A review of anoa conservation efforts in Sulawesi, Indonesia

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Abstract. Anoa is an endemic Sulawesi mammal and listed as Endangered in the IUCN Red List of Threatened Species. This conservation status represents the critical condition of declining population in the wild due to continuing habitat loss and poaching. This paper aims to review anoa conservation efforts both in-situ and ex-situ that have been conducted by the Government of Indonesia, non-governmental organizations (NGOs), private companies, and local communities in Sulawesi. A number of 16 papers were reviewed in order to gather some information regarding the conservation efforts in Sulawesi. Several protected areas were established to protect Sulawesi biodiversity, including anoa. Local communities within the park (e.g., Toro local people) contribute to this effort by having customary laws, not to hunting anoa. The government also ratified relevant policies and regulations to support anoa conservation. Anoa Breeding Center in North Sulawesi was started in 2010 to foster research and breeding program. The center has been working together with other local conservation NGOs, Nature Resources Conservation Agency, and private sectors through their corporate social responsibility (CSR) programs to set up anoa sanctuaries. Also, to organize outreach activities to raise social awareness of this charismatic animal. Increasing the anoa population depends on the continuity of these concerted efforts and regional regulations should be created to improve anoa conservation programs.

1. Introduction
The Island of Sulawesi is well known as having a wide range of endemic flora and fauna. This exceptional level of endemicity was primarily due to island isolation, which occurred in ancient times and enabled evolution on various species of native flora and fauna. Lowland anoa (Bubalus depressicornis) and mountain anoa (Bubalus quarlesi) are classified as Wallacea endemic wildlife and considered as the largest mammals besides babirusa (Babyrousa babyrussa) and wild pig (Sus celebensis) which only distribute in the mainland of Sulawesi Island and Buton Island [1 - 3]. The population of anoa steadily declines due to illegal poaching and deforestation. Forest conversion and habitat fragmentation caused anoa only be found in particularly protected areas, namely in Lore Lindu
National Park, Bogani Nani Wartabone National Park, Nantu Wildlife Sanctuary, Morowali Nature Reserves, Tanjung Peropa Wildlife Sanctuary, Lambu Sango Wildlife Sanctuary and Buton Utara Nature Reserves [1, 4].

Anoa hunting has already been practiced for a long time ago and taken places almost in the mainland of Sulawesi and Buton. The main purposes of this activity were to get meat for food, horns and skin for wall decoration or trophy [5], to earn some money by selling the meat or live animals as domestic animals, and to increase social status. As many people believe that if someone has preserved certain endangered animals and or live wild animals, they will get social recognition or will be considered more superior than another. Consuming and serving wildlife animal meat, including anoa, in traditional ceremonies and cultural parties are often conducted by the people of North Sulawesi, even some communities consider it as a mandatory. To fulfill this social obligation, before the traditional ceremony, people can hunt or purchase anoa meat in traditional markets. Certain Minahasan tribes are pleased to try their luck and go hunting using traditional weapons and traps called “dodeso” in the countryside and woodlands nearby them. Hunting activities for anoa by the local people of Donggala, Central Sulawesi, who live around the forest and woodland were intended not only to fulfill animal protein needs but also to support their household income [6]. Hunting becomes the biggest threat to tropical biodiversity [7]. Hunting activities by local people were not only reported occurred in Sulawesi but also in Papua district, especially for ceremonial events. Each animal that killed was shared with all families or clan members [8].

Moreover, Southeast Sulawesi, which is also famous as the home of anoa, sets out anoa as its regional mascot. Some people of Buton Island maintain the local wisdom to highly respect to anoas similar to those people of Sumatra honoring the tigers. Further, some people still regard that to mention anoa’s name in the local language “nenek” is still prohibited. Nonetheless, illegal hunting and poaching of anoas are still popular and everlasting activities. Anoas are famous for being charismatic animals and often targetted as a flagship species for biodiversity conservation, especially in Sulawesi [1]. For some Indonesians, the existence of anoas might be unpopular as native wildlife of Sulawesi compared to other faunas such as elephants, tigers, rhinos, or orangutans. This is due to the minimal publications of anoas.

Conservation efforts of anoas significantly increased in recent years, although a rapid decline in its population is inevitable. Indonesia itself has classified anoa as preserved fauna since 1931. Internationally, they are categorized as an endangered species in the International Union for Conservation of Nature (IUCN) Red List, which is a species that is very likely to become extinct near the future if immediate conservation acts towards the habitats and population are neglected. This species is also categorized in the Appendix I CITES - the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which is a type of animal that cannot be hunted. Conservation acts for flora and fauna generally can be classified into two different types, which are in-situ and ex-situ conservation [9]. These kinds of actions are the implementation of Biodiversity Conservation regulations, which based on the Basic Biodiversity Conservation Law Number 5 of 1990 and the Ministry of Forestry Regulation Number 54 of 2013 regarding the Anoa Conservation Action Plan Strategy (Bubalus depressicornis and Bubalus quarlesi). It can be a guideline for those who put effort into maintaining anoa in Indonesia. Also, the Ministry of Environment and Forestry has already set out a Key Performance Indicator for Directorate General of Natural Resources and Ecosystem Conservation to increase the population of 25 endangered Indonesian fauna species, including anoas, as many as 10% in 2019 with baseline population in 2015. Additionally, 50 sanctuaries might be established in Indonesia.

In-situ conservation is a genetic resource conservation within its natural habitats, whereas ex-situ conservation is implemented outside the natural habitat. Both in-situ and ex-situ conservation have their benefits and drawbacks. However, expenditure, risks and research needs for ex-situ conservation are much more costly compared to in-situ conservation [10, 11]. Recently, the effort in sustaining anoas using both methods has been intensively carried out by the government, private companies, NGOs and local communities who resided nearby forests. This study aims to observe to what extent
the conservation efforts are implemented by different parties, including government, private companies, NGOs and local people, to conduct anoa preservation as an endemic animal of Sulawesi.

2. Methodology

The literature review method was used in this study. The literature review process as sequential steps to collect, know, comprehend, apply, analyze, synthesize, and evaluate quality literature in order to provide a firm foundation to a topic and research method [12]. There are several appropriate types of sources that can be utilized to make and support an argument in a literature review. The top two most appropriate sources are academic journal articles and academic books [13]. At least 16 papers were gathered and reviewed in order to provide valuable information on anoa’s conservation efforts in Sulawesi. The papers consist of academic journal articles with various themes, for example, feeding ecology, habitat ecology, and genetic.

3. Results and discussion

3.1. Anoa in-situ conservation in Sulawesi

3.1.1. Conservation area to protect anoa’s habitat and population. In-situ conservation is a genetic resource conservation performed inside the natural habitats. The main activity of the in-situ conservation is to designate entire, protected areas where the targeted species live as the maintained areas such as nature reserve, wildlife sanctuary, biosphere reserve [11], and national parks. Protected areas are considered essential elements for global biodiversity conservation [14]. Some studies showed that terrestrial biodiversity inside protected areas is higher than that of the outside the areas [15, 16].

In-situ anoa conservation in Sulawesi is done by appointing several forest areas that have anoa population as protection to the conservation domain of anoa’s population and habitats. Sulawesi has approximately 26 conservation zones that can be classified as terrestrial conservation zones and marine conservation zones. Bogani Nani Wartabone National Park, as large as 282,008 hectares located in northern Sulawesi, is the largest terrestrial national park as anoa’s natural habitation [17]. Anoas occur not only in protected areas, but also the population can still be found outside the areas [1]. Based on the Ministry of Forestry Regulation Number 54 of 2013, 14 areas in Sulawesi are prioritized for anoa population management (Table 1, figure 1).

| Province                      | Forest areas                                      |
|-------------------------------|---------------------------------------------------|
| Northern Sulawesi and Gorontalo | 1. Bogani Nani Wartabone connected area            |
|                               | 2. Sojol mountain area – Nantu connected area      |
| Central and East Sulawesi     | 3. Lore Lindu connected area                       |
|                               | 4. Morowali                                       |
|                               | 5. Bakiriang connected area                        |
|                               | 6. Lombuya                                        |
| West Sulawesi                 | 7. Latimojong mountain area                        |
|                               | 8. Takolekaju mountain area                        |
| Southeast Sulawesi            | 9. Tanjung Peropa                                  |
|                               | 10. Mekongga mountain area                         |
|                               | 11. Verbek mountain area                           |
|                               | 12. Rawa Aopa Watumohai                            |
| Buton Island                  | 13. Lambusango                                     |
|                               | 14. Buton Utara                                    |

Source: Ministry of Forestry Regulation Number 54 of 2013
3.1.2. Research to support fundamental information findings. The success of managing anoas by in-situ conservation within intact, protected areas still requires research supports, although the most important thing is the encouragement from local peoples. Several studies of anoa in the forests of Sulawesi and Buton islands have been conducted by national researchers as well as foreign ones in all over the mainland of Sulawesi from the north to the southeast. These investigations include population, distribution and taxonomic [1], vegetation composition in Pangi Binanga Nature Reserves Central Sulawesi [18], Mekongga Mountains Protection Forest, South East Sulawesi [19] and Bogani Nani Wartabone National Park, North Sulawesi [20], the diversity of natural feeds and habitual preferences in Bogani Nani Wartabone National Park, North Sulawesi [21], genetic diversity, and hunting issues in Donggala District, Central Sulawesi [6]. These findings have significantly enriched the knowledge of Indonesian anoas. However, from the advanced analysis of related research topics, each research result appears to be similar to each other. This observation of anoas inside in-situ territory appears to be specifically challenging for the researchers. Counting animals to estimate their population sizes is often essential for management and conservation [22].

Direct observations of anoas in their habitats become the most complex obstacles for researchers considering the topographic condition in Sulawesi Island which is dominated by steep terrain. Anoas themselves are classified as solitary animals that have an extensive home range, indulge in unexposed and far from humans disturbance territories [1]. Difficulties in observing these faunas are due to not only their natural behaviors but also the sharp decrease in their numbers. Around 1978, the scientist examined and found population anoas in Tangkoko Nature Reserves. Unfortunately, in 2000, it was
stated to be locally extinct. Sanctuary development program, along with ex-situ conservation, comes to be the best expectation for researchers to extend studies about anoas that have been so far tough to observe.

3.1.3. Sanctuary development. Moreover, the establishment of reservations for endangered and near-extinction animals in Indonesia aims to fauna rehabilitation. It supports reintroduction programs for prerelease anoa that are commonly found among people and acknowledged as domesticated animals. These actions are illegal, given that anoas are protected in Indonesia and cannot be domesticated without a state permit, in this matter by the Ministry of Environment and Forestry. Domesticating anoas are sometimes only for pleasure. Furthermore, often in poor conditions, they are confined in small and narrow cages, provided with insufficient food supply and health management, and seldom nurtured with human nourishment. Although not yet clearly defined in Indonesia, sanctuaries are provided for animals that have been long taken care of outside their habitats before returning to their native habitats. This wildlife needs adaptation or continual process in order to improve their survival when it is released into their original habitats. Further purposes of the sanctuary are first, as a learning facilities for animals' behavior and ecology; secondly as the most convenient way of rebuilding animal population; and lastly, to develop a mutual understanding about the importance of conservation through socialization to local citizens, human resource institutions, local government and other associated parties. Lejja Nature Tourist Park in Sopeng, South Sulawesi, is a sanctuary for anoas managed by South Sulawesi Nature Conservation Agency. In this sanctuary, there is only one male anoa, and it needs females to copulate. Meanwhile, other regions such as North and Southeast Sulawesi Nature Resources Conservation Agency are still in the stages of planning.

The public’s involvement in biodiversity conservation is considered highly significant in order to accomplish the successful result of the conservation itself. Unluckily, individuals resided surrounding forests such as national parks are generally lack of facilities and ability to manage their natural resources. Therefore, supports and reinforcements from managers must be delivered to encourage their contributions [7]. Counseling movements about regulations associated with reserved fauna conservation is appointed as a mandatory task and responsibility of the central government (the Ministry of Environment and Forestry), represented by Nature Resources Conservation Agency of North Sulawesi, South Sulawesi, and Southeast Sulawesi. Also, the national parks such as Bogani Nani Wartabone National Park, Lore Lindu National Park and Rawa Aopa Watumohai National Park have a function as the technical implementation units in the regions associated directly with local communities. During monitoring and patrolling, the officers often found hundreds of animal traps installed in the woodland.

3.1.4. Patrolling and outreaching programs. Patrolling and outreach programs are complementary activities, and the most effective protection for wildlife will probably involve both [4]. In developing society’s awareness of anoa supervision, the government is supported by other non-government organizations (NGOs), such as Tasikoki Rescue and Education Centre in North Sulawesi, Aliansi Tompotika, in Central Sulawesi and other concerned organizations including universities. Those organizations are willing to participate in educating both school students and individuals about animal preservation. For example, socialization and counseling from relevant agencies to discuss animal protection aspects which have been conducted in Panni Village, Donggala, Central Sulawesi suggested as the best way to control the hunting activities [23]. Environmental and conservative education on school students appears to be promising for non-stop environmental sustainability program [24].

The North Sulawesi Nature Conservation Resources Agency alongside Forestry and Environment Research and Development Agency in Manado organize research and development of anoa called Anoa Breeding Centre (ABC). ABC’s office center was inaugurated by the Minister of Environment and Forestry, Siti Nurbaya, on the 5th of February 2015. It is an act of conserving anoas that focuses not only on breeding but also conservative learning aiming at school students, particularly those who resided nearby it and conservation area. From the year 2016 to 2019, at least 19 schools have already
received education/outreach about conservation of anoa originated from Manado and Bolaang Mongondow, North Sulawesi. The benefits that can be obtained from outreach activities are: (1) to increase the knowledge and ability of participants to use scientific approaches in understanding conservation issues, and (2) to facilitate opportunities for constructive dialog between researchers and communities located within or adjacent to ecosystems being studied [25]. The purpose is to develop a more fruitful foundation for the development of environmental policies and conservation plans [25].

3.1.5. Anoa conservation effort by local communities. The realization of protecting endangered species in Sulawesi not only derived from the contribution of government, NGOs, and universities, but it was also originate from local individuals through cultural values and local wisdom. Local wisdom is defined as knowledge, while policy and decision making is related to the resolution in order to achieve social harmony and the balance of the ecosystem [26]. It is also a part of the culture and local knowledge that is formed through a process of learning by way of observation, testing, practice and dissemination to the people [27]. Reference exploration findings indicate that there are local communities in Sulawesi that inhabited the forests and known to own custom rules to protect endangered species, for instance, local people of Toro and Kaili in Central Sulawesi, and local people of Moronene in Southeast Sulawesi. Furthermore, the local society of Toro residing by the Lore Lindu National Park allocates its forests with each function. First, Wana ngiki, Wana is the primary forest for endangered species’ habitat and prohibited for agricultural lands except for hunting and collecting gum resin. Second, Pangale and Pahawa Pongko is a long-abandoned former land of agriculture that reforested itself and opened to limited logging. Third, oma is a scrubland that is ready to be reconverted into agricultural land. Finally, Balingkea is an area that requires a fallow period in farming activities due to a decrease in soil fertility, but it is still cultivated for palawija. The Toro natives agreed to penalize criminal behaviors against animal rights, including trapping anoas. Customary punishment for violators is replacing with other kinds of animals, for instance, Tolu Ongu (three cows or buffalos), Tolu Mpulu (30 trays) and Tolu ngakau (30 Mbesa fabric) [28].

Similar to Toro, the local people of Kaili in Central Sulawesi also hold local wisdom in the efforts to reserve forest land, flora and fauna. This intuition is reflected through Ombo, which is the understanding of protecting the living environment, particular flora and fauna, forests, oceans, water springs and river flows, public and customary lands, and preventing diseases. In the context of preserved animals conservation, Ombo strongly stresses in hunting or trading native endangered species of Sulawesi, for example, the anoa, alo bird, enrang bird, manis, black snakes, tigers of Sulawesi, tapir commonly known as Pekanoalu Olo-olo. Furthermore, it is also forbidden to slaughter, harass, hunt, and trade particular wildlife around Kaili Customary region. The arranged penalty based on Ombo is established in order to restrict inappropriate and irresponsible action in trading endemic flora and fauna of Central Sulawesi for personal benefits. If this issue is unresolved, endemic flora and fauna will be extinct. Further, those who violate this customary decree will receive punishment such as samporesi tovau. The existence of prohibiting the slaughter, harassment, hunting, and trading specific faunas as well as collecting, damaging and selling distinct floras in the culture of Kaili proved that their ancestors had contemplated the strategy of protecting endemic flora and fauna of Central Sulawesi. Biodiversity conservation in the region of Central Sulawesi aims to maintain biological natural resources to cultivate and develop at their original habitats. The people believe that the characteristics of protected animals and plants will vanish if they migrate to unfamiliar places. Unfortunately, these customary regulations begin to disappear [29].

In the Southeast part of Sulawesi, Bombana Regency, local people of Moronene Huka’ea La’ea live near the Rawa Aopa Watumohai National Park, they own nine customary territories which are: (1) Inalahi Pure (main forest), (2) Inalahi Popalia (forest buffers), (3) Inalahi Puema (agricultural forest), (4) Olubu (small forest), (5) Kura (meadow), (6) Lueno (meadow), (7) Bako (mangrove), (8) Beo (salt ponds), and (9) Bolo (traditional fish ponds). By customary regulations applied in one of the areas that proudly acknowledge animals, local people of Moronene Huka’ea La’ea ensure that animals must be maintained and preserved; thus, they will not face extinction. These people strongly respect the lives
of animals around them. Besides, wildlife must be utilized wisely. Utilizing wild animals through hunting must be well controlled to avoid conflicts. Undeniably, animal hunting is inherited within the society of Mornene Huka’ea La’ea. However, this action can only be performed at certain times. For instance, deer and anoa can only be hunted when they are adults and not pregnant. Hunting times are allowed during night times and once every three months [30].

Indigenous knowledge can play a vital role in biodiversity conservation. Strict traditional prohibitions on fishing, hunting and undermining the ecological values of sanctuaries involve traditional knowledge and practice in a more explicit way than before in biodiversity conservation and management. However, there are serious indications that this knowledge and its applications disappear quickly due to advanced development and modernization [31]. The tragedy of the disappearance of this knowledge system is most apparent to those who have developed it and make a living through it. Nevertheless, the implication for others can be detrimental as well, when skills, technologies, artifacts, problem-solving strategies and expertise are lost [32].

3.2. Anoa ex-situ conservation activities in Sulawesi

3.2.1. Zoo and captivity. Ex-situ conservation is wildlife, both faunas and plants (genetic resources) preservation activities implemented outside their natural habitats and is aimed as the back up the population. It has two forms of conservation intended for all organisms or parts of a specific organism. For all living organisms, it can be performed in zoos and breeding centers, while parts of a specific organism can be done inside sperm, egg and embryo banks, organ banks, and gene banks [10]. Since the 1970s, The San Diego Zoo has been preserving genetic resources and/or biological materials, including somatic and/or germline cells due to difficulties to conserve anoa species, the project called as “Frozen Zoo” and followed by other projects such as “Frozen Ark” in the United Kingdom [33]. Several studies have been conducted by Indonesian researchers to support anoa ex-situ conservation development. The studies are feeding patterns under ex-situ conservation [34, 35], health and diseases [36], and sexual behavior [37 - 39].

Ex-situ conservation of anoa, at national and international levels, is dominated in the form of maintenance and breeding in zoos. There are at least eight organizations and conversation institutions in Indonesia working together for anoa’s ex-situ conservation with the total number of 42 anoa, namely 24 females and 18 males (Table 2). Three of them are located in Sulawesi Island, namely Anoa Breeding Centre managed by the North Sulawesi Nature Resources Conservation Agency and Forestry and Environment Research and Development Agency in Manado, while the other two are conservation institutions organized by private management Citra Celebes and Gowa Discovery Park.

Global Species Management Plans (GSMP) for anoa recommended that the ex-situ anoa population in Indonesia was targetted as many of 75 individuals. Currently, genetic diversities were estimated at 90% from the existing founder. This percentage was considered higher compared to that of 2016 because several new founders involved in this activity and successfully increased the number of individuals. Gen diversities are projected to be 63% in the next 100 years if the population maintain at 75 individuals. The most effective management strategy to improve the existing population gen is by breeding potential animal founders with a low level of kinship individuals.
Table 2. Ex-situ conservation institutions in Indonesia.

| Institutions                      | Number of Anoa | Administrative Location       |
|-----------------------------------|----------------|-----------------------------|
|                                   | Female | Male   |                                |
| Batu Secret Zoo                   | 1      | 1      | Malang – East Java             |
| Taman Safari Indonesia            | 4      | 3      | Cisarua – West Java            |
| Bali Safari Marine Park           | 2      | 3      | Gianyar – Bali                |
| Ragunan Zoological Park           | 3      | 2      | Jakarta                       |
| Gowa Discovery Park               | 0      | 1      | Gowa – Makassar, South Sulawesi|
| Anoa Breeding Centre              | 7      | 3      | Manado – North Sulawesi        |
| Citra Celebes                     | 3      | 3      | Sokkolia – South Sulawesi      |
| Surabaya Zoo                      | 4      | 2      | Surabaya – East Java           |
| Total                             | 24     | 18     |                               |

Source: GSMP modified (2018)

Anoa Breeding Center (ABC) is established from research and development activities that currently occupies the most significant number of anoa compared to other ex-situ conservation institutions in Indonesia. Studies of anoa have been commencing since 2010 and were conducted within in-situ habitats Bogani Nani Wartabone National Park and Nantu Wildlife Reserves regarding anoa population and its habitats in the north. Study findings were beneficial and contributed to management prescriptions of preserving anoas in ex-situ conservation sites. In 2011, through the cooperation between the North Sulawesi Nature Conservation Agency which held authority in managing wild fauna distribution and the Forestry and Environment Research and Development Agency in Manado, began to do safekeeping animals from the attained of North Sulawesi NCI from both voluntary giving by public and confiscated animals for breeding and research purposes (Table 3).

Table 3. Anoas population in Anoa Breeding Centre 2011 – 2018.

| Year | Number of Population | Additional information                                                                 |
|------|----------------------|----------------------------------------------------------------------------------------|
|      | Plus | Minus | Total |
| 2011 | 1    | -     | 1     | One adult female (Nona) originated from Tandu Rusa Mini Zoo Bitung                   |
|      |      |       |       | Three females, one calf named Ana, two adults named Denok and Manis originated from   |
|      |      |       |       | North Bolaang Mongondow, Nona was died because of health problem                    |
| 2012 | 3    | 1     | 3     | One adult male, named Rambo originated from North Bolaang Mongondow                  |
|      |      |       |       | Breeding Centre has four anoas consist of three females and one male                 |
|      |      |       |       | One adult male named Roki from East Bolaang Mongondow and one adult female named     |
|      |      |       |       | Rita is confiscated from Gorontalo. In this year there are new birth records from     |
|      |      |       |       | Ramo and Denok, but calf (male) are born unsaved caused by dystocia                  |
|      |      |       |       | One female calf named Stela originated from Poso Central Sulawesi, and new birth     |
|      |      |       |       | from Ramo and Ana, calf (female) unsaved caused by dystocia and health problem       |
| 2015 | 3    | 1     | 6     | Two new births from Ramo and Denok, a male calf named Maesa and one from Ramo and    |
|      |      |       |       | Ana, a female calf named Anara                                                     |
| 2016 | 1    | 1     | 7     | One new birth from Ramo and Denok, a female calf named Deandra                      |
| 2017 | 2    | -     | 9     |                                                                                   |
| 2018 | 1    | -     | 10    |                                                                                   |

Source: Anoa Breeding Centre (2019)
Anoa Breeding Centre (ABC) aims to: (1) increase the number of population in both in-situ and ex-situ; (2) strengthen collaboration with other conservation institutions, namely central and regional governments, research institutions, private companies, NGOs, universities, and communities; and (3) conduct research and development to reveal possibilities of anoa domestication and knowledge improvement of people especially children about anoa or Anoa Breeding Centre through conservation education. Various activities that have been carried out until now consist of research and development, training, edu-ecotourism activities, and improvement of facilities and human resources capacities through collaboration with other organizations.

In line with the main tasks and functions of the North Sulawesi Nature Resources Conservation Agency, the activities of ABC are supported by research outputs. The research was not only carried out by internal organization but also accepts external ones such as universities and other research associations. In 2014, the Forestry and Environment Research and Development Agency in Manado collaborated with the Southeast Asian Regional Centre for Tropical Biology (SEAMEO BIOTROP) to do research on anoa reproduction. Likewise, several universities conducted observations at ABC, such as Hasanuddin University on hematology and parasite; Sam Ratulangi University on reproduction; and Bogor Agricultural University on anoas genetic diversities in ex-situ conservation. Ex-situ conservation can support a deeper understanding of anoa, not only in applied research, but also in some basic research such as systematics, reproduction, behavior, genetics, and other biological dimensions that cannot easily be acquired in their native habitats [40].

![Figure 2. Anoas in Breeding Centre Manado, Indonesia.](image)

Training or capacity building is a learning process within a short time that aims to improve knowledge and skills. ABC has conducted two training activities in collaboration with Leipzig Zoo in Germany in 2017 and 2018. The main focus of training is to improve management of anoa ex-situ conservation mainly for keepers and organizing institutions that manage both in-situ and ex-situ
conservation in Sulawesi. The ABC and several conservation organizations such as Gowa Discovery Park and Citra Celebes are intentionally chosen as spots for conservation education about anoa primarily for young generations.

The accomplishment and endurance of the ABC activities cannot be successful on its own as it needs to work together with the others. Since 2015, the ABC has been establishing partnerships with several companies seeking supports regarding anoa ex-situ conservation through Corporate Social Responsibility (CSR) funding such as PT. Cargill Indonesia, PT. J Resources Bolaang Mongondow, and PT. Meares Soputen Mining. These supports are building cages, veterinarians, operational vehicles, and financial assistance for conservation education to local people and communities. Effective and long-term anoa preservation can be realized by associating with stakeholders that have important contribution in protecting anoa. Assistance and active contribution from each party will significantly determine the success of activities. This can be observed from table 3, which points out the achievement of breeding at ABC since 2016 after partnering with various private sectors.

Last few years, anoa became an interesting conservation issue in Sulawesi. The success of the Anoa Breeding Center in the breeding efforts became the triggers for the revitalization of the anoa conservation program. Community awareness has substantially increased by visiting Anoa Breeding Center and other ex-situ conservation institutions, and community knowledge have significantly improved by getting more information about anoa through conservation education and tourism visit. The most interesting thing from this review is the findings of local knowledge from local people who lived around the forest. The local knowledge contains a rule to preserving and protecting anoa as an endemic and endangered animal. The knowledge from local communities can be adopted as anoa conservation regulation in Sulawesi by the local government. The information regarding the number of anoa species, number of anoa population and home range require more research activities. Anoa conservation in Indonesia, especially in Sulawesi, needs supports and collaboration from various parties. The conservation action, in this regard, should encourage the decreasing number of anoa hunting and conserving primary forests as anoa habitat.

4. Conclusion

Besides the values of local wisdom within communities in conserving wildlife, including anoa, anoa conservation efforts in Sulawesi have so far been carried out in two different activities, which are in-situ and ex-situ conservation. It is mostly implemented from the Basic Biodiversity Conservation Law Number 5 of 1990 and the Ministry of Forestry Regulation Number 54 of 2013 about Strategy and Action Plan of Anoa Conservation (Bubalus depressicornis and Bubalus quarlesi) from 2013 to 2022. In-situ conservation activities as an effort to reserve anoa which are carried out through security, patrol, monitoring, improving the capabilities of managing officers in conservation areas, and supporting research in 14 major areas of anoa monitoring. Furthermore, these activities also aim to preserve the integrity of areas regarded as anoa’s habitats, to reduce the number of hunting through public approach, to provide counseling, and to introduce anoa to young children through conservation education. Local wisdom of people of Toro, Kaili and Moronene is regarded as compelling examples of anoa protection.

Anoa sanctuary development in Lejja Nature Tourist Park in South Sulawesi supports the anoa reintroduction program, meanwhile in North and Southeast Sulawesi is still in the planning process. There are eight institutions involved in anoa ex-situ conservation in Indonesia; Sulawesi has three of them, i.e., Anoa Breeding Centre, Citra Celebes and Gowa Discovery Park. Up to this point, ex-situ conservation activities focus on the program of maintenance and anoa breeding in order to increase the population, research and training, education and tourism visiting. Future anoa conservation efforts are highly dependent on solid teamwork, collaboration, and supports of local government.
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