Citizen science networks for waterbird monitoring: Case study of the Asian Waterbird Census in Indonesia

R S Gumilang1,3*, A Mardiastuti1,2, M D Kusrini1,2, and Y R Noor3

1Departement of Natural Resources and Environment Management, IPB University (Bogor Agricultural University), Bogor, Indonesia
2Department of Forest Resources Conservation and Ecotourism, IPB University (Bogor Agricultural University), Bogor, Indonesia
3Wetlands International Indonesia, Jalan Bango 11, Tanah Sareal, Bogor, Indonesia

*Corresponding author : ragilsatriyo@gmail.com

Abstract. Citizen science is a public participation research involving citizen participation, whose outcomes are often advancements in scientific research and increase the public's understanding. This study is aimed to identify the characteristics of volunteers who joined the Asian Waterbird Census (AWC), a part of the long-term global annual monitoring initiative by Wetlands International. Data were gathered through analysis of documentations (year 2015-2019), observation, and deep interview. The number of participants has increased, with the highest was 379 persons in 2019 (an average of 233 persons/year), with half comprised of university graduates (Bachelor or above). There were 5 types of groups involved in AWC: student/universities (34%), NGOs (27%), individuals (19%), government employees (16%), and private sectors (3%). Females’ participation was quite high (43%). About 18% of participants and 44% of the groups, have been joining AWC at least twice, indicating that AWC was an interesting activity. Reasons to join were identified as: increasing personal values, personal scientific development, strengthening social relationships/networks, recreational, and develop a career. Information on AWC schedules was obtained mostly through social media Whatsapp (35%) and Facebook (32%), the organizer (i.e. Wetlands International Indonesia; 37%) and participants’ networks (37%). About 73% of the participants were able to observe less than 100 bird species. Participants’ constraints during the AWC were ability of bird identification, limitation of proper equipment, and low accessibility to potential observation sites. Our study indicated that understanding the characteristics of participants might help to improve the citizen science program, as well as to recruit and retain volunteers.

1. Introduction
The approach to conservation by involving a wide community science is widely promoted globally in the past decade. This approach is known as citizen science or public participation in a scientific research. This is not a brand-new concept and practice. However, the increasing number of resources observation through citizen science indicates that community participation is essential in science [1].

In Indonesia, the citizen science involving volunteers is widely performed. One of the practices is the Asian Waterbird Census (AWC). The AWC is part of a global movement titled the International Waterbird Census (IWC). This annual event is held in January and involves the volunteers from Asia and Australasias regions. A volunteer-based network with the aim of enhancing awareness of waterbird and wetland conservation. The census is conducted by visiting wetlands and counts waterbirds, and
identifying species of birds that are ecologically dependent upon wetlands, including resident or migratory birds. The citizen science approach is a voluntary act. As a citizen science program, the coordinator-scientist of AWC needs to check and requests additional verification of unusual records from participants. In the collation of reports, the authors have to verify the data received from coordinators and participants and refer to coordinators on the validity of information. It has been successful in collecting data and massive information, with at least 2.4 million records are collected globally in the past 23 years. The data also contain the information about the existing condition, threat to the wetlands, and home of the waterbirds [2].

Beside the AWC, there are other bird surveys or monitoring programs involving citizens in Indonesia, especially the bird watchers. The organizers are Raptor watch, Indonesia Shorebirds Monitoring (MoBuPi), Batik Day Bird Observation (Boeharti), and Burungnesia. Based on its classification [1], there are two programs (AWC and Boeharti) defined as contributory. It means the citizen involvement is only in the data collecting process, while the other program, Raptor Watch and MOBUPI, are co-created, meaning the involvement of citizen started from the planning stage, to research design, data collection, data analysis, final result, and follow-ups [3].

The levels of participation in citizen science studies is, however remarkably varied between regions and countries [4]. For citizen science projects to become successful, it is therefore essential to understand the motivations behind the different levels of participation, of which may be different, depending on the local historical and cultural backgrounds and varied among different societal groups [5]. Some studies have identified the main motivations for people to participate in citizen science projects, which include the desire to learn more about scientific issues behind the project, the feeling that they are helping the environment and the enjoyment of developing activities in nature [6], [5]. It was also described that getting to know other people with similar interests, making new friends, having the feeling that they are an active participant and co-owner of the project and gain recognition for their input and achievements were also reasons that encourage people to participate in citizen science projects. The design of citizen science projects should consider both objectives of quality data and goals related to engagement and awareness [4].

The study of citizen networks and involvement in waterbird conservation and its habitat in Indonesia need an in-depth discussion and improvement. Other aspects of involvement, include inventory, data update, research, and awareness. There are many obstacles in the decision-making process related to conservation of waterbird in Indonesia. It might be related to the limited access to data and information, lack of updated data, and limited resource.

This preliminary study aimed to describe the characteristics of the volunteer and the implementation of citizen science in waterbird population monitoring. The study focused on the AWC Indonesia program for the period of 2015 to 2019 as a case study. The researchers then analyzed the volunteers’ characteristics along with the role, potential, and challenge as a program involving a various group of citizens, and to identify the motivations and constraints of volunteers, and provide ideas for improving citizen science program.

2. Methods
Data were gathered through analysis of documentations (annual reports for 2015-2019), observation, and in-depth interview (supported with short questionnaire). Documentation analysis is a form of qualitative research in which documents are interpreted by the researcher aimed to outline the topic of the case study. Document analysis is a social research method. It is an important research tool in its own right and, is an invaluable part of most schemes of triangulation, the combination of methodologies in the study of the same phenomenon. The purpose of triangulating is to provide a confluence of evidence that breeds credibility [7].

Observations and interviews carried out to obtain a description in detail about the experience of the implementation of volunteering. The researchers conducted in-depth interviews (with 3 major topics: reasons, constraints, and ideas) and short questionnaires with 30 volunteers. Respondents were questioned about their views of the reasons for volunteering with AWC. The respondents also discussed
about the limitations and ideas to improve the program. A closed questionnaire (with 10 short-questions) was administered. It aimed to look for a quantitative overview in general to support the analysis of documentation and the results of in-depth interviews. The questionnaire used Likert scale (5 point score). The points are strongly disagree (1 point), disagree (2 point), Neutral (3 point), agree (4 point), and strongly agree (5 point). This scoring were then analyzed using descriptive statistic with mean level. The outcome is the scale of ‘limitation’ experienced by the respondents.

3. Results and Discussions

1.1. Volunteer Characteristics

Based on the documentation’s analysis from AWC (period of 2015-2019), there were 924 volunteers involved directly in waterbird population monitoring in Indonesia. The number of the volunteers increased every year and the peak was in 2019 (up to 379 volunteers) with an annual average number of 233 volunteers. Based on gender, male volunteers comprised of 57%, which was higher than female volunteers at 43%. It was in line with the annual ratio of male to female volunteers. Most of the volunteers only enlisted once in 5 year period (82%). The remaining 18% enlisted more than once in 5 year period of AWC event (see table 1). The number of participants has been increasing, indicating that AWC was an interesting activity, but engaging event although it needs improvement to sustain the number of the volunteers.

The study about the characteristic of volunteer was also conducted in the group (included the institution or the member of it). It was conducted to gather a complete data in designing a strategy and volunteer management. The number of groups enlisted in the study (as a member of an institution) in total was 108. The number of institutions was 48 or 44% involved annually or more than once in 5 year period. Whether the volunteers whose conducted the counting in a group outside the institution were 56 groups in 5 year period. The highest number of group enlisted in AWC was in 2018 (76 groups).

| Volunteer Characteristics       | Individual Total person (ind) | Percentage (%) | Institution Total group | Percentage (%) |
|--------------------------------|--------------------------------|----------------|-------------------------|----------------|
| Gender                         |                                |                |                         |                |
| Male                           | 530                            | 57.4           |                         |                |
| Female                         | 394                            | 42.6           |                         |                |
| Frequency                      |                                |                |                         |                |
| 1 (once)                       | 760                            | 82.3           | 60                      | 55.6           |
| More than 1 (once)             | 164                            | 17.7           | 48                      | 44.4           |
| Group of volunteer             |                                |                |                         |                |
| College /University students   | 515                            | 55.8           | 45                      | 34.4           |
| Non-Government Organization/local group | 224                   | 24.3           | 36                      | 27.5           |
| Individual                     | 99                             | 10.8           | 25                      | 19.1           |
| Government                     | 76                             | 8.2            | 21                      | 16.0           |
| Private sector                 | 10                             | 1.0            | 4                       | 3.1            |
| Year                           |                                |                |                         |                |
| 2015                           | 7                              | 0.6            | 6                       | 2.6            |
| 2016                           | 149                            | 12.8           | 44                      | 18.7           |
| 2017                           | 292                            | 25.1           | 53                      | 22.6           |
| 2018                           | 335                            | 28.8           | 76                      | 32.3           |
| 2019                           | 379                            | 32.6           | 56                      | 23.8           |
| Total                          | 1162                           | 100.0          | 235                     | 100.0          |

Note: Based on the documentation analysis of AWC (period of 2015-2019)

There were five (5) groups of volunteers in the AWC, consisted of college/university student (34%), Non-Government Organization/Local Group (27%), individual (19%), government institution (16%), and private sector (3%). The highest number was college/university student (individual: 56%;
institution: 34%). Most of the group members, shared a common field or study: environment, biology, and biodiversity.

The involvement of college/university students was valued as social capital, which is important in the volunteers management. This group concerned with education and research. In general, this group belonged to student organizations focused on biology, environment, and forestry. The conservation values of citizen science were introduced through AWC event. It is hoped to be the concern of this group in their next project. It is not impossible if they will be the stakeholder related to environmental conservation in the future. The number also indicated that the main goal of the waterbird census was not merely to count the number of waterbird population. It was an effort to bring the awareness, to raise the attention, and capacity building.

The group of Government Institution, at the national, regional, and technical management units, has the potential to be encouraged for wider participation. There were only 21 government agencies (16%) participated in the 5 year period of AWC event. Based on data from the Ministry of Environment and Forestry, Indonesia has 554 Protected Areas (219 Strict Nature Reserves, 72 Wildlife Reserves, 54 National Parks, 118 Nature Tourism Parks, 28 Grand Forest Parks) [8]. Unfortunately, there were several important areas of waterbirds that were not or have not been designated as Protected Areas. Indeed, not the entire habitats were considered to be important waterbird habitats. The Ministry of Environment and Forestry supported the involvement of this group. By issuing letters of support and guidance to the Technical Management Unit to carry out AWC activities, it has resulted to significant impacts in the past 5 years of AWC, shown by the increased number of volunteers from the government institutions.

The networks of AWC organizers and non-government organizations/local groups have been established back in the first AWC in 1989. The AWC organizers and these groups shared its institutional visions, with similar visions on species and habitat conservation, awareness, and policy advocacy. Non-government organizations/local groups have relatively good abilities in observing and identifying animals, as well as individual groups. The members of these groups, often have expertise in photography, both as a hobby or even professional. The interviews showed the biggest motivation of the respondents was to fulfill their passion and desire to contribute, besides hobbies. However, they also agreed to support the improvement of science and environmental preservation policies.

The biggest challenge in AWC network is the involvement of private sector groups, given that several locations outside the Protected Area as crucial habitats for waterbirds were under private authority. For example, the 2017-2018 AWC event found breeding locations for the Milky Stork or Bluwok/Wilwo (*Mycteria cinerea*) located in the company's area in Pantura-Java. In Indonesia, the reports on the presence of endangered and protected species in companies’ lands were scarce. The efforts to obtain data were to observe directly within the company's location. It was in line with the group involvement through collaborative environmental management and monitoring. One of the results was the collaboration in a part of a performance assessment such as *Proper Environment* (performance assessment of a company's environmental management that requires measurable indicators).

1.2. **Motivations of volunteers**

One of the principles of community involvement in citizen science is volunteering [1]. The volunteers devoted their time and resources as manifestations in helping others or certain interests [9,10]. Some volunteers represented their organization, while others, volunteering as individuals. This is in line with the opinion that defines volunteers as individuals who provide free assistance without coercion and the organization has no obligation to pay for it [10].

This study exposed fundamental reasons/motivations of volunteers to join AWC events. Namely the desire or need to participate in: 1) strengthening social relationships/networks, 2) increasing personal values, 3) to seize leisure time with recreation, 4) personal scientific development, and 5) development career (see table 2). The main reason, respondents answered they were also driven by social factors, such as interacting and networking with other volunteers from several institutions involved in AWC events. For respondents, volunteering is an opportunity to make new friends and a chance to interact with new people and to maintain relationships with volunteers they have previously known. It was an
opportunity to help them adjust and get along with important social groups. Most volunteers have interacted with each other, through various communities, academic community, as well as annual events in Indonesia. Two of those events were the Indonesian Bird Watchers Meeting (Pertemuan Pengamat Burung Indonesia/ PPBI) and the Indonesian Bird Watchers and Observers Conference (Konferensi Peneliti dan Pengamat Burung Indonesia/KPPBI).

The social factors are also related to career development. The motivations and rewards for each volunteer differed depending on their age. The study showed that older volunteers prioritized social relationships, while younger volunteers aimed more on portfolio [11]. In brief, the volunteer’s motivation was influenced by their age. Older volunteers tent to be motivated by altruistic motives (concerning the condition of people/other interests), while younger volunteers also motivated by altruistic motives related to their career, social, and understanding which seemed to be more dominant than older volunteers [12].

| Motivational items                              | Mean (M) | Std. Dev (Std) | Ranking |
|------------------------------------------------|----------|----------------|---------|
| Increasing personal values                      | 4.67     | II             |
| I feel it is important for people to volunteer their time to a worthy cause | 4.60     | 0.56          |
| I am concerned about the impacts of environmental change or degradation on waterbirds | 4.90     | 0.31          |
| This programme allows me to actively contribute information to the broader body of scientific knowledge | 4.50     | 0.57          |
| Personal scientific development                | 4.47     | IV            |
| I want to learn more about waterbirds           | 4.57     | 0.68          |
| The AWC allow me to improve my waterbird identification skills | 4.13     | 0.82          |
| I participate in census as it allows for personal development | 4.70     | 0.47          |
| Strengthening social relationships/networks    | 4.70     | I             |
| The AWC allows me to introduce others to birding | 4.90     | 0.31          |
| The AWC provides me with an opportunity for meeting people with similar interests | 4.60     | 0.50          |
| I enjoy sharing new knowledge with others in the birding community | 4.60     | 0.56          |
| Recreational                                   | 4.54     | III           |
| Because it is a lot of fun                     | 4.73     | 0.52          |
| The AWC allows me to indulge my true passion   | 4.47     | 0.82          |
| The AWC provides a great opportunity for recreation | 4.43     | 0.63          |
| Development career                             | 4.34     | IV            |
| It provides me the opportunity to build networking with birding professionals | 4.50     | 0.78          |
| I receive adequate recognition for my work as an volunteer (mention on social media, reports and provision of international certificate) | 4.17     | 0.75          |

Note: n: 30, assessment scale 1 (strongly disagree) to 5 (strongly agree)

The second reason (to encourage/enhance personal values) was closely related to the will to help without expecting rewards. It applied both for human objects, the environment, and the neighborhood. In AWC event, this was related to the concerned for the condition of waterbirds and their habitats. Besides, it is related to the community who concerned about its sustainability. This is in line with the research results [9], [12] which stated that the value, which acted based on the beliefs of helping others, is one of the main factors of volunteer motivation, including in the environmental field.

AWC as an outdoor activity was also the reason for volunteers wanting to spend their time through recreation in wildlife. Even, some volunteers answered that they joined AWC to escape from work routines, while fulfilling their passions. They considered it both as work and hobbies (photography, bird watching, etc.). This is in line with research conducted on the motivation of volunteers who viewed recreational factors in nature (recreation, nature based), as one of the motivations to apply in the environmental field [12].
The study found that AWC volunteers joined to develop their abilities in science and education. This aspect is one of the fundamental objectives of AWC activities as a citizen science and acknowledged by the volunteers. For some respondents, volunteering helped them to increase knowledge and develop or practice some skills they might not accomplish before. This is in line with two (2) main factors of volunteer motivation, those were; 1) aims to fulfill the desire to learn and enhancement, and 2) a motivational process centered on ego growth and development [9]. It was related to the characteristics of volunteer groups (mostly groups of college/universities students) and very relevant to be an important concern for organizers in developing strategies to improve and maintain volunteers. It could be conducted by developing activities outside counting the waterbirds and also training and capacity building. It included activities in producing some contents for publication.

The motivational factors of volunteers in the citizen science activities of waterbird monitoring need further studies. It needs to be done systematically and measured, focusing to the characteristic of the volunteers. The motivation of volunteers in citizen science activities which practicing values of conservation of waterbirds through routine monitoring is an interesting topic in Indonesia. When the study is able to examine the internal motives of volunteers it resulted as an input for volunteer management. The organizer must design such conditions that help to fulfill the internal motivation of volunteers. So, the performance and loyalty of volunteers will increase. From an academic point of view, those further researches would be scientific reference for other studies. It will carry out studies in the field of citizen science on species monitoring or the development of further research, which is scarce in Indonesia.

1.3. Obstacle and technical challenges
The AWC events in Indonesia in past 5 years have been succeeding supported by the active participation of contributors from all regions in Indonesia. However, there are some important habitats for waterbirds which lack of information and need to be documented. It caused by various technical obstacles. From the technical aspect of AWC volunteers, the respondents stated that there were 3 main obstacles and challenges (see table 3). Those were: 1) the ability to identify and to count the waterbirds, 2) access to important and potential observation sites, 3) limited equipment and tools.

The novice observers need assistance to identify the whole 198 species of waterbirds that recorded or found in Indonesia. This obstacle mostly occurred in the similarity of morphological appearance between the infants and the adult waterbirds. The other obstacle is to identify between the waterbirds in the breeding season or the opposite [13]. The ability to identify waterbirds species is, influenced by the frequency of observations in the wild life. To solve this obstacle, the volunteers were equipped with manual book whether at the time of observation or study the existing documentations. However, this effort was often constrained by the limited number of manuals available, as well as the ability of the equipment (optics) for observation and documentation (monocular, camera, etc.). To conduct observation in the shorebird groups, adequate optical equipment becomes the main obstacle. The challenge came from the nature of shorebirds which reactive and sensitive to the presence of humans. Their presence was often far from the reach of the observation site.

Based on the results of review of the AWC report, most of the site visited was accessible. The other potential wetlands areas of waterbirds habitat that suits for resident and migratory birds are relatively inaccessible and require better access. Based on observations and interviews with observers, there were some cause. It included accessibility, limited time and resources (funding). Thus, the observer was not able to calculate for the entire area of observation and reach wider area. Another obstacle related to accessibility was caused by the weather conditions. In January the area covered by heavy rains and large sea waves.

In order to support the results of interviews with respondents, this study also administer short questionnaire. It contained questions to assess the technical obstacles experienced by volunteers. The mean values shown that the obstacle level was in the range from 2.87 to 4.03. It means that the obstacles were experienced by the volunteers. The skill to identify waterbird species ($M$: 4.03) and the skill of counting techniques ($M$: 3.77) were assessed as the most common obstacles experienced by the
volunteers. The other obstacle was accessibility issue which was caused by weather conditions in January (M: 3.57), availability of equipment (M: 3.43), accessibility related to time and distance (M: 3.17), and availability of manuals/field guide (M: 2.87). The level of skill in bird identification was measured by a series of questions about the number of birds in the wild life that they see directly and identified. The results shown that 73% (n: 30) have only observed less than 100 species of bird. This result indicated that the ability to identify was varied. Even it might inadequate for novice observers, and is strongly related to the intensity and experience of observing in nature.

Table 3. Obstacle Assessment for volunteers of AWC

| The obstacle experienced by the volunteers in AWC event(s)                                      | Mean (M) | Std. Dev (Std) | Ranking |
|------------------------------------------------------------------------------------------------|----------|----------------|---------|
| Skill to identify waterbirds species                                                           | 4.03     | 0.67           | I       |
| Skill to count the waterbirds (survey technique)                                              | 3.77     | 0.68           | II      |
| Accessibility (transportation and distance) to reach important site (s)                         | 3.17     | 1.05           | V       |
| Accessibility (time) in January - caused by the weather condition                             | 3.57     | 0.77           | III     |
| Availability of manuals/field guide                                                           | 2.87     | 1.07           | VI      |
| Availability of observatory tools (optical)                                                   | 3.43     | 1.19           | IV      |

Note: n: 30, assessment scale 1 (strongly disagree) to 5 (strongly agree)

The important locations of waterbirds habitats were abundant in Protected Areas with crucial wetlands. It was both located on the Natural Reserve Area (Kawasan Suaka Alam/KSA) and the Natural Conservation Area (Kawasan Pelestarian Alam/KPA). However, the available data showed that the census had not been carried out comprehensively in these areas. The concern of the authority was very limited, and it is important to be improved. The data from AWC is a reference to design conservation efforts, especially areas of wetlands. Furthermore, based on the results of the study, the decline in population and conservation efforts of waterbird in the world depend on the effectiveness of the institution [2].

1.4. Dissemination and knowledge management

The growing use of information technology, especially internet, expands the opportunities for the community to take parts in citizen science. Building and maintaining the involvement of volunteers required ongoing efforts and resources. One of the efforts and strategies applied was the dissemination and information management with internet technology [14]. This tool provides an opportunity to communicate between the organizers of AWC events and the volunteers. It encourages involvement and learning process. The opportunity to learn could be a motivation and beneficial aspects for environmental volunteers [15].

Table 4. Assessment of information source and platform about AWC events

| Source and media platform to obtain AWC information | Number of Response | Percentage (%) |
|-----------------------------------------------------|--------------------|----------------|
| The most feasible source of information             | Friend/colleague(s) | 7              | 17.1            |
|                                                    | Internal network (group/community/institution/organization) | 15 | 36.6            |
|                                                    | AWC Organizer (Wetlands International/KLHK)                  | 15 | 36.6            |
|                                                    | Mass media                                                  | 4  | 9.8             |
|                                                    | **Total response**                                          | **41** | **100.0**     |
| The most accessed social media                      | Facebook                                                    | 21 | 32.3            |
|                                                    | Instagram                                                   | 11 | 16.9            |
|                                                    | Twitter                                                     | 1  | 1.5             |
|                                                    | Email                                                       | 9  | 13.8            |
|                                                    | Whatsapp                                                    | 23 | 35.4            |
|                                                    | **Total response**                                          | **65** | **100.0**     |

Note: The type of questionnaire was multi-response and analyzed with the frequency distribution.
To date, the official media for disseminating information of the AWC events was on Facebook Fanpage (@wetlandsinternationalindonesia), Wetlands website (https://indonesia.wetlands.org), the website of the Directorate General of KSDAE of the Ministry of Environment and Forestry (www.ksdae.menlhk.go.id), and the Whatsapp Group for Waterbirds Monitoring (Monitoring Burung Air ID/KNKBBH - under coordination with the National Partnership for the Conservation of Migratory Birds and their Habitats. Based on the results of the questionnaires, the most feasible social media that ease the dissemination were Whatsapp (35%) and Facebook (32%). While the most accessible source of information for volunteers in obtaining information directly through AWC organizers, was from Wetlands International Indonesia (37%) and through the internal network of volunteers (37%). The information was forwarded by the groups/communities/institutions they belonged to (see table 4).

One point that stands out in the AWC events was the use of Whatsapp Group as an interactive media. Social media can provide forum for learning, exchange of information, and data sharing. This media was joined by volunteers with various backgrounds and levels of expertise. It even including wildlife experts and other fields related to the subject. This condition had also created a more comprehensive discussion and learning hub. It provided opportunities to share knowledge and expertise with others which are important for experienced environmental volunteers [16]. The interactions from the various types of backgrounds and expertise in this media allows for diverse discussions and provides opportunities for less experienced volunteers to learn and develop related skills.

4. Conclusions
This study found that understanding the characteristics and participation of volunteers could support the improvement of citizen science programs. As a citizen science, the 2015-2019 AWC events involved community participation and supports the development of science. The number of participants has been increasing indicating that AWC was an interesting activity. Reasons to join were identified as: increasing personal values, personal scientific development, strengthening social relationships/networks, recreational, and develop a career. Participants’ constraints during the AWC were ability of bird identification, limitation of proper equipment, and low accessibility to potential observation sites. The interactions from the various types of backgrounds and expertise in social media allows for diverse discussions and provides opportunities for less experienced volunteers to learn and develop related skills.

5. Recommendations
We recommended to the organizer for: increasing network engagement (esp. to private sector, government, & student), keeping responsive two way communication with volunteers, increasing waterbird identification & survey skills (by training/coaching/lecturing or producing guideline material), intensive use of social media, and giving recognition of volunteer’s contribution, e.g. mention on social media, reports and provision of international certificate.

However, it would need further study and efforts to engage and retain volunteers. The motivational aspect of volunteers in the citizen science of waterbird monitoring need to be investigated further, systematically and measured, focusing on the characteristics of the volunteers. Such further study would become the scientific reference materials for other researcher. Especially for researchers who are studying similar field (the citizen science on waterbirds species monitoring) or development of further research, which is not a popular study in Indonesia.

Acknowledgments
This study was supported by the Wetlands International Indonesia and the National Partnership for the Conservation of Migratory Birds and their Habitats. The authors wished to thank all the volunteers of the AWC in Indonesia.
References

[1] Bonney R, Cooper C B, Dickinson J, Kelling S, Phillips T, Rosenberg K V and Shirk J 2009 Citizen Science: A Developing Tool for Expanding Science Knowledge and Scientific Literacy *Bioscience* 59 977–84

[2] Amano T, Székely T, Sandel B, Nagy S, Mundkur T, Langendoen T, Blanco D, Soykan C U and Sutherland W J 2017 Successful conservation of global waterbird populations depends on effective governance *Nature* 553 199

[3] Yuda P 2017 *Proc. Nat. Conf. of Indonesian Bird Watchers and Observers (KPPBI)* Vol III (Denpasar: Udayana University) 1-12

[4] Tiago P, Gouveia M J, Capinha C, Santos-Reis M and Pereira H M 2017 The influence of motivational factors on the frequency of participation in citizen science activities *Nat. Conserv.* 18 61–78

[5] Widjaja E 2010 Motivation Behind Volunteerism *C. Sr. Theses* 1–36

[6] Steven L, Ian T and Neil B 2016 Citizen science: advantages of shallow versus deep participation *Front. Environ. Sci.* 4

[7] Bowen G A 2009 Document analysis as a qualitative research method *Qual. Res. J.* 9 27–40

[8] Kementerian Lingkungan Hidup dan Kehutanan 2019 *Statistik Direktorat Jenderal Konservasi Sumber Daya Alam dan Ekosistem Tahun 2018* (in Bahasa) (Jakarta : Kementerian Lingkungan Hidup dan Kehutanan)

[9] Clary E G, Snyder M, Ridge R D, Copeland J, Stukas A A, Haugen J and Miene P 1998 Understanding and assessing the motivations of volunteers: A functional approach. *J. Pers. Soc. Psychol.* 74 1516–30

[10] Clary E G and Snyder M 1999 The motivations to volunteer: Theoretical and practical considerations *Curr. Dir. Psychol. Sci.* 8 156–9

[11] Cnaan R a and Handy F 2005 Towards understanding episodic volunteering *VIO - Vrijwillige Inzet Onderzoek* 2 29–35

[12] Cnaan R A, Handy F and Wadsworth M 1996 Defining who is a volunteer: Conceptual and empirical considerations *Nonprofit Volunt. Sect. Q.* 25 364–83

[13] Gidron B 1978 Volunteer work and its rewards *Volunt. Adm.* 11 18—32

[14] Wright D R, Underhill L G, Keene M and Knight A T 2015 Understanding the Motivations and Satisfactions of Volunteers to Improve the Effectiveness of Citizen Science Programs *Soc. Nat. Resour.* 28 1013–29

[15] Howes J, Bakewell D and Noor Y R 2003 *Panduan studi burung pantai* ed Prawiradilaga D M (Bogor: Wetlands International IP) 37

[16] Liberatore A, Bowkett E, MacLeod C J, Spurr E and Longnecker N 2018 Social Media as a Platform for a Citizen Science Community of Practice *Citiz. Sci. Theory Pract.* 3 1–14

[17] Alender B 2016 Understanding volunteer motivations to participate in citizen science projects: A Deeper look at water quality monitoring *J. Sci. Commun.* 15 1–19

[18] Measham T G and Barnett G B 2008 Environmental Volunteering: Motivations, modes and outcomes *Aust. Geogr.* 39 537–52