The estimation of the coastal fisheries resources quantity based on waterbirds in the Ujung Pangkah Region, Gresik Regency, East Java

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Abstract. Waterbirds are a group of birds that have a high dependence on natural and artificial aquatic habitats. Its existence indicates the availability of sufficient feed at that location. This is related to bird habitat preference, which always makes feed one of the basic things to fulfill their daily needs. The Ujung Pangkah area is an estuary habitat occupied by waterbirds, both resident and migratory birds. Therefore this area provides sufficient feedstock for the existing waterbirds. Most of the aquatic bird feed is aquatic animals that live in aquatic ecosystems. This research is expected to provide a general description of the relationship between waterbirds and the number of fishery resources. The research was conducted in November 2019 in six locations in the Ujung Pangkah Region, Gresik Regency, East Java. The study results found that the waterbird population’s highest density of the was found in Kalianyar with a density of 3,878.98 ind/ha. In line with this, Kalianyar has become a high location for stocks of fishery resources. A total of 8,880,000 ind/ha benthic and 29.30 ind/ha necton were found in this location.

Keywords: coastal management; fishery resources; Ujung Pangkah; waterbirds

1. Introduction
The movement of birds, examining various factors, both biotic and abiotic factors. One that affects the movement of waterbirds is the presence of a source of feed [1]. Waterbirds are fish-eating birds with a suitable habitat that will not be far from wetland habitats such as swamps, paddy fields, rivers, coastal areas, and lakes. This shows that these wetland habitats are important locations for supporting water bird life [2].

Rahman and Ismail [3] state that water birds are a large group of birds that have a high dependence on both natural and artificial aquatic habitats. Even Ainley [4] state that seabirds can spend about 90% of their life in the ocean. Therefore, most seabirds are exploratory species with a wide distribution in several oceans in the world [5].
The main feed of waterbirds is fishery resources starting from Benthos and Necton [2]. Of course, these fishery resources are closely related to the biophysical environmental conditions in a location. Therefore, sometimes waterbirds can be used as a bio-indicator of environmental health in aquatic habitats, such as seabirds, to indicate changes in ecosystems [6]. According to Cita and Budiman [7], the high diversity of waterbirds in a mangrove forest can show the health of the mangrove forest in that location. Meanwhile, Budiman [8] states that water birds are one of the components used in measuring environmental sensitivity to change.

The ecosystem balance in a location will significantly depend on the presence of environmental biophysical components. Waterbirds and fishery resources are closely related components because fishery resources will automatically invite waterbirds to come over. The presence of waterbirds can be an early sign of the availability of fishery resources at that location. This condition is driven by waterbirds habitat preferences, which is a component of feed and the basic needs of waterbirds in a habitat [1].

The Ujung Pangkah area is an estuary habitat occupied by waterbirds, both residents and migratory birds [9]. Therefore, this area is certainly able to provide sufficient feedstock for existing waterbirds. Most of the waterbird feed is aquatic animals, which can be defined as fishery resources, both from macrozoobenthos and necton that live in aquatic ecosystems [2]. This research is expected to provide a general description of the relationship between the waterbird density and the number of fishery resources.

2. Method
The research was conducted in November 2019 in six observation locations in the Ujung Pangkah Region, Gresik Regency, East Java. The six locations are Badan sungai (J1), Kalimalang (J2), Lebaan (J3), Kalianyar (J4), Lawean (J5), and Paloh (J6) (see figure 1).

![Figure 1. Map of research locations.](image-url)
The object of observation is in the form of waterbirds found in all observation paths as well as benthic and necton fishery resources. Observers monitor the feeding behavior of waterbirds to determine groups of waterbird feeding behavior [11]. Observations were made throughout the day, starting in the morning (07.00) until late afternoon (17.00). Bird-watching tools were binoculars, a field guide book of birds [13], a global positioning system (GPS), cameras, and stationary. Benthos samples were taken using Grab measuring 30 x 30 cm for deep sampling and using a 1 mm edged sieve to take samples in the shallow substrate with a sampling plot measuring 1 x 1 m. Necton observations are carried out using a double loop net measuring 2 m high and looped around 100 m in circumference. Bird-watching used a single station technique at each location with an observation radius of 50 m [14]. The flowchart of the method in this research is shown in figure 2.

![Flowchart of method in this research](image)

Figure 2. Flow chart of method in this research.

The observer calculates the number of birds in the research radius every 30 minutes, then the total number of individuals becomes the data for encounters at one point of observation. Benthic observations were carried out by taking samples in three observation plots where each sample represented a depth, namely at a depth of < 5 m, 5 - 10 m, and > 10 m. Benthos samples were taken from each substrate to a substrate depth of 40 cm. Then the necton observation was carried out by spreading a net in each estuary, which was the observation location for one day where the fishing was made every one hour to count the number of necton individuals caught [15].

Analysis of the density of waterbirds at each location used the individual density formula to calculate the ratio of the number of individuals found in the area observed [10]. The bird-eating behavior group used the eating behavior group, according to Kurniawan and Arifianto [11]. It is used to differentiate the fishery resources consumed by birds. Fishery resources were analyzed by looking at each location’s density, both from the benthic and necton found [10]. Field area statistical of the relationship between bird density and fishery resources density was carried out using the regression.

3. Result and discussion

The study results found 44 species of water birds from 10 families (see table 1). The species with the largest number found was the *Egrettagarzetta*, with a total number of encounters in all locations, 1,286 individuals. On a massive scale, this species’ existence indicates that the location is quite rich in fishery resources, especially shallow water fish. This is because the characteristics of *E. garzetta* usually eat groups of crustaceans, mollusks, and fish in shallow-waters, or mangrove areas [13]. This bird hunts by
sneaking close to its prey and then quickly sticking its head into the water to catch the prey, or so-called lunging [10]. This bird has a long neck morphology and has a body size that is not too large. These birds usually flock to hunting and are sometimes seen in groups with flocks of other species [13].

Table 1. List of waterbird species found in Ujung Pangkah.

| No. | Family      | Indonesia name | Scientific name            | Total encounter (ind) |
|-----|-------------|----------------|---------------------------|-----------------------|
| 1   | Anatidae    | Itik benjut    | Anas gibberifrons         | 38                    |
| 2   | Anatidae    | Belibis kembang| Dendrocygna arcuata       | 21                    |
| 3   | Ardeidae    | Bambangan merah| Ispyrynchus cinnamomeus   | 19                    |
| 4   | Ardeidae    | Blekok sawah   | Ardeola speciosa          | 813                   |
| 5   | Ardeidae    | Cangak merah   | Ardea purpurea            | 4                     |
| 6   | Ardeidae    | Kokokan laut   | Batorides striata         | 436                   |
| 7   | Ardeidae    | Kuntul besar   | Ardea alba                | 825                   |
| 8   | Ardeidae    | Kuntul kicil   | Egretta garzetta          | 1286                  |
| 9   | Ardeidae    | Cangak abu     | Ardea cinerea             | 27                    |
| 10  | Ardeidae    | Cangak laut    | Ardea sumatrana           | 3                     |
| 11  | Ardeidae    | Kowakmalam abu | Nycticorax nycticorax    | 29                    |
| 12  | Charadriidae| Cerek java     | Charadrius javanicus      | 184                   |
| 13  | Charadriidae| Cerek kurnut   | Pluvialis fulva           | 31                    |
| 14  | Ciconiidae  | Bangau bluwok  | Mycteria cinerea          | 20                    |
| 15  | Ciconiidae  | Bangau tong-tong| Leptoptilos javanicus    | 17                    |
| 16  | Laridae     | Daralaut jambul| Sterna bergii             | 121                   |
| 17  | Laridae     | Daralaut kicil | Sterna albifrons          | 185                   |
| 18  | Laridae     | Daralaut putih | Gygis alba                | 12                    |
| 19  | Laridae     | Daralaut tengkuk-hitam | Sterna sumatrana | 203                   |
| 20  | Laridae     | Daralaut tiram | Gelochelidon nilotica     | 892                   |
| 21  | Laridae     | Daralaut Kumis | Chlidonias hybrida        | 260                   |
| 22  | Laridae     | Daralaut Benggala | Sterna bengalensis      | 41                    |
| 23  | Laridae     | Daralaut biasa | Sterna hirundo            | 127                   |
| 24  | Laridae     | Daralaut cina  | Sterna bernsteini         | 2                     |
| 25  | Laridae     | Daralaut sayap-putih | Chlidonias luecoperus | 46                    |
| 26  | Pelicanidae | Undan kacamata | Pelecanus conspicillatus | 7                     |
| 27  | Phalacrocoracidae | Pecukpadi hitam | Phalacrocorax sulcirostris | 57                   |
| 28  | Phalacrocoracidae | Pecukular asia | Anhinga melanogaster     | 29                    |
| 29  | Rallidae    | Kareo padi     | Amaurornis phoenicurus    | 4                     |
| 30  | Recurvirostridae | Gaganghayam timur | Himantopus leucocephalus | 18                    |
| 31  | Scolopacidae| Gajahan penggala| Numenius phaeopus        | 158                   |
| 32  | Scolopacidae| Trinil pantai  | Actitis hypoleucos        | 356                   |
| 33  | Scolopacidae| Gajahan besar  | Numenius arquata          | 234                   |
| 34  | Scolopacidae| Gajahan timur  | Numenius madagascariensis | 246                  |
| 35  | Scolopacidae| Birulaut ekor-blorok | Limosa lapponica       | 123                   |
| 36  | Scolopacidae| Birulaut ekor-hitam | Limosa limosa            | 48                    |
| 37  | Scolopacidae| Gajahan kecil  | Numenius minutus         | 62                    |
| 38  | Scolopacidae| Kedidi golgol  | Calidris ferruginea       | 3                     |
| 39  | Scolopacidae| Kedidi putih   | Calidris alba             | 13                    |
| 40  | Scolopacidae| Trinil kaki-merah | Tringa totanus          | 13                    |
| 41  | Scolopacidae| Trinil semak   | Tringa glareola          | 7                     |
| 42  | Scolopacidae| Trinil bedaran | Xenus cinereus            | 3                     |
| 43  | Scolopacidae| Trinil kaki-hijau | Tringa nebularia        | 4                     |
| 44  | Scolopacidae| Trinil pembalik-batu | Arenaria interpres    | 2                     |

Source: Primary data (2019)
The waterbird feeding behavior groups encountered consisted of Scanning, Probing, Lunging, Dabbling, Dipping, Diving, Plunge diving, and Skimming (see figure 3, detail per species shown in Appendix 1). According to Kurniawan and Arifianto [11], these findings are based on field observations based on grouping. The proportion of feeding foraging behavior of waterbirds that encountered is shown in figure 3. The Scolopacidae family feeds on macrozoobenthos, which are at a depth of 0 - 15 cm. This is one factor that causes the family to have Probing behavior in looking for its prey. This behavior is to insert the beak into the material’s surface (mud or sand) to find and take food. It is widespread for shorebirds to look for worms, mollusks, and crustaceans [12]. This condition confirms the theory by Dann [15], which states that beak shape and feeding behavior are a form of morphological adaptation of each shorebird species.

Figure 3. The proportion of foraging behavior in waterbirds in Ujung Pangkah.

The division of bird groups can be divided into three groups based on dependence on the sea. This division includes seabirds, shorebirds, and other scaffolding or common waterbirds. Seabirds are a group of birds that spend most of their life at sea. His visits to land are usually only in the context of breeding or coastal areas that are still affected by ocean dynamics [5]. This bird usually eats fish in coastal areas and the middle of the sea [16]. The existence of this seabird has a wide distribution. This is because seabirds are exploratory-type birds. Even seabirds, several species live in remote areas in the middle of the ocean or have a very wide home range so that the exact population size is not known [17]. In general, the adaptation of shorebirds morphology to feed can be seen in the illustration shown in figure 4.

Shorebirds are ecologically highly dependent on the beach as a place to find food or a place to breed [2]. This group of shorebirds is included in the Charadriiformes order, which consists of the Jacanidae, Rostratulidae, Dromadidae, Haematopodidae, Ibidorhynchidae, Recurvirostridae, Burhinidae, Glareolidae, Charadriidae, Pluvianellidae, Scolopacidae, and Thinocoridae families [18]. Commonly, these birds eat benthos and nection in the mud. There are different types of food eaten based on their morphological shape. Birds with long legs with webless toes, such as *Tringa nebularia*, usually feed on benthos in the soft mud. Its legs’ ability allows this bird to maintain its body balance when preying on benthos in the mud [2]. Another shorebird that has webs on its feet and oil glands in its feathers allow it to dive underwater. This condition can be found in Cormorants whose feeding behavior is often found diving into the water to catch fish prey [19]. Seabirds usually have some feeding behavior to catch fish in the water. It depends on water conditions and also the depth of the fish from sea level. Several kinds of seabird feeding behaviors are shown in figure 5.
Other scaffolding birds, such as the Ardeidae family, have a fairly wide habitat inland. These birds occupied various wetland locations — even locations with a high disturbance level, such as in urban areas. One of the locations that still have waterbirds and still survives is Yogyakarta’s Adisutjipto airport with waterbirds, such as *Bubulcus ibis* and *Ardea cinerea* [20]. This also happens because it is still able
to provide complete habitat factors for the waterbird. The study shows that water birds at Adisutjipto airport can be seen throughout the study zone, where there are still intersections with rice fields and rivers [20].

The density of the waterbird population was found in Kalianyar with a density of 3,879 ind/ha there is equivalent to 4 ind/ha. At that location, the waterbird habitat is in the form of a secondary mangrove forest, which is still quite thick. Besides that, mudflat stretches were also found with a substrate in mud and a little sand. The substrate can still be used as a foraging location for seabirds and other water birds. In mud-substrate locations affected by waves, benthos such as worms and small shells are usually easy to find, so birds with long beaks such as *Himantopus leucocephalus* and *Limosa lapponica* will prefer to be there. Meanwhile, for denser beaches with more sand composition, benthos such as crustaceans and mullusks are usually found, preferably *Charadrius javanicus* and *Actitis hypoleucos*.

Seabirds usually prefer charred beach areas that are not submerged by water, because in these locations seabirds such as *Sterna albifrons* will raise their young by providing feed obtained from hunting in the sea. When hunting in the sea, this tern often grabs small fish or shrimp that tend to be close to the surface of the water. However, it is not uncommon for these species to be seen in a herd somewhere. Also, there is a possibility of mingling between water birds and shorebirds in a flock (figure 6). This occurs in a mudflat, which provides feed for shorebirds and provides a resting site for seabirds.

![Figure 6. Terns, Whimbrel, and Sandpipers in one flock.](image)

There is often competition both between species and intra-species for food. The feeding behavior of these birds is closely related to the feed preferences of each species. Usually, this condition also adapts to the morphology of the beak. Although a species is closely related to other species, it does not necessarily have the same food preferences and morphological forms. Some species have similar morphological forms with similar feed preferences, which are quite distant. This is related to evolutionary convergence in the past [12]. So this also can lead to competition between species.
The finding of high bird density in Kalianyar is in line with its fishery resource stock findings. A total of 8,880,000 ind/ha benthic and 29 ind/ha necton were found in this location. The invention showed that the stocks of fishery resources in Kalianyar were higher than those found in Lebaan. These findings have confirmed the theory that fishery resources will attract waterbirds (shorebirds, scaffolding and seabirds) to stop at these locations [21]. In this study, these findings are preliminary in estimating the available fishery resources.

Observations of benthos and necton were only carried out in two locations: the Kalianyar and Lebaan locations. This was done because of difficulties in collecting data in other locations. These difficulties are related to accessibility and limited time. So that in estimating fishery resources in all locations, a statistical calculation is needed to predict it.

The statistical calculation process is carried out using linear regression in which the model used in estimating fishery resources uses the results of the model obtained from bird density modeling. The first step is to sort bird density data upward (from lowest to highest). This is done to develop a statistical model; bird density data in all observed locations are sorted from lowest to highest bird density with the assumption that location names will not make a significant contribution to bird density. Thus, it is assumed that the location names’ order will not affect the statistical analysis, so that the data line obtained is obtained in figure 7.

![Figure 7. The density of waterbirds at each location.](image)

The highest bird density is found in Kalianyar, while the lowest bird density is found in Kalimalang. This condition is suspected because Kalianyar is one of the estuaries with a fairly wide stretch of mudflat compared to other estuaries [9]. At the location of Kalianyar, there are many sandbars and mudflats with a mud substrate that allows various types of benthos and necton to live in each substrate. This also invites more birds to visit this location.

The next step is to build a statistical model based on the sorted bird density. The model is obtained in the form of the notation $y = 121.22e^{0.5881x}$, where the y-axis is the density of the birds and the x-axis is the order of its location, $e$ is the exponential basis used where this base is the natural base. This model also appears $R^2 = 0.922$, where the choice of this exponential regression model is ideal because it is easier to use and the uncertainty value is relatively low.

The correlation test between the density of benthos, necton, and birds indicates a positive correlation between the three components. This analysis can be used to predict the density of benthic and necton populations in other locations. The real necton and benthos encounter was found at the Lebaan estuary and the Kalianyar estuary. In other locations, benthos and necton have not been observed. This is done...
because, in this research, it is still the indicting process of further research. Seeing these two locations can also be seen in plain view the correlation between the two. However, statistical tests also need to be carried out to obtain a model to estimate the density of benthos and necton in other locations. Assuming that the density of necton and benthos will follow the quantitative pattern of bird density, then the necton and benthic density models are developed using an exponential regression model. The results of these predictions are shown in the table 2 and table 3.

Table 2. Densities of individual birds and necton.

| Location | Density of birds (ind/ha) | Field study necton (ind/ha) | Prediction density base of bird model (ind/ha) |
|----------|---------------------------|----------------------------|-----------------------------------------------|
| Kalimalang | 238                       |                            | 25                                             |
| Badan sungai | 239                      |                            | 26                                             |
| Lawean    | 1,125                     |                            | 27                                             |
| Lebaan    | 1,475                     | 28                         | 27                                             |
| Paloh     | 1,997                     |                            | 28                                             |
| Kalianyar | 3,879                     | 29                         | 29                                             |

Table 3. Densities of individual birds and benthos.

| Location | Density of birds (ind/ha) | Field study benthos (ind/ha) | Prediction density base of bird model (ind/ha) |
|----------|---------------------------|-----------------------------|-----------------------------------------------|
| Kalimalang | 238                       |                             | 100,703                                       |
| Badan sungai | 239                      |                             | 246,676                                       |
| Lawean    | 1,125                     |                             | 604,243                                       |
| Lebaan    | 1,475                     | 1,480,000                   | 1,480,116                                     |
| Paloh     | 1,997                     |                             | 3,625,602                                     |
| Kalianyar | 3,879                     | 8,880,000                   | 8,881,056                                     |

Based on this table, it can be described as the linear regression graph on necton and benthos. This prediction can complement the missing data in the estimation of fishery resources in Ujung Pangkah. Using the same model in the prediction model then applied to the actual model, the uncertainty value is $R^2 = 0.9816$ so that the predicted value with the real value will not be much different. Likewise, with the model obtained for benthos. The predictive value was applied to complement missing data at locations for which data was not captured. The exponential regression model’s application is used in calculating the actual data, where the uncertainty value is $R^2 = 1$. The data generated by the predicted value can be said to be the same as the actual data.

In the data translation, there is not to much difference between the results of the benthos and necton field observations at these two locations (Lebaan and Kalianyar). The results of necton field observations were found 28 and 29 ind/ha and through the prediction were found 27 and 29 ind/ha. Meanwhile the results of the benthos field observations were found 1,480,000 and 8,880,000 ind/ha and through the predictions found 1,480,116 and 8,881,056 ind/ha. It is suspected that there is a positive correlation between bird density and the density of necton and benthos (see table 4). The hypothesis used is that the higher density of birds in a location, the higher density of benthos and nectontoo in that location. This can be used to estimate fishery resource estimates. The estimation of the individual density of necton obtained from the calculation results is that it has an average of 27 ind/ha with a confidence interval of 98.16%. The estimated density of benthic individuals obtained from the calculation results is to have an average of 2489733 ind/ha with a 100% confidence interval.
Table 4. Estimates of population density of fishery resources.

| Location     | Benthic density (ind/ha) | Necton density (ind/ha) |
|--------------|--------------------------|-------------------------|
| Kalimalang   | 100703                   | 25                      |
| Badan sungai | 246676                   | 26                      |
| Lawean       | 604243                   | 27                      |
| Lebaan       | 1480116                  | 27                      |
| Paloh        | 3625602                  | 28                      |
| Kalianyar    | 8881056                  | 29                      |
| Total        | 14938396                 | 162                     |
| Average      | 2489733                  | 27                      |

The assumption used in this linear regression is to follow a model with $R^2$ that is closest to the value 1, where 1 is the actual condition. However, in this condition, the modeling still uses a very minimum number of samples. This relates to this research, which is still in the process of being developed. Using as many samples as possible will improve the emerging model in which the model will be more accurate. It was also confirmed by Zhang et al. [22], that the relationship between bird density and fishery resources, where at Wuiliansuhai Lake, China, there was a positive correlation between the density of shorebirds and benthos. The correlation that appears in the modeling is 53.63% with $p = 0.046$ during the autumn period.

The follow-up use of these statistics can make it easier to predict conditions in a location as an initial guess before going to the field. Besides, in the engineering sector, the assumptions obtained will make it easier to predict which locations are abundant in fishery resources. The fishery resources, i.e., benthos and necton (fish), are challenging to see because their habitat is in the waters. By looking at the presence of birds that are quite dense in a location, this can indicate of the existence of abundant fishery resources in the same location.

It should also be borne in mind that birds are quite opportunistic in their foraging [2]. In addition to the natural presence of food that will invite birds to the location, the presence of catch fishery resources can also invite birds to come too. Before seeing the size or size of a flock of birds in a location, it is necessary to pay attention to human activities in the vicinity, namely exploiting fishery resources. This can take the form of spreading seeds in ponds, catching fishery resources in water bodies, or other activities that can invite the presence of waterbirds.

4. Conclusions
The findings of waterbirds in Ujung Pangkah consisted of 44 species with a different type of eating behavior. There are 43% of shorebirds in Ujung Pangkah doing problems in finding prey. The density of the waterbird population was found in Kalianyar with a density of 3,879 ind/ha. The finding of high bird density in Kalianyar is in line with its fishery resource stockfindings. A total of 8,880,000 ind/ha benthic and 29 ind/hanecton were found in this location. The exponential regression model obtained based on the bird density model is $y = 121.22e^{0.5881x}$ with $R^2 = 0.922$. The estimation of the individual density of necton obtained from the calculation results is that it has an average of 27 ind/ha with a confidence interval of 98.16%. The estimated density of benthic individuals obtained from the calculation results is to have an average of 2489733 ind/ha with a 100% confidence interval.

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# Appendices

## Appendix 1. List of feeding behaviour.

| No. | Family         | Indonesia name           | Scientific name                | Feeding behaviour |
|-----|----------------|--------------------------|--------------------------------|-------------------|
| 1   | Anatidae       | Belibis kembang          | Dendrocygna arcuata            | Da                |
| 2   | Anatidae       | Itik benjut              | Anas gibberifrons              | Da                |
| 3   | Ardeidae       | Bambangan merah          | Ixobrychus cinnamomeus         | Lu                |
| 4   | Ardeidae       | Blekok sawah             | Ardeo speciosa                 | Lu                |
| 5   | Ardeidae       | Cangak abu               | Ardea cinerea                  | Lu                |
| 6   | Ardeidae       | Cangak laut              | Ardea sumatrana                | Lu                |
| 7   | Ardeidae       | Cangak merah             | Ardea purpurea                 | Lu                |
| 8   | Ardeidae       | Kokokan laut             | Butorides striata              | Lu                |
| 9   | Ardeidae       | Kowakmalam abu           | Nycticorax nycticorax          | Lu                |
| 10  | Ardeidae       | Kuntul besar             | Ardea alba                     | Lu                |
| 11  | Ardeidae       | Kuntul kecil             | Egretta garzetta               | Lu                |
| 12  | Charadriidae   | Cerek jawa               | Charadrius javanicus           | Pr                |
| 13  | Charadriidae   | Cerek kenyut             | Pluvialis fulva                | Pr                |
| 14  | Ciconiidae     | Bangau bluwok            | Mynertia cinerea               | Pr                |
| 15  | Ciconiidae     | Bangau tong-tong         | Leptoptilos javanicus          | Pr                |
| 16  | Laridae        | Daralaut benggala        | Sterna bengalensis             | Sc                |
| 17  | Laridae        | Daralaut biasa           | Sterna hirundo                 | Sc                |
| 18  | Laridae        | Daralaut cina            | Sterna bernsteini              | Sc                |
| 19  | Laridae        | Daralaut jambul          | Sterna bergii                  | Sc                |
| 20  | Laridae        | Daralaut kecil           | Sterna albisflora              | Sc                |
| 21  | Laridae        | Daralaut kumis           | Chlidonias hybrida             | Sc                |
| 22  | Laridae        | Daralaut putih           | Gygis alba                     | Sc                |
| 23  | Laridae        | Daralaut sayap-putih     | Chlidonias leucopetra          | Sk                |
| 24  | Laridae        | Daralaut tengkuk-hitam   | Sterna sumatrana               | Sk                |
| 25  | Laridae        | Daralaut tiram           | Gelochelidon nilotica          | Sc                |
| 26  | Pelecanidae    | Undan kacamata           | Pelecanus conspicillatus       | Pd                |
| 27  | Phalacrocoracida| Pecukpadi hitam         | Phalarocorax sulcillosus       | Dv                |
| 28  | Phalacrocoracida| Pecukular asia          | Anhinga melanogaster          | Dv                |
| 29  | Rallidae       | Kareo padi               | Amaurornis phoeniculus         | Lu                |
| 30  | Recurvirostrida| Gaganghayam timur        | Himantopus leucocephalus       | Pr                |
| 31  | Scolopacidae   | Birulaut ekor-blorok     | Limosa lapponica               | Pr                |
| 32  | Scolopacidae   | Birulaut ekor-hitam      | Limosa limosa                  | Pr                |
| 33  | Scolopacidae   | Gajahan besar            | Numenius arquata               | Pr                |
| 34  | Scolopacidae   | Gajahan kecil            | Numenius minimus               | Pr                |
| 35  | Scolopacidae   | Gajahan penggala         | Numenius phaeopus              | Pr                |
| 36  | Scolopacidae   | Gajahan timur            | Numenius madagascariensis      | Pr                |
| 37  | Scolopacidae   | Kedidi golgol            | Calidris ferruginea            | Pr                |
| 38  | Scolopacidae   | Kedidi putih             | Calidris alba                  | Pr                |
| 39  | Scolopacidae   | Trinil bedaran           | Xenus cinereus                 | Pr                |
| 40  | Scolopacidae   | Trinil kaki-hijau        | Tringa nebularia               | Pr                |
| 41  | Scolopacidae   | Trinil kaki-merah        | Tringa totanus                 | Pr                |
| 42  | Scolopacidae   | Trinil pantai            | Actitis hypoleucos             | Pr                |
| 43  | Scolopacidae   | Trinil pembalik-batu     | Arenaria interpres             | Pr                |
| 44  | Scolopacidae   | Trinil semak             | Tringa glareola                | Pr                |

Information:
- Sc : Scanning
- Dv : Diving
- Pr : Probing
- Pd : Plunge Diving
- Lu : Lunging
- Sk : Skimming
- Da : Dabbling
- Di : Dipping