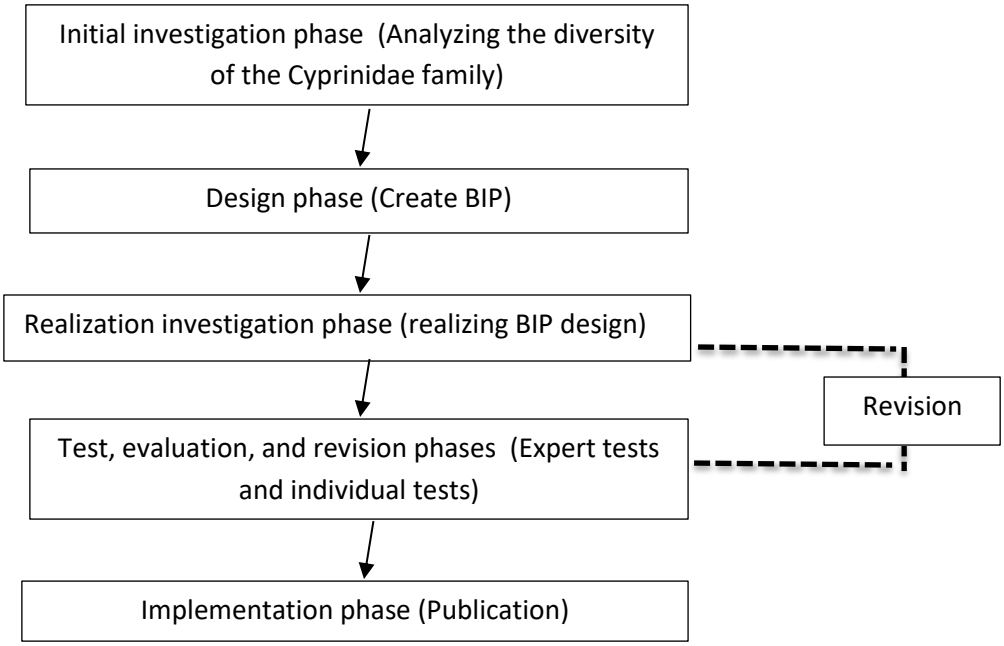

Figure 1 Research scheme

This research was conducted in the Sari Embun Lake Area, Tanah Laut Regency, to collect data on the diversity of the Cyprinidae family. Meanwhile, research and development are carried out in the Biology Education Study Program, Faculty of Teacher Training and Education, Lambung Mangkurat University (ULM) Banjarmasin. The preparation and development of the PSB took six months, from January 2022 to June 2023, including the preparation of proposals, data collection, data analysis, and the preparation of research reports. Data collection is scheduled to begin in March 2023.

The resulting PSB validity data was analyzed using the validity value of the validation results of two experts. The results of the known validity are matched with Dharmono et al. (2020) criteria, which are shown in Table 1. The resulting PSB product readability data was assessed by calculating scores using Formula 1 from three student readability tests. Based on the average score, the readability of the product is written descriptively based on students' reactions to learning during individual exams. The known readability results were matched with modified criteria according to Dharmono et al. (2020), as presented in Table 2.

Table 1 Validity criteria based on value

Score	Validity statement	Information
3.26 – 4.00	Highly valid	No revision required
2.51 – < 3.26	Valid	Minor revisions
1.76 – < 2.51	Less valid	Major revisions
1.00 – < 1.76	Invalid	Total revision

(Source: Dharmono et al., 2020)

$$\text{PK} = \frac{\text{Total score of data collection results}}{\text{Criterion score}} \times 100\% \text{.....Formula 1}$$

Description:
PK = Readability percentage (%)
Criterion score = Total maximum score of readability

Table 2 Readability criteria based on grades

No	Score	Information
1	80 > 80%	Excellent
2	70 – < 80%	Good
3	60 – < 70%	Pretty good
4	50 – < 60%	Not good
5	< 50%	Bad

(Source: Dharmono et al., 2020)

RESULTS AND DISCUSSION

Based on the results of research that have been carried out for the sampling of fish of the Cyprinidae family in the Sari Embun Lake area of Tanah Laut Regency using throwing nets or lunta at 20 observation points, the types of fish of the Cyprinidae family presented in Table 3 are obtained.

Table 3 Diversity of fish of the Cyprinidae family found in the Sari Embun Lake Area

No	Species Name	∑Ind	KR (%)	FR (%)	NP (%)	Pi	-Pi Ln Pi	
1.	*Rasbora argyrotaenia*	46	45,54	17,07	62,62	0,46	0,36	
2.	*Cyclocheilichthys armatus*	21	20,79	24,39	45,18	0,21	0,33	
3.	*Hampala macrolepidota*	15	14,85	19,51	34,36	0,15	0,28	**H' = 1,42**
4.	*Barbodes gonionotus*	14	13,86	26,83	40,69	0,14	0,27	
5.	*Barbodes schwanenfeldii*	3	2,97	7,32	10,29	0,03	0,10	
6.	*Osteochilus hasselti*	2	1,98	4,88	6,86	0,02	0,08	
	Sum	101	100,00	100,00	200,00	1,00	1,42	

Table 3 shows six different fish varieties of the Cyprinidae family at each observation point. Because 1 < H' < 3 = 1.42, the fish diversity index is classified as moderate. This shows that the abundance of fish in the Cyprinidae family is moderate. According to Saanin (1984), the Cyprinidae family is distinguished by the presence of a single protrusion on the head or behind the eyes, a free or closed eye cavity border, a slightly downward mouth, and no more than four antennae. There are no wrinkles in the jawbone joints. The dorsal fin is often hard-fingered and corresponds to the ventral fin.

The lives of living things are inseparable from the environmental factors around them, as are the lives of fish, whose main habitat is water, especially in the Lake Sari Embun area. Environmental conditions greatly influence the presence of Cyprinidae family fish in the waters. Water quality metrics can be used to identify these environmental situations. Table 4 shows the observations and measurements made in and around the Sari Embun Lake area, Tanah Laut Regency.

Table 4 Results of measurement of environmental parameters in the Lake Sari Embun area

Parameters	Measurement Results	Book
A. Abiotic		
1. Water pH	7,5	6,5-9,0*
2. Water temperature (^oC)	28,5-29,5	20-32**
3. Water brightness (cm)	33-93	50-80**
4. Dissolve oxygen (mg/L)	2,0-2,7	6,2-7,4**
B. Biotic		
5. Plankton density (Ind/L)	15.120-35.345	>1500***

The acidity degree of the water in Lake Sari Embun is 7.5, according to water quality measurements. This is beneficial for the survival of Cyprinidae fish because it meets the quality standards or criteria for the degree of acidity of the waters. According to Aprilliyani & Rahayuningsih (2020), the ideal pH of live

freshwater fish is 6.5–9.0. The dissolved oxygen value in the Lake Sari Embun area ranges from 2.0 to 2.7 mg/L. Because it meets the norms or criteria for dissolved oxygen quality in the waters, this greatly helps the survival of fish in the Cyprinidae family. According to Ayyubi et al. (2018), the ideal dissolved oxygen concentration for live freshwater fish is 6.2–7.4 mg/L.

Water quality readings for water brightness in the Lake Sari Embun area ranged from 33 to 93 cm. This helps fish in the Cyprinidae family survive because they meet water quality standards or clarity criteria. The ideal water brightness for freshwater fish is 50–80 cm.

The measurement of plankton density in the Sari Embun Lake area is 15,120–35,345 Ind/L. This shows that the waters of Sari Embun Lake are rich in food sources for fish species of the Cyprinidae family and also indicate fertile waters. According to Krebs (2014), aquatic fertility is classified as oligotrophic when the level of plankton abundance ranges from 0 to 2000 L-1 individuals, mesotrophic when the level of plankton abundance ranges from 2000 to 1500 L-1 individuals, and eutrophic when the level of plankton abundance exceeds 1500 L-1 individuals.

The fish that dominate the research area are Seluang Langkai, Quail Sangin, Adungan Fish, and White Lampam Fish. This is related to the species' adaptability in utilising food sources and habitats that support their survival and benefit their growth and development. Red lampfish and babuluhan fish, on the other hand, are rarely found.

The development of PSB using the Plomp model, consisting of 5 phases, is carried out in total. However, in the implementation phase, it is limited to limited printing and through Instagram social media. The resulting products are declared suitable for use as supporting materials for animal ecology courses. The Plomp model is one of the models that can be used to develop biology teaching materials.

This is evidenced by several studies, including research by Mecita (2019), with the title "Development of Handouts with Nuances of Drawings and Concept Maps on Classification Materials for Grade VII Students of SMPN 23 Padang," which, based on research, has produced handouts with nuanced images and concept maps about the classification of living things for grade VII students of SMPN 23 Padang that are valid and practical. Research by Hidayah (2019), titled "Development of Android-Based Human Motion System Learning Media for Grade XI Science High School Students," shows that the results are very feasible to use in biology learning activities using the Plomp development model. Another study is Ali et al. (2022), titled "Development of Teaching Materials for Plant Anatomy and Physiology Accompanied by Mind Maps to Improve Student Hots", using the Plomp model. The results of this study show that the teaching materials for plant anatomy and physiology are declared valid.

Based on the description above, the Plomp model is very suitable for developing teaching materials. The results of the three previous studies show that the teaching materials that have been developed using the Plomp model have obtained very feasible, valid and practical results. The difference between the development of PSB teaching materials and the teaching materials of the three previous studies lies in the implementation phase. In this phase, limited printing of teaching materials is carried out, namely only through Instagram social media. Although carried out on a limited basis, the results of the development of PSB regarding fish diversity are suitable for use as teaching materials.

The development of the teaching materials is a PSB using the Plomp model. After conducting field research, the PSB developed was entitled "Diversity of Cyprinidae Families in the Sari Embun Lake Area", with Figure 2 as the front cover, back cover, and table of contents. After the PSB is developed, it is then continued with the PSB feasibility test is limited only to the validity and readability tests. Two experts carried out the validity test. According to Ghozali (2013), validity tests are used to determine whether a statement is true or false. Validation of a product is very important to understand the advantages and disadvantages of the product being developed in relevance, acumen, language, and learning. This is in accordance with Arikunto (2008) that validity is a certain dimension that determines the difficulty level.

Validation considers coherence, readability, vocabulary, active and passive sentences, form, writing approach, application and implication, explanatory definition, and other styles. The validation findings are shown in Table 5, based on PSB validation by two expert validators. The results of the two validators above are given as the total value of the average validation score of 3.67. Hence, the criteria obtained from the two validators included in the validity criteria are very valid.

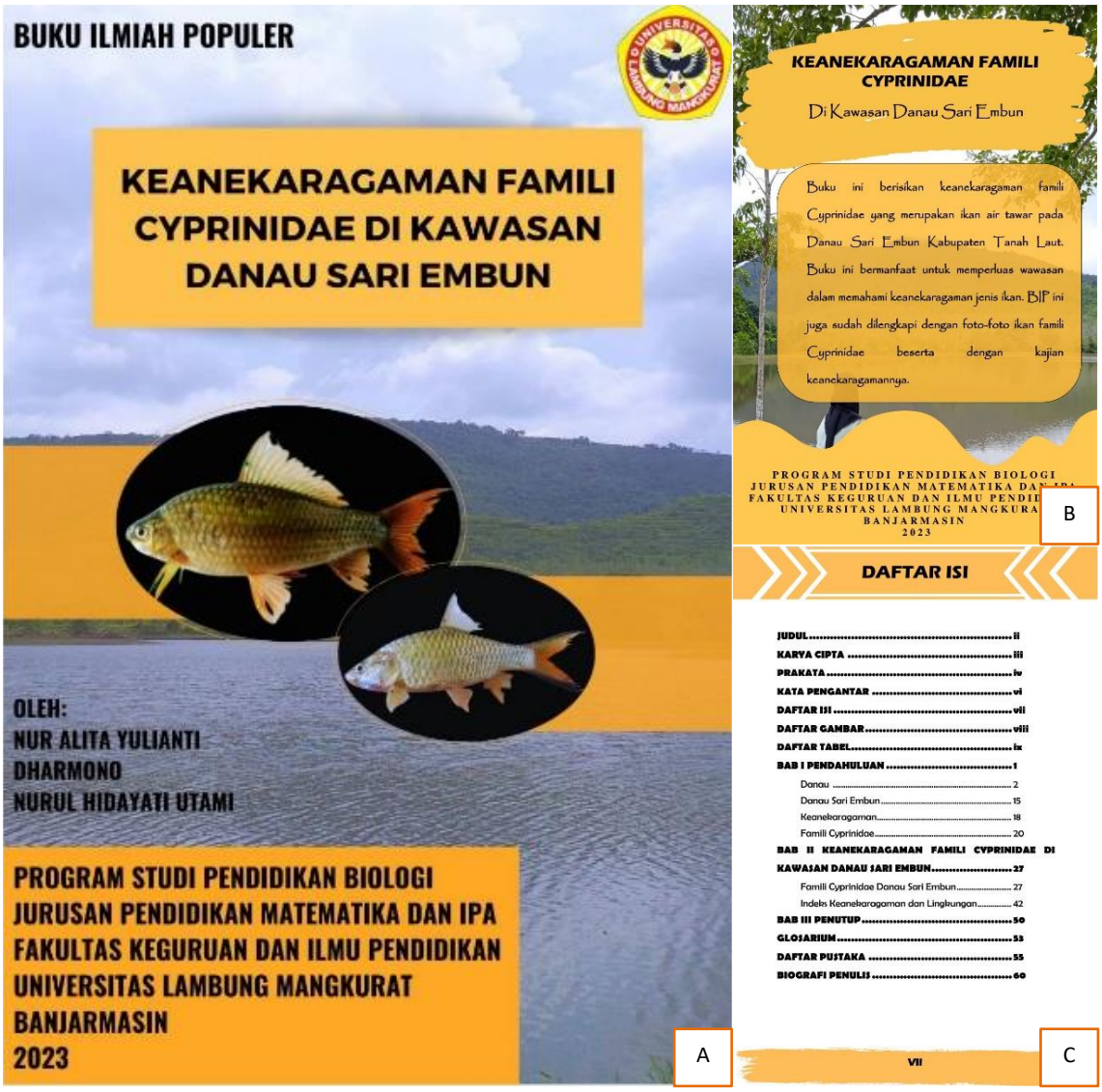

Figure 2 Design of (A) front cover, (B) back cover, and (C) table of contents (in Indonesian)

Based on the average validation results in Table 5 above, the PSBs developed are suitable for use in the field, as is done so that products in the form of PSBs can be better and can be used for further research. condition of improvement. This is done so that PSB products can be better used for further research. Good and feasible PSB products can be used as a benchmark for future research. This is in accordance with the validity contained in the teaching materials developed. According to Rahayu & Festiyed (2019), validity aims to measure the learning tools' validity. Validity is carried out by experts or practitioners who are experts in learning tools using validation sheets. According to the literature, overall, the PSB entitled "Turtles Supporting Life on Pulau Sembilan Kotabaru" was declared very valid because it was contextual in nature, had an attractive appearance, and used simple language so that students could more easily understand and learn the material according to the results of the validation by experts (Irwandi et al., 2019).

The effect of measuring validity is identifying important teaching material aspects. Aspects that need to be considered are aspects of coherence, readability, vocabulary, active and passive sentences, format, writing method, application and implication, definition of explanation, and other styles of devices in teaching materials before use. The information in the teaching materials must also contain concise, complex, and not convoluted explanations. This is in accordance with the literature; according to Dianto (2019), information is generally presented as narratives and uses analogies and metaphors to explain a complex process. According to Dharmono et al. (2020), the PSB developed has completeness ranging from design, material description, drawings, simplicity, the existence of instructions for critical thinking skills, and the emergence of regional

names to make experts provide a very valid assessment to be used as teaching materials for the Tall Plant Botany course. According to other literature, the active and passive sentence aspects of the PSB of Palm Plants (*Arenga pinnata* Merr.) that have been developed are included in the category of very valid. This means that the existence of active and passive sentences can produce stories whose sentences are clear and worthy of use (Sintia et al., 2021). Three students who completed the Animal Ecology course and received an A grade took the readability exam. The PSB, Diversity of the Cyprinidae Family in the Sari Embun Lake Region, was tested for readability to assess its appearance and presentation. According to Hidayat (2014), the purpose of the individual test is to obtain limited empirical evidence about the feasibility of the initial product.

Table 5 PSB validation results

Assessment Indicators	Validators		Average
	1	2	
Coherence Aspect			
Every paragraph in a Popular Science Book has a main idea	4	4	4
Connecting sentences using conjunction words	3	4	3,5
Ideas are presented in a row	4	3	3,5
The sentence has directed the reader to understand the content of the book	4	4	4
Total			3,75
Readability			
The content of the text is according to the age/education level	4	4	4
Sentences and many words can measure the reader's level	3	3	3
Total			3,5
Vocabulary: expressions, work, choices, redundancies			
Limited use of expressions	3	4	3,5
The word or phrase used does not use much vocabulary	4	4	4
Total			3,75
Active and passive sentences			
Using active and passive sentences	4	4	4
Total			4
Format			
In the form of scientific writings that display evidence in the form of data or systematically arranged images.	4	4	4
Total			4
Writing Method			
The simplicity and attractiveness of a piece of writing	4	3	3,5
Total			3,5
Applications, implications			
Using real-world problems to engage readers	4	4	4
Total			4
Definition of Explanation			
Use descriptions, examples, analogies and metaphors to facilitate the reader's understanding.	3	3	3
Total			3
Other styles of devices: narrative, humour, analogy			
Using analogies to explain complex ideas	3	3	3
Use a narrative to explain the idea presented	4	3	4
Total			3,5
Total average validation score		**3,67**	
Validation criteria		**Highly Valid**	

After the PSB is corrected according to the suggestions, the PSB criteria can be found in Table 6. The results of this readability test show that PSB has very good criteria, with an average score of 93.06%. This shows that PSBs are easy to understand and easy to apply in daily life by students. According to Pratiwi et al. (2014), if the teaching materials are included in the valid category in the validation test, revisions also need

to be made based on the results of individual student tests to make the product better for testing. This readability test is important so that the teaching materials developed are in accordance with the conditions of students who will use them in the field in real life. According to other literature, the assessment results on the aspect of PSB readability show that the category is very valid and can generate interest and motivation to learn from readers (Rahmawati et al., 2022).

Table 6 Student readability test results

No.	Statement	Responses		
		M1	M2	M3
1	Each part studied is easy to understand.	4	4	4
2	The entire content of the PSB is complete (Cover, editorial, preface, table of contents, introduction, main contents, references, index, glossary).	4	3	3
3	The words used are easy to understand.	4	4	4
4	The image quality is good, and you can understand what it means.	4	4	4
5	No typos or grammatical errors were found.	3	3	3
6	The photo on the cover is clear and understandable.	4	4	4
	Total	**23**	**22**	**22**
	Validation Score	**95,83%**	**91,67%**	**91,67%**
	Average		**93,06%**	
	Validation Criteria		**Excellent**	

The final product of the PSB that was made had a very good value and had been improved based on the recommendations of expert validators and three students, so this PSB was declared suitable for use as a teaching resource that supports learning. The advantages of the PSB developed are the content of the PSB in the form of material that really describes the Cyprinidae species found in the Sari Embun Lake area, the images presented originally from the Cyprinidae species found in the Sari Embun Lake area, and the language used is simple and easy for readers. The weaknesses of the PSB developed are in the aspects of readability, definition of explanation, and also in the narrative part. Therefore, these aspects should be the focus of improvement in order to produce better products. According to Latifah et al. (2020), suggestions from students related to PSBs are to clarify sentences or narratives listed in PSBs and clarify pictures of plants. This proves that students expect PSBs to be used to learn Tall Plant Botany to make it easier for them to understand the material. According to Irianti & Mahrudin (2021), other support for the assessment aspect in PSB readability can be in the form of a cover that is designed by prioritising the appearance of the object on the existing local potential, in this case, related to the species of fish of the Cyprinidae family with the river ecosystem as the background. According to Putri et al. (2020), the individual test stage results have several inputs to the PSBs developed, namely that some terms are poorly understood, so students ask to add terms to the glossary so that people can understand more terms in the glossary.

CONCLUSION

Based on the findings of the Development of PSBs on the Diversity of the Cyprinidae Family in the Sari Embun Lake Area, Tanah Laut Regency, it can be concluded that the diversity of the Cyprinidae family is included in the category of moderate diversity because it gets a score of 1.42. The score was used to make a PSB entitled Diversity of the Cyprinidae Family in the Sari Embun Lake Area. The results of the PSB met very valid and good criteria in the feasibility and readability tests. Although the results of the PSB have met the expected criteria, there are several points that still need to be considered, including the use of fishing gear during the research, which is quite heavy and whose large size greatly affects the process of catching the Cyprinidae family. Research is also only carried out until the product's validation and readability test phase, so it is necessary to conduct further research on the practicality and effectiveness of the product so that the results are even better. Meanwhile, the development of PSB products is only carried out until the implementation phase, which is developed in a limited manner and published through Instagram without going through evaluation. So it is highly recommended for further research to be evaluated before being published to the public.

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