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Tyto alba Cultivation in Balinese Cultural Perspective

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ABSTRACT: Rat infestation (*Rattus argentiventer*) in Subak Pagi and Subak Bengkel, Tabanan regency, Bali has resulted in rice crop failure in both areas. Rice production decreased drastically to only about 10 - 20% of normal conditions. The utilization of *Tyto alba* as a biological control of rat pests, turns out to be able to play a very effective role in controlling pest attacks. In nature, *Tyto alba* population continues to decline due to hunting and agricultural land clearing. This research aims to study the cultivation of *Tyto alba*, especially from a cross-generational cultural perspective. Generations are grouped by year of birth with a range of 20 years, from 1960 - now, into generations X, Y and Z, respectively. The research used descriptive qualitative method, through depth interview approach and forced field analysis. The results showed that there are four supporting factors for the cultivation of *Tyto alba* as a rat pest control, namely first *Tyto alba* is very effective in controlling rat pests. Another supporting factor is that *Tyto alba* has actually been known for a long time by the people in the two subak and has a belief value system in the life of the subak community, as well as environmentally friendly and able to maintain the food chain. There are four inhibiting factors in *Tyto alba* conservation efforts, namely, the lack of committed breeding officers, availability and management of food, land for preservation and development and very limited financial support. Analysis forced field concludes that, cross-generational public perception in the acceptance of *Tyto alba* as a biological control of rat pests is very positive. However, preservation efforts with a breeding system cannot be done in both subak at this time. Efforts to preserve and develop *Tyto alba* are carried out by releasing it in nature with conservation protection through village regulations.

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INTRODUCTION

The barn owl (*Tyto alba*) is one of the most widespread bird species worldwide. Almost in all regions this bird can be found, except in Antarctica (Askewa et al., 2007). The utilization of owls (*Tyto alba*) as pest control for rice field rats (*Rattus argentiventer*) is increasingly used by farmers in an effort to control rat pests that are increasingly uncontrolled in rice fields. Naturally, *Tyto alba* is a nocturnal animal and is one of the hunting birds (Glue, 2009). The variety of prey of *Tyto alba* is very wide, from small rodents, bats, amphibians, reptiles, and also fish (Roulin, 2020), although the most important prey is rats (rodents) (Frey et al., 2011).

The utilization of *Tyto alba* as a natural predator of rice field rats has been conducted in Subak Pagi and Subak Bengkel, both in Tabanan regency, Bali, with very satisfactory results. Subak is a Balinese irrigation system that has a distinctive characteristic, namely social-agricultural-religious with a spirit of mutual cooperation to meet the water needs in the cultivation of rice and secondary crops. An infestation of paddy rats in Subak Pagi in 2015 has left the community's rice production at 10% of normal, while a similar infestation in Subak Bengkel in 2019 has reduced their production to around 20%. Only a year after the utilization of *Tyto alba* as a biological control of paddy rats, rice yields in both villages have reached 80-90%. Compared to using other methods in controlling field mouse pests, such as the Trap Barrier Systems (TBS) method, rat poison, installation of nets, use of snakes and crop rotation, the use of *Tyto alba* is much more effective (Jonita, 2022). The advantages of using *Tyto alba* as a pest control for rice field rats are that it is environmentally friendly, sustainable, relatively cheaper (Sanjaya, 2020) and safe (Wahya, 2022).

Tyto alba can also shape culture and build belief systems among the community (Suarca, 2022). From the perspective of existing values in society, *Tyto alba* is perhaps one of the most controversial. *Tyto alba* is widely regarded as a harbinger of disaster, bad luck or death, also associated with mystical things, witchcraft etc. However, on the other hand, *Tyto alba* is also no less often used as a symbol of meaning for positive things, such as a symbol of wisdom, a symbol of science, a symbol of peace and a symbol of fertility (Morris, 2009).

There are many factors that play a role in the formation of values in society. Na-Ayudia (2008) states that education and age factors will greatly affect the speed at which a person, group of people or generation accepts or rejects new ideas or innovations, which will then become the basis for the formation of a value system in an individual or group of people. The values of a generation can be formed by traumatic circumstances, events or phenomena (war, genocide), natural disasters (tsunami, liquefaction, virus, etc.), or technological advances (Industrial Revolution 1.0 to 4.0). These special circumstances can shape new behaviors, values and beliefs that can shape the perception of a generation. The transition of perceptions between generations can be smooth, but often if not managed properly it can cause friction and turmoil in society (Johnson and Johnson, 2010). This can be an obstacle to creative innovative programs implemented in the community if done without proper socialization.

Based on the situation above, research on the cultivation of owls (*Tyto alba*) in a cultural perspective needs to be carried out to better understand the process of accepting biological control innovations against rat pests in the village, the dynamics of community perceptions of owl (*Tyto alba*) cultivation Subak Pagi and Bengkel.

MATERIALS AND METHODS

Research Location

This research was conducted in Subak Pagi, Senganan Village, Penebel District, Tabanan Regency and Subak Bengkel, Bengkel Village, Kediri District, Tabanan Regency. Research and data collection took place for 7 months, from March - September 2022. These two locations were chosen as research sites because both villages have utilized owls (*Tyto alba*) as an effort to control rat pests (*Rattus argentiventer*). Subak Pagi has started implementing it since 2015, while Bengkel Village has only started implementing it since 2019.

Senganan Village has an area of 24.12 km2, with a population of 7,239 people, so the village has a population density of 226 people/km2 (2016 Census). Geographically, Senganan Village is located in the lowlands with an altitude of 350-500 m above sea level. The fertile soil (sandy loam latosol) and high rainfall of 2,358 mm/year, with 180 rainy days, make this village suitable as an agricultural area as well as the cultivation of food crops, plantations, perennials and so on. In the land use pattern of Senganan Village, land use for rice fields is 3,798,125 m2 of the total village area of 7,741,048,125 m2 (Senganan Village Monograph, 2015).

In terms of utilizing *Tyto alba* as a biological control of rat pests, Banjar Pagi is a pioneer area because it is the only area that is the location of *Tyto alba* breeding. From Banjar Pagi, dozens of *Tyto alba* have been released into the wild. Meanwhile, Bengkel Village is administratively included in Kediri District, Tabanan Regency. The total area of Bengkel Village is 2.91 km2. The population of this village according to the Census (2020) is 2,312 people, so the population density per km^2 is 780 people. In this village, in addition to the indigenous community, there is also a Village Community Organization (LKD) in the form of a subak, namely Subak Bengkel. Subak Bengkel covers two official villages, namely Bengkel official village and Pangkung Tibah official village. Subak Bengkel consists of 18 tempekan. Subak community is a community whose members are farmers.

The total area of Subak Bengkel is 325 ha, with 300 ha of paddy fields. The average rainfall in this area is 1,322 mm/year with 5 months of rain per year. Subak Bengkel is a low-lying area with an average sea level elevation of 45 meters. With these conditions, Subak Bengkel is a fertile area and is very productive in producing agricultural products.

In terms of utilizing *Tyto alba* as a biological control of rat pests, Subak Bengkel includes *Tyto alba* development subak. Beginning in 2019, Bengkel Village received 3 *Tyto alba* from Subak Pagi, Senganan Village, and continues to develop the Subak Bengkel environment to date.

Barn owl *(Tyto alba).*

Tyto alba, also known as barn owl, or in Indonesia as *Tyto alba* lumbung, is naturally a nocturnal animal that has instincts as true hunters (raptors) (Glue, 2009). Worldwide it is estimated that there are no less than 700 species and eight of them are reported in Indonesia, including *Tyto alba*. This Tyto alba species has a very high sensitivity to the sense of hearing. This is in line with the research of Dent et al. (2002), that *Tyto alba* has a special hearing system in achieving the high sensory acuity it needs to capture its prey, including the process of its great ability in the speed of capturing sounds that are almost the same as the sound source and able to analyze sound signals in capturing its prey. *Tyto alba* is able to detect the lowest sound speed at 10-20 Hz (Köppl, 1997; Wagner et al., 2012). *Tyto alba*'s ear position is not symmetrical, the position of the right ear is higher than the position of the left ear, the hearing sensitivity of this bird is above the average of other birds (Soares et al., 2002). *Tyto alba*'s eyeballs cannot be moved, but its neck can be rotated by 270^0, which is 135^0 to the left and 135^0 to the right.

Tyto alba's main prey is *Rattus argentiventer*. In a day it is estimated that a *Tyto alba* can prey on 3-4 rats, with a home range of about 10 km2. Hence, in a year it is estimated that a *Tyto alba* can prey on up to 1000 rats. This makes *Tyto alba* one of the most effective natural predators of field mice.

Function as biological control

Tyto alba has the instincts of prey hunters (Raptors) and night animals (Nocturnal) making *Tyto alba* has great potential as a biological control against field mouse pests. Its sharp eyesight and hearing, as well as its strong and sharp beak, feet and nails make *Tyto alba* an ideal night predator. In the Middle East (Israel, Palestine and Jordan) *Tyto alba* is used as a symbol of agricultural land conservation because of its success as a biological control against rat pests in the area (Roulin, 2020). The use of *Tyto alba* as a biological pest control for rat pests meets the requirements of environmental conservation, because in addition to being cheap (economical sounds) it is also environmentally friendly. Therefore, farmers there prefer *Tyto alba* as a pest control compared to pesticides with inorganic chemicals. The experience of crop failure of rice farmers in Rangkasbitung Subdistrict, Lebak Regency, West Java, Indonesia, in 2014, due to rat infestation, was related to the significant reduction of *Tyto alba* population. Tyto alba hunting since 1990 has been the cause of the reduced *Tyto alba* population there (Liputan6.com, 2015).

Perception of *Tyto alba*

In many parts of Indonesia, human interactions with Tyto alba have also been going on for a relatively long time. Just like other ethnic groups, various mithos both positive and negative are given to *Tyto alba*. *Tyto alba* can be symbolized as a sign of knowledge, life or pregnancy, but it can also be a sign of a bad event that will occur, grief and death.

Perceptions of individuals, groups, collectives can be formed because in interacting with their environment humans form knowledge, understanding and then behavior that binds these interrelationships. This long complex process will involve physiological, psychological and cultural aspects (Silva et al., 2016). A group of people can have the same perception because physiological, psychological and cultural aspects converge and respond to the same phenomena. The phenomenon of the threat of crop failure caused by rat attacks that were successfully reduced, eliminated or saved by *Tyto alba* will certainly form a new perception of *Tyto alba*.

Data Source

This research is qualitative descriptive research. The data collected includes Primary Data and Secondary Data. Primary data was obtained through depth interviews from informants. The determination of informants was based on non-probability sampling. Informants were selected based on the criteria of having been involved and experienced in barn owl (*Tyto alba*) activities as biological control of rat pests for at least 3 years. Active in subak activities in the research location. Active in the village community in the research location. Representing three generations, identified by year of birth. Births in 1960 - 1980, births in 1981 - 2001, and births in 2001 to the present are referred to as generation X, generation Y and generation Y, respectively. The list of informants is as shown in Appendix 1. Secondary data was obtained from the Livestock Group, Village Office and Tabanan District Agriculture Office.

Data Analysis

Data was analyzed using descriptive methods and Forced Field Analysis. Forced Field Analysis requires a Small Group Discussion, consisting of a minimum of 5 people.

RESULTS AND DISCUSSION

***Tyto alba* cultivation**

Tyto alba is not a good nest builder. *Tyto alba* moves from one nest that has been abandoned by other birds or holes in logs, cliffs or empty buildings. Therefore, *Tyto alba* conservation efforts made by the community in both research locations are to make *Tyto alba* nests in rice fields, which they call Rubuha (*Tyto alba* House) (Figure 1). This is in line with research by Charter and Rozman (2022), that *Tyto alba* uses more rubuha when rubuha is placed in trees than when placed on poles. The placement of rubuha can increase the use of the rubuha itself, and can also increase the success of breeding to increase *Tyto alba* populations, because it can increase protection for *Tyto alba* as well as being able to increase the efficiency of conservation and biological pest control projects. Furthermore, Klein et al. (2007) reminded to prevent rubuha from becoming "ecological traps" but to make the rubuha very useful by designing the interior of the rubuha where *Tyto alba* is given facilities to lay and incubate their eggs comfortably.

Figure 1. *Tyto alba* House Model (Rubuha) community-made nest for Tyto alba

Tyto alba is a difficult bird to keep because its instinct to hunt prey in the wild is very strong. Therefor, *Tyto alba* is not very comfortable in a cage. One of the environmental activists and pioneers of using *Tyto alba* as a natural predator of field mice pests, breeding *Tyto alba* naturally is more effective than being caged, as long as it is protected by hunting prohibition rules (Jonita, I. M. 2022, pers. comm. September 21). In addition to needing a large enough cage, *Tyto alba* consumption also requires attention. For the maintenance of 3 *Tyto alba*, 4-5 rats are needed. The rats given must also be alive or at least in a fresh state (in a state where the rat is dead, but there is still blood flowing). The *Tyto alba* egg-laying cycle is 6 - 8 months with the number of eggs can reach 5 - 7 eggs. This is related to the basic instinct of *Tyto alba* as a hunting bird. *Tyto alba* breeding pilot efforts have been carried out in Pagi Village, starting in 2019 with the help of cage construction from the Ministry of Agriculture through the Bali Provincial Agriculture Office (Figure 2).

Figure 2. Tyto alba breeding cage in Senganan Village, Penebel District, Tabanan Regency

Community support in both research sites for the program is very positive. As an expression of this support, *Tyto alba* statues were installed in front of almost every house in Banjar Pagi, Senganan Village.

The population of *Tyto alba* in nature is estimated to have declined sharply. This is mainly due to deforestation and the clearing of agricultural lands, which have destroyed the habitat where *Tyto alba* lives (Godfrey et al., 2012). In many European countries, massive agricultural intensification is the main cause of the threat and extinction of species richness and some taxa. The habitat and nesting sites of many bird species, including *Tyto alba*, have been destroyed (Frey et al., 2011). Meanwhile, massive hunting of *Tyto alba* in Lebak Banten, West Java, resulted in the same thing, namely the endangerment of *Tyto alba* (Liputan6.com, 2015).

Tabel 1. Result Force Field Analisis

No.	Driving Factors	Score	Restraining Factors	Score
1	Belief systems	1.45	Committed officers	1.94*
2	Effectiveness of Tyto alba as biological control of field mice pests	1.45	Feed availability	1.94
3	Eenvironmentally friendly	0.79	Land for cultivation development	0.71
4	Maintain the food chain	0.79	Supported funding	0.71
	Total skor	4.48		5.3

Description: * The values of Supporting factors and Restraining factors indicate the amount of the influence given to the factor. The greater the number the bigger the influence.

Discussion

Driving factors for barn owl (*Tyto alba*) cultivation in Subak Pagi and Bengkel

a. Values and Belief Systems

According to Arinata (2022), *Tyto alba* has actually existed in Bengkel village since decades ago. It's just that the existence of *Tyto alba* at that time has not been utilized as a biological control of rat pests. In line with changes in time, the environment of Bengkel Village has also changed, large trees as habitat and *Tyto alba* nests have been cut down and only a few remain. At the same time as habitat changes, the presence of *Tyto alba* also decreased over time, until it finally escaped the attention of the community. At that time, *Tyto alba* was perceived as a divine bird (*kedis duwe*) that protected farmers' rice fields and the overall environment. As a consequence, *Tyto alba* was respected by the local community and guarded from poaching.

A similar perception of *Tyto alba* also occurs in Banjar Pagi, Senganan Village, where *Tyto alba* is considered a messenger of *Ida Ratu Batukaru* to protect the environment around Mount Batukaru (Suarca, 2022). The treatment of the people of Subak Pagi, Senganan Village, towards *Tyto alba* is exactly the same as the people in Subak Bengkel, preserving and protecting it from poaching.

When *Tyto alba* was re-presented with its new role as a biological control of rat pests in Subak Pagi and Subak Bengkel, in 2015 and 2019, respectively, according to Jonita (2022) and Wahya (2022), there were no obstacles at all in terms of socialization and diffusion of the idea to the community. Wahya (2022) explained this phenomenon as *Tyto alba* already exists in the collective memory of the local community and has even entered into the belief systems of the community, thus shaping the perspective (perception) of the Subak Pagi and Bengkel communities. *Tyto alba* as *kedis duwe* (God's bird) by the community has long been believed to be the guardian of the rice field environment and the wider natural environment.

The expression of the belief of the Subak Bengkel community, seen when receiving *Tyto alba* assistance from Subak Pagi, is by conducting ritual activities in one of the temples in Subak Pagi, as a sign of respect and notification (*matur piuning*) to the unseen (*niskala*) ruler of the local environment and likewise a similar ceremony was carried out in one of the temples in Bengkel Village.

b. Effectiveness of *Tyto alba* as a biological control of rat pests

The utilization of *Tyto alba* as a biological control of rat pests was felt to be very effective from all informants interviewed, even though at the beginning it was very doubtful of its success. The most obvious thing that was observed and felt by the community was during the seeding of rice seedlings the following year. Almost 80% of the seeding of rice seedlings by farmers was successful, whereas in previous years farmers had to seed rice seedlings up to 2-3 times due to rat infestation. This successful seeding was able to restore the harvest as in the years before the rat infestation.

According to Agus (2022) the peak of the effectiveness of utilizing *Tyto alba* as a biological control of rat pests is during this seeding. At this time, when the rice plants are not too lush to grow, *Tyto alba* can easily monitor the movement of rats in the rice fields and also *Tyto alba* will easily attack the rats because the lushness of the rice plants does not inhibit the movement and flapping of *Tyto alba*.

Jonita (2022) added that, the way *Tyto alba* controls rat pests, not only by directly eating them, but there is also a kind of deterrent effect given by *Tyto alba* to the flock of rats. This makes the flock of rats no longer free to destroy rice. In fact, it is estimated that just hearing the sound of *Tyto alba* has made the rats not too brave to come out of their nests. This certainly adds to the effectiveness of the utilization of *Tyto alba* as a rat predator.

In Subak Bengkel, the indicator of this effectiveness can be seen from the reaction of the farming community who are very enthusiastic in helping to maintain and preserve *Tyto alba*. According to Wahya (2022), this would not have happened if the farming community did not immediately feel the positive impact of the role of *Tyto alba*. Compared to the use of snakes as rat pest control, the use of *Tyto alba* is not only effective but also provides a sense of security to local farmers in working in the fields (Arinata, 2022).

c. Environmentally friendly

The use of rat poison to control rat pests can pollute agricultural land and cut off many food chains, and can even cause the death of pets that accidentally eat the poison or eat small animals that die from poisoning. Snakes that eat rats that die from eating the poison will also be poisoned. Likewise, birds, ducks and other rice field animals such as frogs, snails, snails, hedgehogs and others that drink water and live in rice fields are very likely to be poisoned as well. A more serious threat is the possibility that humans will be poisoned from the poison they themselves spread.

d. Maintain the food chain

The fact that the use of *Tyto alba* in the biological control of rat pests, is not able to destroy rats at all, it is good to maintain the balance of nature while maintaining the food chain. Harvest losses of up to 10% caused by rat pests are still considered a normal

harvest by farmers. Total extermination of rats will actually cause an imbalance in the food chain in nature, because this will disrupt not only the existence of rat predators, but also other food chains. Thus the utilization of *Tyto alba* as a rat pest control has no adverse impact on the environment. This is very much in line with the spirit of sustainable agriculture.

There are several inhibiting factors in owl breeding efforts. These factors are,

a. Committed officer

Understanding of characteristics and behavior is still limited. Data on owl breeding and rearing of owl chicks is still very limited. This can hamper the effectiveness and efficiency of the breeding process. For the Tyto alba cultivation program, officers who are fully committed and professional are needed. Currently, efforts to recruit officers with the above criteria are still experiencing problems.

b. Feed availability

Owls are true hunting birds (raptors). The feeding behavior of owls is to prey on food that is still alive or at least there is still fresh blood in the prey. This condition certainly requires extra effort in providing food for *Tyto alba*. Captive managers have had to hunt rats every day to overcome this problem. Giving rats as Tyto alba food during captivity is an important part of the cultivation process, namely for conditioning and getting used to *Tyto alba* preying on rats when later released in nature.

Cultivating rats as an effort to overcome the problem of *Tyto alba* food procurement, is not effective on a large scale because rats are cannibals that will prey on fellow rats. Also, cultivating rats for the above purpose may be counter-productive, as the purpose of owl rearing in this case is to control the number of rats naturally.

c. Land for cultivation development

The locations in the two research sites are productive agricultural areas. Land acquisition for cultivation purposes requires about 25 acres for each breeding cage and other facilities. This certainly requires detailed thinking and economic calculations to get maximum land use benefits. The land currently used for *Tyto alba* cultivation is borrowed from one of the village administrators by not calculating the economic profit and loss.

d. Supported Funding

Funding in cultivation activities is still very limited. Although the benefits of using *Tyto alba* as a biological control of rat pests have been felt by the community in general and farmers in particular. Financial assistance from the government is still very sporadic and not well planned and structured. The private sector does not seem interested in investing in this program. The long cultivation process and low return on capital may be the reason why it is difficult to obtain funds to support this program.

From the results of the Force Field Analysis, it showed that the value of restraining factors is greater than the value of driving factors. This does not mean that *Tyto alba* cultivation cannot be carried out. The strategy for the cultivation process to be in line with expectations is to pay attention and improve the restraining factors and at the same time strengthen the supporting factors.

Cross-Generational Perceptions of *Tyto alba* Cultivation

In each generation, the meaning of owls in society is very diverse. Mythological stories about owls are still widely circulated, especially among the X generation. In generation Y, and especially generation Z, these stories have begun to fade and have not even been heard or recognized. Among these mythological stories, in banjar Pagi, owls are symbols or signs and markers of disaster. This myth is especially true of the bali owl (*Celepuk*), which physically smaller but has louder voice that *Tyto alba*.

In general, the perception of generation X, Y and Z on the role of *Tyto alba* as a biological control of rat pests is very positive. However, for cultivation activities, generation X tends to be more passive, accepting and "go with the flow", while generation Y takes a more active role as an initiator and is full of ideas to be developed. For example, they will plan a tour package that can explore the activities and beauty of *Tyto alba* at night. In terms of technical farming, Generation Y has also thought about organizing cropping patterns that can help reduce the impact of rat infestations.

***Tyto alba* as a New Ecological Symbol**

The fact that *Tyto alba* cannot exterminate all rats in rice fields in both research locations, but can effectively control rat pests with indicators of returning rice production as before rat infestation, provides a phenomenon that *Tyto alba* can play a role as a guardian of ecological balance. This phenomenon has a very important meaning in maintaining the uninterrupted food chain in an ecosystem. Losing one food chain will disrupt the balance of the ecosystem and can make it unsustainable.

The inability of *Tyto alba* to make its own nest makes this bird look for large trees as a nesting place, in addition to utilizing other birds' nests that have been abandoned. Among the farming community, this phenomenon is used as a sign that in locations or areas where there are many *Tyto alba* birds, there must be many large trees where *Tyto alba* nests. The existence of large trees must require a lot of water for its life. In conclusion, the farming community sees that where there are many *Tyto alba*, there will be many water sources. Water is one of the important factors in agricultural activities.

***Tyto alba* as a New Mythological Symbol**

In both research locations, the sound of owls is no longer a sound that frightens farmers because of the past mithos that the presence of owls is a sign that something negative or bad will happen. The sound of owls today is an encouraging sign for farmers, as they know that their rice fields are being guarded by owls from rats. The owl's calm and focused nature is interpreted as a symbol of intelligence and knowledge. Knowledgeable people tend to be calmer, quicker to make decisions and right on target.

The two points above strengthen the mithos that owls are divine birds "*kedis duwe*" who are messengers of *Ida Ratu Batukaru* to protect the natural environment of rice fields with their new role as biological control of rat pests.

CONCLUSIONS AND SUGGESTIONS

Conclusions

1. Public perception of the use of *Tyto alba* as a biological control of rat pests (*Rattus argentiventer*) is very positive.
2. There are cross-generational perception dynamics towards *Tyto alba* cultivation. Generation Y is the driving force and initiative taker in activities related to *Tyto alba*. Generation X is ready to support and trust generation Y. Generation Z, although supportive, has not been able to fully engage in this activity because there are many other choices of activities and tend to choose pragmatic activities that can immediately generate financially.
3. At present time, the preservation of *Tyto alba* with a breeding system cannot be developed in both Subak Pagi and Bengkel Village. The development of *Tyto alba* in both subak is currently done by releasing it in nature and getting protection from the community.

Suggestion

Research on ethnozoology, which looks at the interrelationship between humans and animals or livestock, needs to continue to be developed. This will be related to understanding the values of a particular animal or livestock in the life of a community. On a practical level, ethnozoology will be able to provide an indication of the response, either acceptance or rejection, or the community's perception of a cultivation innovation or utilization of certain species in the life system in general and the agricultural system in particular. By knowing the response and perception of a community, this will be an important indicator to ensure whether an innovation will be able to run effectively or not.

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