

Role of Education and resource benefit can affect people perception towards the largest freshwater lake of Odisha, India

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Abstract

Ansupa is the largest freshwater lake of Odisha that is significant for its biodiversity and provisioning services. In the light of its wide range of social and economic benefits and many effects on human wellbeing the present communication attempts to determine local stakeholder's dependency or resource use, knowledge, and perception towards this wetland. The survey found that people living on the fringes of the lake are either directly or indirectly dependent on it, regardless of their caste or economic status, and that nearly 40% of the respondents rely completely on the lake for their livelihoods. Irrigation, pisciculture, non-timber forest products, and fodder are just some of the economic benefits derived from the lake. In this context the findings of the study highlights a substantial link between dependency, benefits, and education in influencing local residents' perceptions of the lake. Further, our study could be useful to the society in terms of Ansupa lake conservation and management planning, as well as to the local government in involving locals in lake conservation initiatives and decision-making processes.

Introduction

Wetlands are dynamic, ecologically fragile, and one of the most productive ecosystems exhibiting a wide range of ecological and financial gains to society. These wetlands function as biodiversity hotspots (Mitsch and Gosselink 2000; Bassi et al. 2014) as well as provide various ecosystem services, including flood abatement, pollution amelioration, groundwater recharge, maintenance of biogeochemical cycles, and bioremediation sites (Bassi et al. 2014; Goodwin and Niering 1974). Economically, wetlands sustain different livelihood strategies supporting agriculture, replenishing fodder availability, ecotourism, Non-timber forest product (NTFPs), and aquatic wildlife-related activities (Goodwin and Niering 1974; Kangalawe and Liwenga 2005; Bassi et al. 2014). However, despite its significance, the deterioration of wetlands around the world has gained a rapid pace. Especially during the 20th century, approximately half of the wetlands of the world have gone disappeared (Millennium Ecosystem Assessment 2005; Verones et al. 2013) owing to the ever-increasing human population and subsequent anthropogenic pressures such as over-extraction of the resources, encroachment, eutrophication, and land reclamation (Junk et al. 2012; Junk et al. 2013; van Asselen et al. 2013; Molur et al. 2014; Bassi et al. 2014). In relation to the globe, India is also not left behind in losing its wetlands and studies found a significant proportion of the countries wetlands have been lost in the last few decades (Prasad et al. 2002; Bassi et al. 2014) despite of the continuous efforts (declaring wetlands as of national or International importance, Ramsar sites, protected areas) of the Governments. In India, a total 7,57,060 numbers of wetlands have been identified by the Space Application Centre (SAC) in the year 2011, which covers around 5% of the total geographic area of the country and is also known to support about 20% of the country's biodiversity (National Wetland Atlas 2011). Hence, considering the significance, it is of the utmost important to ensure the continued existence of these ecosystems with effectively implemented conservation strategies.

In recent years' conservation initiatives programs inclusive of local communities has proven to be more effective in the restoration and conservation of natural resources (Streever et al. 1998; Silori 2007; Nepal and Spiteri 2011; Badola et al. 2012; Karanth and Nepal 2012; Scholte et al. 2016; Sinthumule 2021).

However, gaining public support has always been a challenging task and can be achieved by understanding their socio-economic and cultural status, assessing their attitude and perception or by satisfying their livelihood needs (Ogra 2009; Bhagwat et al. 2011; Badola et al. 2012; Karanth and Nepal 2012). Wetlands being full of resources provide numerous ecosystem services to the humankind (Mitsch and Gosselink 2000; Zedler and Kercher 2005; Bassi et al. 2014). However, these are less apparent to the general public, which significantly influences their perception (Meindl 2000; Nassauer 2004; Scholte et al. 2016). Besides, several other factors, including socio-economic, education, dependency, tangible and intangible benefits from the ecosystems, have also influenced the local people's attitude and perception towards conservation of wetlands (Sah and Heinen 2001; Bhattarai et al. 2020). For instance, (Ambastha et al. 2007) found that the dependency on wetlands in terms of agriculture and fishing directly affects the perception and attitude of local people towards the conservation of Kabartal wetland in the mid-Ganga basin. Similarly, in the case of Bhattarai et al. (2020), education and economic factors affecting local's attitudes and perceptions towards the conservation of the Koshi Tappu wetland in Nepal were observed.

The current communication aims at studying the socio-economic status, dependency, and perception of local communities residing at the periphery of Ansupa lake, Odisha. The study can provide baseline data for conservation planning and decision making of the largest freshwater lake of Odisha because wetland ecosystem services integrate with their social, cultural, economic, and political status and strongly impact the sustainability of their livelihood. If this is not appropriately conserved and managed, this relation will conversely affect the sustainability of the wetland (Finlayson et al. 2019).

Methods

Study area

Ansupa, a horseshoe-shaped lake, is the largest freshwater lake in Odisha (Payra et al. 2014; Dash et al. 2018). It is located on the left bank of the river Mahanadi and spreads over 328 acres. It is surrounded by Saranda hill on the South-Western side and the Mahanadi river on the South-Eastern side (Fig. 1). The lake is rich in biodiversity composition with 136 species of birds, 33 fishes, 51 odonates, 88 butterflies and 244 macrophytes (Payra et al. 2019a; Payra et al. 2019b; Payra et al. 2020; Dash et al. 2018; Panda et al. 2018). In addition, thousands of winter migratory birds also visit the lake every year. The lake also has immense importance in terms of economic perspectives. Around 30–50 thousand people lived adjacent to the lake (https://censusindia.gov.in/pca/cdb_pca_census/Houselisting-housing-OR.html) and associated either tangibly or intangibly.

Data Collection And Questionnaire Survey

The survey was conducted in the Ostia, Subarnapur, Kadalibari, Anandapur, and Malviharpur villages located at the immediate edge of Ansupa Lake (Fig. 1). All the respondents were selected randomly while visiting the villages on foot. Survey data was collected only from males, as the gender of the interviewer

created an aversion for participating the females and therefore, no females were interviewed. We interviewed a total of 120 respondents within these villages between February and April 2015. All the interviews were conducted in the regional language (Odia) and later translated to the appropriate format in English. Interviews were mainly based on the socio-economic background of the locals and their perceptions towards the conservation importance of the lake.

A semi-structured questionnaire was used, which was primarily divided into two main sections. In the first section, the questions related to respondents' socio-economic status and dependencies like their age, caste, education, demography, occupation, livestock holdings, land holdings, house type, income, and resource use from the lake. In the later section, we targeted to understand their knowledge and perception towards lake conservation (Wattage and Mardle 2005; Ambastha et al. 2007; Dimitrakopoulos et al. 2010; Badola et al. 2012). We asked ten questions with three categorical responses for each that is agreed, neutral, disagreed with the respondent's choice.

Data Analysis

We used continuous data sets for the independent variables such as age, education, income, family member, landholdings and livestock holdings and categorical data sets for variables such as caste, house type, and dependency on lake (Supplementary Table 1). Similarly, all the dependent variables were in the form of categorical datasets in the form of not agree, neutral and agree (Supplementary Table 2). All the datasets were transliterated and coded into Microsoft excel (2007) and analysed in R software (version 4.0.1). To understand the respondents' socioeconomic status and the factors behind the responses of locals, we performed ordinal logistic regression (Agresti 1996; Agresti 2002) as responses of the locals were recorded in the categorical form (agree, neutral, disagree). Based on the literature review, we conducted the quantitative analyses along with chi-square tests to determine if survey responses varied significantly between their different groups. Before performing the regression analysis, Brant tests (Brant 1990) were conducted to check the suitability of the datasets for the regression analysis. We used stepwise regression (Backward elimination) methods (Efroymson 1960; Draper and Smith 1981) and selected the best suitable models (Table 1) based on the lowest Akaike Information Criteria (AIC) values (Kullback and Leibler 1951; Burnham and Anderson 2002; Akaike 1974). Regression analysis was conducted only when the statement got all three types of responses.

Table 1

Best fitted experimental Models of Ordinal regression analysis conducted to analyse the factors governing perception of locals on Ansupa lake conservation

Sl. No	Best Fitted Model	Residual deviance	AIC	AICc
1.	ST 1 ~ Occupation + Resource used + Livestock Holding + Family Member + House Type	123.16	147.16	148.10
2.	ST 2 ~ Age + Income + Cast + Occupation + Resource used + Land Holding + Livestock Holding + Participation	92.39	124.39	126.05
3.	ST 3 ~ Age + Income + Cast + Occupation + Resource used	14.09	40.09	41.19
4.	ST 4 ~ Education + Cast + Occupation + Resource used + House Type + Participation + Fodder Source	183.03	213.03	214.49
5.	ST 5 ~ Housetype + Occupation + Resource used + landholding	102.73	128.73	129.83
6.	ST 6 ~ Education + Family Member + Resource used + Occupation + Cast	35.69	61.69	62.79
7.	Statement (7–10) were not fitted for regression			
*NB: ST = statement				

Results

Socio-economic background

The majority of the people belongs to the OBC (Other Backward Cast) (60%) and SC (Scheduled Cast) (30%), followed by General categories (10%). The average age of the respondents was 49.12 ± 1.19 (SE) ranged between 20 and 80. Education percentage was low with the average educational year was 6.01 ± 0.40 (SE) with a range of 0–15. All the respondents were Hindu by their religion, and there were no indigenous tribal communities living near the lake. The primary livelihood of the people ranged from agriculturists 43.33%, 20.83% engaged as daily wages laborers, 18.33% fishermen, 5.83% as businessmen, 4.16% as teachers, and 7.5% involved with miscellaneous occupations such as private jobs, shops etc. The average household size was 5.84 ± 0.20 (SE) ranged from 1–13. The average income (in thousands) of the respondents was 7.06 ± 0.42 (SE) per months, ranged from 2.5–30.0. Most of the respondents (80%) possessed agricultural land. The average landholding size was 1.28 ± 0.13 (SE) acres, and 45% of the respondent had livestock, including cow, goat, and poultry, with average numbers 3.9 ± 0.52 (SE). Most of the respondents (66%) stayed in mud houses with thatch roofs, and 34% stayed in houses made up of concrete.

Resource Use/ Dependency On Lake

In the context of lake dependency, about 97% of respondents specified that, the lake Ansupa is their lifeline, and they rely on the lake's resources in different forms for their livelihoods. Around forty-six (45.83) percent of people depend on the lake for their irrigation, followed by 20% for both fishing and plant product collection, 18.33% only for plant product collection, and 12.5% for both irrigation and plant collection either for food or to make Non-timber forest products. Only 3.33% is not reliant on the lake in any way.

Responses Towards Conservation Of The Lake

Statement 1: Conditions of the lake have deteriorated during recent years

The Ansupa lake is under stress due to the anthropogenic pressure; only 4.17% of those interviewed disagreed with us on the above statement. By their response, almost 80% (79.17%) of respondents agreed, while 16.67% were neutral ($\chi^2 = 96.875$, $df = 2$, $p < 0.001$). Regression results showed that agreed responses with this statement increase with people who depend on the lake for fishing than those who utilize the lake water for irrigation and gather edible plants from the lake (Table 2).

Table 2

Parameter estimates of variables in final Logistic Regression model (variables were eliminated by Wald backward stepwise) used to predict local people's attitudes toward ansupa lake conservation. The probability of holding agree (score = 1) for the first listed categorical variable compared to the second (reference category) is the odds ratio [Exp.(b)].

Category		ST 1.	ST 2.	ST 3.	ST 4.	ST 5.	ST 6.
Income	Low: high		0.33 ± 0.12 *	0.58 ± 0.07 *			
Land holdings	Low: high		0.61 ± 0.22 *				
Livestock holdings	Low: high	1.19 ± 0.07 *					
Cast	Sc: Gen		10.28 ± 1.14 *			0.01 ± 0.49*	1.82 ± 1.19 **
	OBC: Gen				0.20 ± 0.75 *	0.01± 0.41 *	1.14 ± 1.33 **
House Type	Concrete house: Mud house				3.03 ± 0.55 *		
Occupation	Fisherman: Farmer			6.95 ± 0.21**		0.09 ± 1.01**	5.30 ± 1.23 **

The numbers are in the format Exp.(b) ± standard error *= P value < 0.5, **= P value < 0.001

Greater + ve value means peoples placed on the numerator of the ratio are intended towards disagree and vice versa.

NB: St. = Statement

Category		ST 1.	ST 2.	ST 3.	ST 4.	ST 5.	ST 6.
	Teacher: Farmer				1.23 ± 1.73 **	6.5 ± 3.87	3.37 ± 7.73**
Dependency	Water for Irrigation : Fishing	5.87 ± 0.43 **				0.02 ± 0.517 *	
	Plant collection: Fishing	2.89 ± 1.04 **				0.05 ± 0.95 **	0.06 ± 1.29**
	Irrigation & Plant collection: Fishing	2.89 ± 0.55 **		2.23± 1.54 *		0.01± 0.59 *	0.01 ± 0.06 **
The numbers are in the format Exp.(b) ± standard error *= P value < 0.5, **= P value < 0.001							
Greater + ve value means peoples placed on the numerator of the ratio are intended towards disagree and vice versa.							
NB: St. = Statement							

Statement 2: It is the responsibility of the local people to conserve and protect the lake

The majority of individuals responded neutrally (83.33%) towards the aforementioned question, followed by agreed (10.83%) and disagreed (5.83%) ($\chi^2 = 112.88$, $df = 2$, $p < 0.001$). However, regression data shows that respondents with the increase in their income in one thousand had a 1.33 times greater chance of disagreeing with this statement. Similarly, those with larger landholdings were more likely to agree with our statement than those with fewer landholdings (Table 2).

Statement 3: It is more important to meet the public need rather than conservation of the lake

Ninety-five percent of respondents were neutral, 3.33% disagreed, and only 1.67% agreed with us, indicating that sustainable development could meet both public needs and lake conservation ($\chi^2 = 171.17$, $df = 2$, $p < 0.001$). When comparing farmers to fishermen, the probability of those agreeing with statement 3 increased significantly in the case of farmers (Table 2).

Statement 4: Participation Of Local People In Lake Conservation Will Improve The Lake Condition (Dup:

Abstract ?)

Community participation plays a crucial role in wetland protection. Most of the respondents (48.33%) agreed to the statement 4, 17.5% disagreed and 34.17% were neutral ($\chi^2 = 14.292$, $df = 2$, $p < 0.001$). Regression results showed that positive responses increase in people living in mud houses and farmers in their occupation (Table 2).

Statement 5: There Is Equitable Distribution Of Resources And Benefits Among All Social Groups (Dup: Abstract ?)

We can only achieve long-term ecosystem management by bridging the gap between diverse social groups. Most of the respondents disagreed (81.67%) with this statement followed by 15.83% neutral and only 2.50% agreed, ($\chi^2 = 107.79$, $df = 2$, $p < 0.001$). According to regression results, respondents who work as teachers are more likely to agree. In contrast, people who engaged as fishermen or utilized water for irrigation have higher probabilities of disagreeing (Table 2).

Statement 6: You Are Willing To Contribute For The Conservation Of The Lake

The loss of wetlands directly or indirectly impacts the socio-economic benefits of the associated population. So, almost ninety-six percent (95.83%) of people were agreed with the above statement followed by 3.33% were neutral and only 0.83% were disagreed ($\chi^2 = 175.88$, $df = 2$, $p < 0.001$). Those who use water and plants from the lake and who worked as teachers have a greater probability of giving positive responses. The likelihood of receiving a negative response increases with people having fishing as their occupation.

In the case of statements 7, 8, 9 and 10, people were restricted to only two categories of responses. In statement number 7, "The quality of living of people will improve if the lake is conserved", almost all the people (99.16%) agreed with us and only 0.83% people were neutral on this statement ($\chi^2 = 195.04$, $df = 2$, $p < 0.001$). In statement number 8, "Overexploitation should be controlled", we got 93.33% positive responses and 6.67% neutral ($\chi^2 = 162.67$, $df = 2$, $p < 0.001$). In statement 9, "Lake encroachment and expansion of agricultural field around the lake should be stopped", 85% were agreed and 15% were neutral ($\chi^2 = 123.5$, $df = 2$, $p < 0.001$). In statement 10, "The flourishing tourism industry creative negative impact on lake conservation", we found 24.17% responses of neutral and 74.83% disagree ($\chi^2 = 87.302$, $df = 2$, $p < 0.001$).

Discussion

To achieve an effective conservation goal, understanding the socioeconomic background of the local people, as well as their opinions and attitudes, are of great significance (Ambastha et al. 2007; Dimitrakopoulos et al. 2010; Badola et al. 2012). This research provides insight into the people's dependency and their perceptions of the Ansupa Lake conservation issue. The results also reveal the factors behind their perception, which can prove effective in conservation planning and decision-making. Wetlands have always proven their significance in supporting the livelihoods of human beings living adjacent to them (Silvius et al. 2000; Lamsal et al. 2015). In our study, ninety-six percent of the respondents were dependent on the lake for their livelihood, which indicates the significance of such wetland for supporting local's livelihoods.

Statement 1: Conditions Of The Lake Have Deteriorated During Recent Years And Need Conservation

Earlier people were acquainted with relying on most of their needs from the lake. They used water for drinking purposes in addition to using it for cultivation and fishing. As a result, people were more concerned about lake conservation. However, after installing tube wells and bore wells, dependency on drinking water decreased, and attention towards lake conservation was also reduced. In our study, people who depend on fishing have shown a higher level of care for lake conservation than those who use the water for irrigation. We hypothesized that those who are more closely associated with lake resources and who directly benefit from them might be more concerned than those who are indirectly dependent on them. Similar findings of our result were also observed by (Desta 2021) from Ethiopia, (Das et al. 2015) from West Bengal, India, and (Park et al. 2020) from Baekdudaegan, South-East Asia, where people associated more with wetlands showed more concern for the conservation and protection of the wetland.

Statement 2: It is the responsibility of the local people to conserve and protect the lake

Respondents are more neutral in this circumstance than confiding to a certain judgement, i.e., agree or disagree. People from the community have also stated that as various government departments and authorities receive funds, they should accept responsibility to conserve the lake. According to our study, higher-income people were more likely to disagree than those with lower incomes. It may justify it because persons with higher incomes may have alternate sources of income and are less reliant on the lake for their livelihood. People with low average income, on the other hand, could be entirely dependent on the lake for their livelihoods, leading them to assume that lake conservation should be their responsibility. The significant relationship between dependency and responsibility, or positive perception, was once again demonstrated by our results for these statements (De Boer and Baquete 1998; Gillingham and Lee 1999; Hamilton et al. 2000; Mehta and Heinen 2001; Abbot et al. 2001; Tomićević et al. 2010; Park et al. 2020).

Statement 3: It is more important to meet the public need rather than conservation of lake

Around 95% of those respondents said they were unconcerned with the statement. We assumed that their neutral response was due to both of these issues being important. When comparing farmers to fishermen, the regression result showed that the chances of getting a positive response to our statement were significantly higher in the case of farmers. We hypothesized that the education factor, as well as dependency, would influence such responses. Fishermen around the lake depend on it directly for their livelihood; however, farmers are less associated with the lake as they only use its water for irrigation. (Badola et al. 2012) and (Vodouhê et al. 2010) found a similar association between people's attitudes, perceptions, and the direct and indirect benefits they receive from the sources.

Statement 4: Participation Of Local People In Lake Conservation Will Improve The Lake Condition

Our respondents gave mixed responses, with 48.33% indicating they agreed, 17.5% disagreed, and 34.17% neutral. Respondents' socioeconomic circumstances and educational backgrounds can justify this response pattern. Following the respondent's response to our statement number 5, it is apparent that people believe the authority is getting more benefits from the lake in terms of money allocated to its conservation. They also think that they may implement many potentials for the benefit of the community but that the authority is prohibiting them from participating in lake conservation initiatives. According to our study result, people who live in mud houses and farmers in their occupation have a favorable response to the statements. It can justify it on the same premise because farmers are not as directly involved with the lake as local fishermen are. Thus they may believe they are associated with the lake in its various conservation measures to develop the lake conditions. People living in mud cottages, on the other hand, are primarily underprivileged and seeking ways to participate in the lake conservation programme; as a result, they believe that local participation will benefit both the lake and them. Such studies have been carried out in several parts of the world, where community members have already begun to recreate the conservation development programme without the need for outside assistance (Rijal 2001; Shraatha 2011).

Statement 5: There Is Equitable Distribution Of Resources And Benefits Among All Social Groups

According to the findings, only those with higher educational degrees believe that the lake's resources are used equitably by the local population. Their impression of the lake may be toward its overall benefits and usage; however, individuals with less educational qualifications may perceive merely using the direct benefits shown to all. As a result, they may feel that the resource is only accessed by a small group of individuals and not by everyone. As many professionals have discovered, education is one of the key variables influencing people's perceptions on various issues (Ogra 2009; Harun et al. 2018; Hager et al. 2020).

Statement 6: You Are Willing To Participate In The Conservation Initiatives

Almost everyone agreed with our statement. People frequently enquired about the compensation for their involvement in response to this statement. They only agreed with us when they had some possibility of receiving some reward for their cooperation. Our findings are consistent with those of (Karanth and Nepal 2012), who concluded that conservation of natural resources is only achievable when the livelihood requirements of local people are fulfilled.

In the case of statement 7, "People's living conditions will improve if the lake is retained," practically everyone agreed with us. Community engagement of all stakeholders is required to match any conservation efforts to protect or conserve the ecosystem and improve their lifestyle and livelihood. It has been perceived that people who live near natural resources are concerned about their conservation (Dimitrakopoulos et al. 2010; Scholte et al. 2016). Similarly, because most of our respondents are dependent on the lake for their livelihoods, they believe that improving the lake will help them better their livelihoods. Again, statements 8 and 9 stipulate, "Overexploitation should be regulated" and "Lake encroachment and agricultural field expansion around the lake should be stopped." Again, we got the majority of the respondents to agree, and a few disagreed with our statement. We conclude that because approximately all respondents were directly or indirectly dependent on the lake, they believe its resources should be conserved for future generations. As a result, individuals may assume the lake is being conserved for future generations.

In statement 10, "The blooming tourism business has a negative impact on lake conservation," we found the majority of our responses to be negative, since residents in the Ansupa lake area might have benefitted in some way from the influx of tourism, which again created a relationship on the dependency/benefits and perception towards the conservation of natural resources.

Conclusion

Community participation of all stakeholders is required to preserve or conserve the ecosystem, which improves their quality of living. This process can be done more effectively by identifying and building the stakeholders' capacities around these areas. It is also necessary that communities receive financial and technical assistance and education to maintain these wetlands sustainably. We had a major limitation as we did not include women in our study. Women are the resilient part of any community because they are more associated with wetlands resources than men, particularly in rural regions. They have larger domestic responsibilities. It increases their social and psychological exposure and makes them more sensitive towards their surroundings (Andrade and Rhodes 2012; Parks et al. 2014). Most (44%) of the respondents believed that by educating people about the ecological importance of wetlands, the lake's rehabilitation and conservation might improve.

Our findings revealed a clear link between dependency, benefits, and local people's attitudes toward natural resource conservation. People who depend on the lake or profit from it are more concerned about its conservation. Similarly, persons who depend only on the lake for their livelihood showed positive attitudes and expressed concern about its conservation and sustainable resource use. As local people depend on the lake, we suggest that they should be involved in lake conservation initiatives and be part of the conservation institution's planning and decision-making.

Declarations

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Authors Contribution:

HSP: Conceived the Idea. SKD, AP, HSP, RKM: Designed the study. SKD, AP: Conducted fieldwork. SKD, AP: Shorted the data conducted formal analysis. SKD, GS: Drafted the manuscript, HSP, AKM, RKM: Guided overall study, edited and reviewed drafts of the manuscript. All the authors have read the manuscript and approved the final version for publication

Ethical declaration

Before conducting the field survey, the necessary approval was taken from the concern authority of Athgarh forest division and the Chief Wildlife Warden of Odisha. The authors have also taken prior permission from the village heads (Pradhans) before conducting interviews in the villages

Conflict of Interest

The authors declare they have no conflict of interest

Consent to Participate

All the respondents were verbally asked and necessary consent were taken before their participation in this study

Consent for Publication

All the respondents were informed that, their statements will be used for public welfare and all the recorded data to be used for scientific research before their participation.

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Data Availability

All the raw data collected during the field surveys can be made available on request to the corresponding author

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Figures

Figure 1

Map of Ansupa Lake and the surrounding villages in Odisha, India

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