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Quantitative Analysis of Aquatic and Associated Macrophytes in Selected Wetlands of North Dinajpur District, West Bengal

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ABSTRACT

Aquatic macrophytes are the taxonomically most diverse and important biotic component of any aquatic ecosystem. They perform significant role in both structural and functional maintenance of the ecosystem. Depth, density, diversity and types of macrophytes also represent as bioindicator of overall water body health. The current research deals with the diversity of macrophytes from 3 selected wetlands of North Dinajpur District. Extensive wetland survey was conducted from November 2021 to March 2023, reporting the presence of total 31 species belonging to 20 families. Asteraceae is the most dominant family followed by Cyperaceae and Polygonaceae. Among various growth forms, helophyte with 12 species showed qualitative dominance over hyperhydrate(06 species) followed by pleustophyte (05 species) and vittate (04 species) consecutively decreased in other form. According to Raunkiaer's life form classification therophytes (24 species) showed the dominance over other 5 life form followed by hydrophytes and hemicryptophytes (02 species each) Different ecological parameters such as dominance, diversity, species richness and evenness have also been described in the present study.

Keywords : Bioindicator, Diversity, Macrophytes, Species Richness.

I. INTRODUCTION

Macrophytes are the integral and key component of all wetland ecosystems, which are the most taxonomically diverse group of macroscopic plants[1]. Macrophytes are also considered important biotic constituents as they have an impactful role in structuring communities and maintaining ecosystems such as biomineralization, transpiration, nutrient cycling, sedimentation etc[2, 3]. Due to great ecological importance, the macrophytes are recognized as a bioindicator to analyze the depth, density, and diversity along with the overall health of the water body. Besides that of all biological treatments for

controlling eutrophication, submerged macrophytes have been recognized as being the most effective[4]. However, an aquatic ecosystem is highly affected and created alarming global concern due to the different anthropogenic activities like pollution, untreated sewage, diverting their flow, and disposal of garbages which has various detrimental effect[5]. As a result, wetlands gradually lose their native biodiversity. So the purpose of the present study is to examine the presence of macrophytes, summarize their biodiversity and distribution make documentation of three selected wetlands such as Kachan Beel, Chamrabari Beel and Paschim Beel of North Dinajpur district.

II. METHODS AND MATERIAL

A. Study area

The selected study area is the North Dinajpur district of West Bengal. North Dinajpur district lies between 25.11°N to 26.49° N latitude and between 87.49° E to 90.00° E longitude occupying a total area of 3142 sq. km. It is enclosed by Thakurgaon, Panchagarh, and Bangladesh on the East, Purnia, Kishanganj, and Katihar districts of Bihar on the West, Darjeeling district and Jalpaiguri district on the North, Malda district and South Dinajpur district on the south. The district comprises two sub-divisions: Raiganj and Islampur, 110 km apart from each other. The main rivers of this district are Kulik, Mahananda, Nagar, etc. The district is rich in alluvial soil and mostly sandy to sandy-loam in texture and porous along with thick forest. The climate of this district is characterized by a hot summer with high humidity, abundant rainfall, and cold winter. The district forms a part of a basin lying between Rajmahal hills on the east. To carry out the present intensive study three wetlands such as Kachan Beel and Chamrabari Beel of Karandighi block and Paschim Beel of Raiganj block of North Dinajpur district were selected.

B. Macrophytes collection and identification

Extensive field surveys and collection of macrophytes are important to study and analyze the current status of macrophytes diversity. So field survey was done from November 2021 to March 2023 to collect the data. The collected macrophytes were dried properly by changing the paper and carried to the laboratory to work out for identification. Different standard taxonomic literature [6,7,8,9,10, 11,12,13,14,15,16,17,18,19, 20, 21, 22,23, 24, 25, 26, 27,28, 29] were consulted for the proper identification of the flora. Besides that, POWO (Plants of the world online) was used for checking the accepted names of the identified specimen[30]. After identification vegetation of the plant species were classified after Raunkiaer's life forms(1934) and growth forms also classified according to Cook (1996).

The quadrates sampling method is the most popular method for ecological research for wetland purposes. The number of quadrates varied according to the macrophytes diversity and wetland size of the study area. Total 13 sites were located in which total 39 plots of 10 m radius were taken. GPS readings of the three selected wetlands were taken during the survey. Diversity status was assessed during the analysis. Species richness was obtained by calculating the total number of species and the diversity status of the aquatic macrophytes was calculated by using the Shannon-Weiner diversity index and Evenness analysis was also done.

C. STATISTICAL ANALYSIS

Shannon and Weiner diversity index (H) calculated using the Shannon and Weiner formula (1949)

$$H' = -\sum (ni/N)\, log_e\, (ni/N)$$

H' = Index of species diversity

ni = Density of one species

N= Density of all species

e= Base of natural logarithm log(ni/N) = 2.303log_{10} (ni/N)

∑ (ni/N)= Addition of the expression for the values of i = 1 to i = s

Simpson's Diversity Index (D)

It provides higher weightage to dominant species in the sample and decreases as diversity increases and was computed as:

$$D = 1 - \sum(pi)^2$$

where, "pi" is the proportion of individuals in the "ith" taxon of the community and "s" is the total number of taxa in the community (Simpson, 1949).

Evenness

Evenness is a measure of the relative abundance of the various species that contribute to an area's richness. The following formula was used to calculate the evenness:

$$J' = H'/H'max$$

Where: J' = Evenness index

H' = the observed value of Shannon index

H'max = lNs

S =Total number of species

III. RESULTS AND DISCUSSION

A total of 31 species of macrophytes belonging to 20 angiosperm families are tabulated in this paper (Table1) along with their growth form (Cook,1996] and life form (Raunkier, 1934). Total 39 quadrates were laid in and around the 3 sele- cted wetlands by selecting the particular sites. Out of total 39 quadrates highest 15 quadrates were laid in Chamrabari Beel (W2) followed by Kachan Beel(W1) and Paschim Beel (W3) which were 12 in each (Table 2).

Aquatic macrophytes species diversity index is found in W2(0.67) followed by W1(0.56) and W3 (0.52) respectively. Dominance index was highest in W1(0.25) followed by W3(0.24) and W2(0.18). Highest evenness was reported from W3(0.55) followed by W1(0.53) and W2(0.52).

IV. CONCLUSION

Out of total 31 aquatic macrophytes belonging from 20 families from 3 selected wetlands Asteraceae is the most dominant family followed by Cyperaceae and Polygonaceae. On the basis of different growth forms according to Cook(1996) therophytes showed the highest value followed by hydrophytes and hemicryptophytes. Foregoing study also reveals that macrophytes proliferation is gradually increasing in Chamrabari Beel(W2) as vegetation richness showing the high nutrients content. Besides that lowest dominance index and species diversity index also indicates the alarming situation to take immediate action for the conservation of macrophytes diversity due to its great ecological importance. As loss of biodiversity can disrupt the functioning of ecosystem, so there should be need of effective managements to deal with this global threatened situation.

Table 1. An enumeration of macrophytes associated with wetlands in North Dinajpur District along with their life form and growth form

Sl. No.	Scientific Name	Family	Life form (LF)	Growth form(GF)	W_1	W_2	W_3
1	*Acmella uliginosa* (Sw.) Cass.	Asteraceae	TH	Hel	+		
2	*Aeschynomene aspera* L.	Fabaceae	TH	Hel		+	
3	*Albidella oligococca* (F. Muell.) Lehtonen	Alismataceae	TH	Hyp		+	

4	*Alternanthera sessilis* (L.) DC.	Amaranthaceae	TH	Hel		+	
5	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	TH	Hyp			+
6	*Ammannia auriculata* Willd.	Lythraceae	TH	Ten			+
7	*A. baccifera* L.	Lythraceae	TH	Ten		+	
8	*Centella asiatica* (L.) Urb.	Apiaceae	TH	Hel		+	
9	*Colocasia esculenta* (L.)Schott	Araceae	GP	Hel	+		
10	*Cyperus eragrostis* Lam.	Cyperaceae	TH	Hel		+	
11	*Cyperus esculentus* L.	Cyperaceae	TH	Hel	+		
12	*Cyperus microiria* Steud.	Cyperaceae	TH	Hel		+	
13	*Eclipta prostrata* (L.) L.	Asteraceae	CH	Hel	+	+	
14	*Enydra fluctuans* Lour.	Asteraceae	HCP	Hyp		+	+
15	*Hygrophila polysperma* (Roxb.) T. Anderson	Acanthaceae	TH	Ple		+	
16	*Hygroryza aristata* (Retz.) Nees ex Wright &Arn.	Poaceae	TH	Ple			+
17	*Ipomoea aquatica* Forssk.	Convolvulaceae	HCP	Hyp			+
18	*Ludwigia adscendens* (L.) H. Hara	Onagraceae	TH	Hyp		+	
19	*L. perennis* L.	Onagraceae	TH	Hel			+
20	*Marsilea.quadrifolia* L.	Marsileaceae	TH	Ple	+	+	+
21	*Najas minor* All.	Hydrocharitaceae	TH	Vit		+	
22	*Nymphoides hydrophylla* (Lour.) Kuntze	Menyanthaceae	HY	Eph	+		
23	*Pistia stratiotes* L.	Araceae	TH	Ple	+	+	+
24	*Pontederia crassipes* Mart.	Pontederiaceae	HY	Ple	+	+	+
25	*Polygonum aviculare* L.	Polygonaceae	TH	Hel	+		
26	*Pseudognaphalium affine*(D.Don) Anderb.	Asteraceae	TH	Hyp		+	
27	*Ranunculus sceleratus* L.	Ranunculaceae	TH	Vit		+	+
28	*Rumex conglomeratus* Murray	Polygonaceae	TH	Vit			+
29	*R. palustris* Sm.	Polygonaceae	TH	Vit	+	+	
30	*Torenia crustacea*(L.)Cham.& Schltdl.	Linderniaceae	TH	Hel	+		
31	*Utricularia aurea* Lour.	Lentibulariace	CP	Pla		+	

LF(Life form) abbreviations: **CH**=Chamophytes, **CP**=Cryptophytes, **GP**=Geophyte, **HCP**=Hemicryptophytes, **HY**= Hydrophytes, **TH**=Therophytes, **GF: (Growth form)** abbreviations: **Eph**=Ephydate, **Hel=**Helophyte, **Hyp**= Hyperhydate, **Pla**=Plankton, **Ple**=Pleustophyte, **Ten**=Tenagophyte, V**it**=Vittate.

Table 2. Wetland wise statistical analysis of the aquatic macrophytes.

Name of the wetlands	Macrophytes species richness reported in wetlands	No. of sites	No. of the plots/ quadrates	Dominance_ D	Shannon_H	Evenness_e^H/S
Kachan Beel (W1)	11	4	12	0.25	0.56	0.53
Chamrabari Beel (W2)	19	5	15	0.18	0.67	0.52
Paschim Beel (W3)	11	4	12	0.24	0.52	0.55

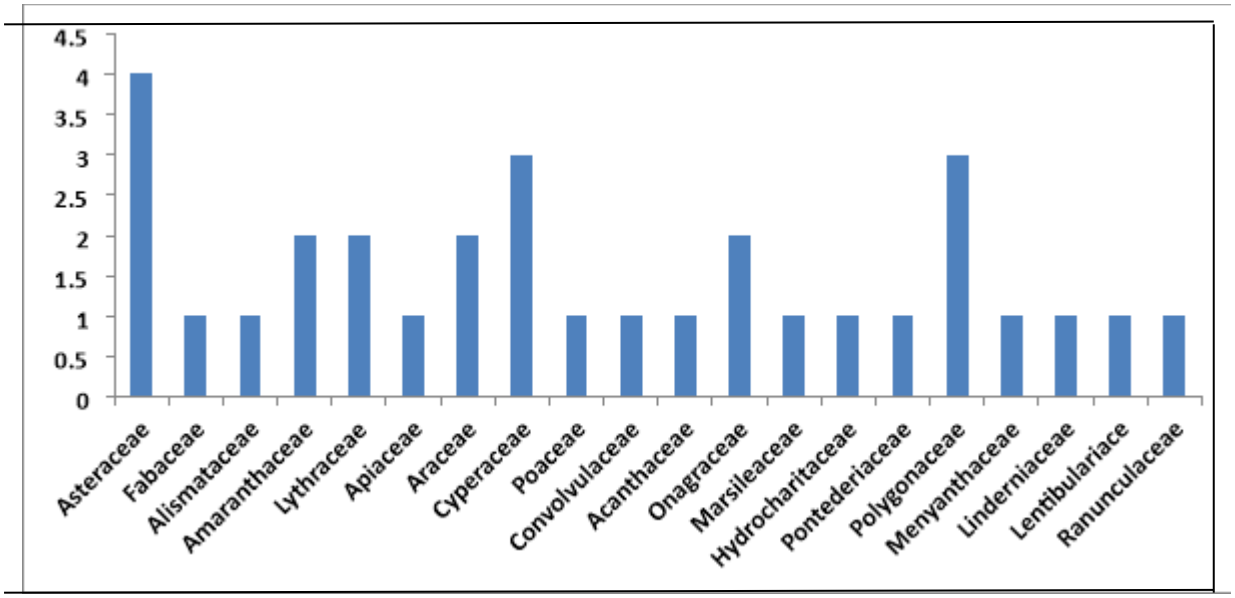

Figure 1. Presence of family throughout the study site.

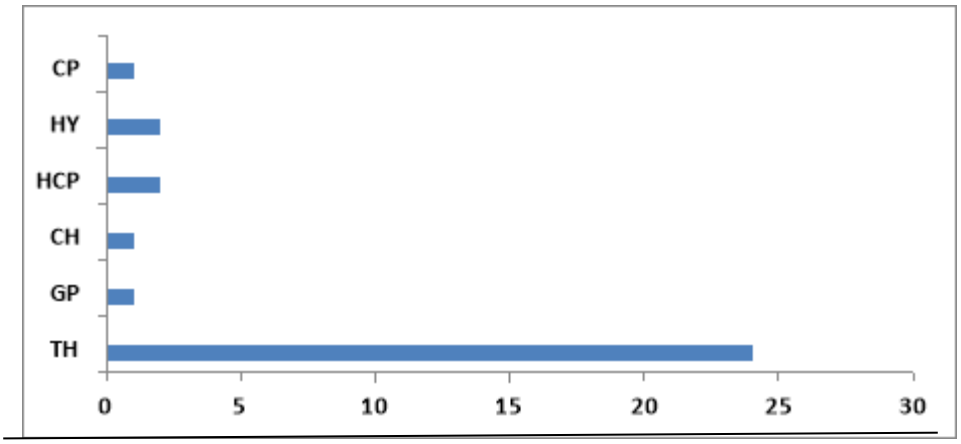

Figure 2. Life forms of documented macrophytes (Raunkiaer,1934).

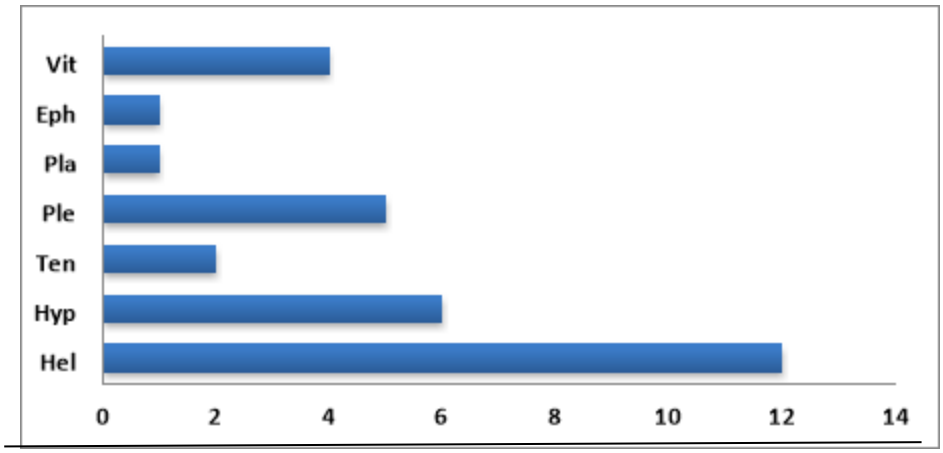

Figure 3. Growth Forms of documented macrophytes (Cook, 1996).

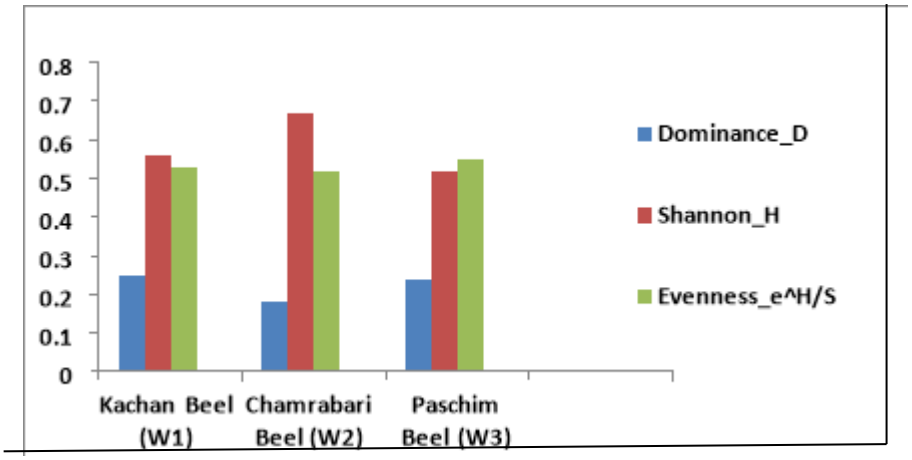

Figure 4. Wetland wise diversity indices of documented macrophytes.

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VI. REFERENCES

[1]. Lesiv,M.S., Polishchuk, A.I. and Antonyak, H. L. 2020. Aquatic macrophytes: Ecological features and functions Biologichni Studii, 14(2), 79-94.

[2]. Ayoade, A. A. and Adeyemi, H. A. 2022. Composition, distribution and diversity of macrophytes and benthic macroinvertebrate communities in eleyele Lake, Southwestern Nigeria. Biologija, 68 (4), 200-211.

[3]. Haroon, A.M. 2022. Review on aquatic macrophytes in Lake Manzala, Egypt. Egyptian Journal of Aquatic Research, 48, 1-12.

[4]. Vukov,D., Ilić, M., Ćuk, M., Igić, R. 2023. Environmental drivers of functional structure and diversity of vascular macrophyte assemblages in altered Waterbodies in Serbia, Diversity, 15, 1-15.

[5]. Jogdand,S.K.2022.Survey of aquatic macrophytes biodiversity of Domri water reservoir, Ukhanda Dist. Beed (M. S.).International Journal of Novel Research and Development, 7(4), 299-302.

[6]. Cook, C. D. K.1996. Aquatic and Wetland Plants of India.Oxford University Press, New York.

[7]. Shah, J. P., Dabgar, Y. B. and Jain, B. K. 2011. Quantitative analysis of aquatic macrophytes in certain wetlands of Kachchh district, Gujrat.Journal of Pure and Applied Sciences, 19, 11-13.

[8]. Deshmukh, U. B., Reddy, E. S. and Rathor, O. S. 2017. Survey of aquatic macrophyte diversity of Mohabala Lake from Bhadrawati Tahsil of Chandrapur district, State Maharashtra (India). International Journal of Current Science and Technology, 5(5), 413-418.

[9]. Mandal, S. K.and Mukherjee, A. 2012. Study of wetlands in Puruliya District,West Bengal With special emphasis on their macrophytes, Ph. D. Thesis, The University of Burdwan, Burdwan.

[10]. Mandal, S. K. and Mukherjee, A. 2017. Documentation of some rare species of macrophytes associated with Wetlands in Purulia District, West Bengal. Indian Journal of Scientific Research, 16(1), 73-82.

[11]. Bolpagni, R., Laini, A., Stanzani, C. and Chiarucci, A .2018. Aquatic plant diversity in Italy: distribution, drivers and strategic conservation actions. Frontiers in Plant Science, 9, 1-12.

[12]. Sarmah, R. and Das, A .K. 2020. Ecological status of aquatic vascular macrophytes of Nalbari Assam, north-east India. Indian Journal of Ecology, 47(2), 462-466.

[13]. Singh,B.P.,Krishna,A.,SinghS.C.and Kumar,S. 2020. Species diversity amongst aquatic/Wetland bodies of Lucknow district, U. P. India. Interna- tional Journal of Current Microbiology and Applied Sciences,10, 359-367.

[14]. Boro, K. K., Das, B. and Nath, N. 2021. Floristic diversity of Kakalbhagi and Borakota wetland of Sonitpur District, Assam. Journal of Applied and Fundamental Sciences, 7(2), 93-99.

[15]. Germ, M., Janež, V., Gaberščik, A. and Zelnik, I. 2021. Diversity of Macrophytes and Environmental Assessment of the Ljubljanica River (Slovenia). Diversity, 13, 1-13.

[16]. Reshi, J. M., Sharma, J. and Najar, I. A. 2021. Current status of macro phyte diversity and Distribution in Manasbal Lake, Kashmir, India. Interna tional Journal of Lakes and Rivers, 14(1), 81-92.

[17]. Patel, H. A. and Sahoo, S. 2021. A floristic account of macrophytes in The selected Wetlands of Valsad District, Gujarat, India. International Journal of Lakes and Rivers, 14(1), 113-121.

[18]. Saha, M. 2021. Diversity of wetland plants of Tripura. Bioscience Discovery, 12(2), 48-53.

[19]. Agbogidi, O .M., Nwabueze, A. A., Edema, N. E., Erhenhi, A. H. and ObiIyeke, E. G. 2022. Diversity and life forms of aquatic macrophytes in relation to physicochemical parameters of river Ethiope in Delta State, Nigeria. Annals of Plant Sciences, 11(4), 5040-5050.

[20]. Bytyçi , P., Shala-Abazi, A., Zhushi-Etemi, F. Bonifazi, G., Hysen Spahiu, M., Fetoshi, O., Çadraku, H., Feka, F., Millaku,F. 2022. The Macrophyte indices for rivers to assess the ecological conditions in the Klina river in the republic of Kosovo. Plants, 11, 1-18.

[21]. Chowdhury, M. and Chowdhury, A. 2022. Wetland Flora of West Bengal. Bluerose Publishers, Pvt. Ltd.

[22]. Jeffry, M.S.,Kimberly,B.P.,Deven, P.C.and Mary, J.P.A. 2022.Aquatic macrophytes composition and diversity in selected sites of Lumbocan river, Butuancity, Agusan del Norte, Philippines. American Academic Scientific Research Journal for Engineering, Technology and Sciences, 89(1), 1-14.

[23]. Khan, K., Shah, G. M., Saqib, Z., Rahman, I. U., Haq, S. M., Khan, M. A., Ali, N., Sakhi, S., Aziz-ud-Din, Nawaz, G., Rahim, F., Rasheed, R. A., AlFarraj, D. A.and Elshikh, M. S. 2022. Species diversity and distribution of macrophytes in different wetland ecosystems. Applied Sciences, 12, 1-12.

[24]. Mishra, R. and Singh, N. 2022. Hydrophytic plant diversity of aquatic body of Govindgarh lake in Rewa district (M.P.)India. International Journal of Applied Research, 8(7), 08-11.

[25]. Patil, P. S. 2022. Diversity of aquatic weeds in Washim region of Maha rashtra, India. International Journal of Creative Research Thoughts, 10(2), 343-347.

[26]. Paul, P. T. 2022. Aquatic plant diversity of ponds in Thrissur district, Kerala, India. Indian Journal of Ecology, 49(1), 174-177.

[27]. Tiwari, S. and Sandya, K. 2022. Current status of macrophyte diversity and distribution in Ghunghuta dam of Surguja(CG)India.International Journal of Applied Research, 8(8), 167-171.

[28]. Haque, M. and Sinha, S. N. 2022. Species diversity and distribution of macrophytes in Chupisar wetland ecosystem, West Bengal, India. Int. J. Res. Publ. Rev. 3(9), 1626-1629.

[29]. Banerjee, R. and Ghosh, A. R. 2016. Identification and quantification of aquatic macrophytes with ecological indices in the Damodar River. Int. J. Sci. Res. Sci. Eng. Technol. 2(6), 275-281.

[30]. POWO 2023. "Plants of the World Online Facilitated by the Royal Botanic Gardens, Kew Published on the internet;http://www.plantsofthe worldonline.org/Retrived11th April 2023".

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