Habitat Conservation of Australian Pelican (Pelecanus conspicillatus Temminick 1824) in Mangrove Ecosystem of Bengawan Solo Estuary, Gresik Regency – East Java Province

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Abstract. Presence of Australian Pelican (P. conspicillatus) in mangrove ecosystem of Bengawan Solo Estuary is an important indicator for estuary health especially as a habitat that provides a feeding ground for water birds’ species. This indicator needs to be maintained for the long term through the right management. Aim of the research is 1) Identify and analyze the problem of mangrove ecosystem management; 2). Identify and analysis stakeholders’ roles; 3). Providing management strategy of mangrove ecosystem to conserve the species habitat in the study area. Research was conducted during one year (October 2017 – December 2018). Primary data of the present species was taken used the concentration count method, and management data collected by interview. Main problem of mangrove ecosystem in the study area like land conversion, land status out of the conservation areas, and unavailable specific policy concerning the protected species in this area. Stakeholders’ role had been identified such as uncoordinated and un-similarity objectives and understanding to manage this areas as essential habitat. Management strategy i.e. involve the community, local government, and academician to implementing the action plan of habitat conservation that was provided in this study.

1. Introduction
Study areas is a part of Bengawan Solo watershed and it’s identified as Important Bird Areas [1], and Burung Indonesia was mentioned this area also as Endemic Bird Areas. Important indicate of the areas is still to be vagrant areas of Australian Pelican (P. conspicillatus), this is migrant species from Australia. In Indonesia, its protected refers to the national regulation No. 7, 19992 and red list IUCN was categorized at level least concern. These status not guarantee the habitat in the study areas had best condition as vagrant areas. Government of Gresik Regency through the local regulation No. 8, 2011 about spatial planning (2010 – 2030) has set this areas as coastal areas with mangrove forest coverage, but this regulation has impersonal, and do not specific regulation to habitat management of its species in the study area. Mangrove ecosystem in the study area was more degraded as conversion activity to be fishpond and settlement. Land use in the coastal zone has over from its carrying capacity, fluctuation like accretion and aberration [2], he was analyses at least ten years (2006 – 2016) there is accretion more than 411.38 hectare and aberration is 177.64 hectare. This research aimed to identify and analysis problem of management at current time; identify and analysis stakeholders’ roles; provide management strategy of mangrove ecosystem to conserve the habitat of Australian Pelican in the study area.

1 Defined at UU No.41, 1990 about forestry
2 Government Regulation Regarding flora and fauna are protected species
2. Method

2.1. Materials
Object observed was Australian Pelican, and its mangrove ecosystem as feeding ground habitat, also key stakeholders at level government (regency, district, and village), private sector, community group (fisherman and young group). Tools are used i.e. Pro-Summer digital camera, ship, map, and birds’ field guide.

2.2. Procedure

2.2.1. Data Collection
Presence data of pelican was collected since October 2017 – November 2018. Field observation of the species is using concentration count method. Management data are collected using interview with several main stakeholders as key stakeholders, external stakeholder like academic, NGOs and central government who have interest in the study area. Phase to select the stakeholder is following method by Grimble [3], with deliberation no matter how small interest and influence (program and policy) they are the still too considered as part of the roles.

2.2.2. Data Analysis
Presence of pelican species was analyzed by qualitative-descriptive, quantitative data is only nominal about the individual numbers of species during the observation period. Management problems analyzed by descriptive based to actual condition in the study area. Stakeholder’s roles analyzed by quadrant matrix [4, 3, 5]. Approach is used due to determine the interest and influence for each stakeholders in order to habitat conservation of Pelican using direct and indirect influence from every activities or policy. Stakeholders was defined into three categories such as primary, secondary and external [6]. Each stakeholder’s interest and influence presented at quadrant matrix [7, 6]. Its level were analysis used scale that was obtained from interview regarding with several parameter like pelican presence in the study area is an important indicator of health coastal zone quality; its habitat need to conserve; create regulation to protect the mangrove ecosystem as an effort to conserve its habitat; involve multi-stakeholders; role implementation each stakeholders. These scale only used to seeing stakeholder position in the interest-influence quadrant with ordinal data basically. Strength-weakness-opportunity-threats analyzed by internal and external factor.

2.3. Description of study area
Administratively, the study areas located at Ujung Pangkah District, Gresik Regency, East Java Province. There are two villages that have large coastal with mangrove ecosystem in this district and both are selected as object the research. Its village are Pangkah Wetan and Pangkah Kulon with each mangrove areas are 48.1 ha and 28.6 Ha. Coastal zone in the study area is 42.15 kilometer, split into Pangkah Wetan is 23.60 kilometer and Pangkah Kulon is 15.06 kilometer [2]. Geographically, the study area at coordinate 112° 29’ 16.138” – 112° 37’ 42.384” East and 6° 51’ 8.14”– 6° 59’ 8.668” South. At flora and fauna aspect, there are identified of 17 mangrove species and over than 41 water bird species in this area [8]. Mudflat fluctuation is highest in this areas, as impact from Bengawan Solo sedimentation. Its fluctuation influenced by water flow and wave pattern in Madura Strait and Java Seas [9].

3. Result and discussion

3.1. Presence of Australian Pelican
Field observation during fourteen months (October 2017 – December 2018) was found total number of population was 36 individuals, maximum counting at December, and during June up to August no individual found in this area, probably they returned to breeding ground in Australia. Interview with
local community had shown that during five years (2013 – 2017) the species was not found in this area, and new record was recorded at October 2017 through this research. No additional information about the species are published as a references in this study. The presence of Pelicans individual number was spread at several estuary like “Kali Anyar; Lewean; Kali Ngapuri and Haji Rojula”. Substrate habitat condition dominated by mudflat, and land coverage like mangrove species was found at ecotone areas contain Rhizophora species (R mucronata, R apiculata), Avicennia (A alba, A marina), Sonneratia (S alba, S caseolaris). Prasetyo [2] was calculated total of mudflat potency in this area reach to 4,160.7 hectare, with sedimentation average is 224.56 hectare/year [9]. These mudflat is preferential place for feeding ground the congregators of water birds. Pelican’s presence also supported by fish potency for feed during the migration at Bengawan Solo estuary. During seven months to observe the fish sample, and identified 59 species in this estuary [10]. Its big number to support in site habitat for various water birds species especially for P. conspicilatus. The following figure showed its species encounters in the study area since October 2017 – November 2018. Figure 1.

![Figure 1](image)

**Figure 1.** Australian Pelicans encounter during October 2018 – December 2018

### 3.2. Problems of mangrove management

Problems at mangrove ecosystem management in Bengawan Solo estuary is varies, and only focus at technical problem in the study areas like degradation it caused by land conversion for fish pond activities [11], tree logging of mangrove species [12], reclamation and sedimentation also environment pollution [13]. Factor that caused the highest of land conversion for aquaculture activities is suitable substrate for these activity like fish and shrimp [14]. There was not research furthermore regarding management, mainly about stakeholders role and management strategy that have focused at species component especially wildlife in the study area. Its problem at site level also influenced by people’s participatory and awareness to maintain mangrove ecosystem are still lowly [15]. These problems had impact to the conservation effort, and could be obstacles and challenges. Identification to the problem of habitat management in the study had shown Pelican’s habitat has been marked its land ownership, even in the areas which hadn’t the mudflat have waiting list of the ownership.

### 3.3. Stakeholder’s analysis

Stakeholders are every single stakeholder who have interest and correlated with natural resource demand [4] specific in this case at Bengawan Solo estuary. There are 23 stakeholders who have role due to conserve the Pelican habitat’s with detailed 13 (thirteen) are categorized as primary stakeholders, nine (9) are secondary stakeholders and 1 (one) as external stakeholder. Main stakeholder including the elements from local government, fisherman groups (aquaculture and marine), youth community and NGOs. As a regency’s leader, the regent have important role, high interest and influence to drive all government element and saving mangrove ecosystem in the estuary as Pelican habitat’s and other water

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1 First numbering of month start at October (1st) and November 2018 as the 14th month
birds migrant species. An example, the policy that was published by regent is letter decree of Gresik Regent No.: 8031/56/HK/403.14/2007 regarding the environmental education content for elementary school up to senior high school, it has aimed to realize the school with environment knowledge cultural. Through this policy, student and lecturer start begin to understanding the important of mangrove ecosystem as feeding ground the *P conspicillatus*, and moreover they begun implement the habitat conservation gradually like introduce the ecology of mangrove and its ecosystem components. Local government also has role as communicator from regency to the village government (Pangkah Wetan and Pangkah Kulon).

**Table 1.** Stakeholder roles, interest and influence level

| No. | Stakeholder’s category) | Roles | Interest | Level of influence | Level of interest |
|-----|-------------------------|-------|----------|--------------------|------------------|
| A 1 | Gresik Regents’         | Policy maker and decision regarding the species conservation | Regulator in Regency Level | High | High |
| A 2 | Government of Ujung Pangkah District | Policy Coordinator at Regency Level to head of Village | Coordinator at district level both the village | High | High |
| A 3 | Village Governments’ of Pangkah Wetan | Policy creator at Village level; coordinator both the peoples element and executor the policy and multi-stakeholder cooperation | Executor, coordinator and facilitator at site level | High | High |
| A 4 | Village Governments’ of Pangkah Kulon | Policy creator at Village level; coordinator both the peoples element and executor the policy and multi-stakeholder cooperation | Executor, coordinator and facilitator at site level | High | High |
| A 5 | Natural Resource Conservation Office of East Java | Authority areas of the Nature and Wildlife Conservation in East Java Province | Creator and coordinator regarding the development of essential ecosystem in East Java | Low | High |
| A 6 | Marine and Fisheries Office of Gresik Regency | Coordinating and facilitate build the rehabilitation program and empowerment to community in coastal areas to improve the marine and fisheries products | Coordinator, Facilitator and Evaluator regarding the coastal community development program | High | High |
| A 7 | Regional Environmental Agencies (BLH) of Gresik regency | Controlling and coordinator the environmental quality | Controller and coordinator to keep the environmental quality | Low | Low |
| A 8 | Forestry Office of East Java Province | Monitoring of Forest Land Coverage and a Forestry Program in East Java | Facilitator and evaluator the land coverage condition | Low | Low |
| A 9 | NGOs : P.U.P.U.K 4 | Community partnership to manage the Corporate Social Responsibility Program | Facilitator on social economic development | High | Low |
| A 10 | Marine Fishermen’s Group | As actor’s to implement action of conservation strategy | Executor the Environment and Social Program from multi-stakeholders | High | High |
| A 11 | Aquaculture Fishermen Group | As actor’s to implement action of conservation strategy | Executor Environment and Social Program from multi-stakeholders | High | High |
| A 12 | Youth Community (Pangkah Wetan Village) | Actor due to the mangrove Ecotourism Program | Executor the ecotourism and species conservation program | High | High |
| A 13 | Community Partner of POKMASSWAS Sari Laut | As a partner due to conserve the mangrove ecosystem in Ujung Pangkah with government parties. | As an executor anything about mangrove program | High | High |

**Note:**

4 P.U.P.U.K (Perkumpulan Untuk Peningkatan Usaha Kecil)

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| No. | Stakeholder’s category) | Roles | Interest | Level of influence | Level of interest |
|-----|------------------------|-------|----------|-------------------|------------------|
| 15  | Ministry of Environmental and Forestry (central) | expert and partner for community and government in order to implement the conservation strategy | ecosystem from local academician | Low | High |
| 16  | Ministry of Marine and Fisheries (central) | Creator the policy at central level | Authority and facilitator due to monitoring of mangrove land coverage at national level | High | High |
| 17  | Tourism and Culture Office of Gresik Regency | Creator the marine and fisheries program for coastal community at central level | Facilitator to implement its program | Low | High |
| 18  | PT Smelting | Prospect actor to development the ecotourism in Ujung Pangkah region | Develop ecotourism program in Ujung Pangkah, using mangrove services basically. | High | High |
| 19  | PT PGN Saka | Provide CSR Program and mangrove rehabilitation in Ujung Pangkah | Support the economics’ peoples, through the mangrove rehabilitation program | High | High |
| 20  | Suara Rakyat Gresik (Mass Media) | Providing update news in Gresik Regency | Take a part due to distribute news at Gresik development | High | Low |
| 21  | Watershed Management Authority (BP DAS) Bengawan Solo | Controlling water flow into Bengawan Solo River and maintain the floods | Executor and facilitator management program of watershed | High | Low |
| 22  | Regional Development Plan Agency (BAPPEDA) | Coordinator due to development of Gresik Regency | Grown up development in the Gresik Regency | High | Low |
| 23  | IPB University | As an expert, scientist and partner for government and peoples in Ujung Pangkah | Research and partnership program for mangrove ecosystem and social in coastal areas. | Low | High |

Based on the description of the power-interest grid of each stakeholders, then stakeholders which was identified could be categorized into four quadrant (key players-context setters-crowd-subject). Stakeholders as ‘Key players’ are include government; community and company. They are having high power and interest, approaches are needed for this stakeholder shall be involving them fully on coordination and communication intensively. They had roles as a regulator to provide policy; as a facilitator regarding conservation efforts; coordinator and communicator between multi-stakeholders and executor at site level. Keep communicate with them to avoid miss-understanding in order to develop conservation efforts. Furthermore, stakeholders as ‘context setters’ can influence in the future overall context, so should seek to raise awareness and develop interest and convert them into players [16]. Whereas the ‘Subject’ have probably as ‘key player’ in the future, and could encourage coalition to increase their power and convert them to players—they have capacity and wait to encourage to take a participatory. While, the ‘Crowd’ is stakeholders with low interest-influence, in this study they are consist five stakeholders like academic institution, government and NGOs. They had role but its low toward habitat conservation in this ecosystem. Following figure regarding stakeholders power-interest grid in the study area (Figure 2).

Strength analyses had shown several strengthens factors toward conserve pelican’s species and habitat such as: 1). Mangrove ecosystem in the study area have large mudflat number, and continues increase sharply [2], abundant fish resources, it’s important to be conserve as feeding ground areas; 2). Large people’s population that can be used as human resources to provide strength in carrying out conservation activities programs from the government and the private sector; and 3). There are community group who become aware to keep the pelican’s presence in the study areas at migrant season, they could use as power to involving other communities toward implementing conservation program.
Factors become weaknesses are: 1). Mangrove ecosystem had out the conservation areas, it has disturbance vulnerable \[17\]; 2). There are peoples have low awareness toward conserve the species and habitat, it can be a weak and problems for activities program at current and in the future \[18\]; 3). Low coordination and communicate both the stakeholders, it has consequence to misinterpretation program, and could be a resistor factor; 4). There is no regulation regarding habitat and species management in the study area, it is important as a fundamental element to support the conservation program and as a guidance to minimize degradation of mangrove ecosystem in the study area (Negara 2011), it’s also as a protection tools of biodiversity conservation.

Factors are become opportunity such as 1). Village government had commitment to develop they areas through the mangrove ecotourism activities, it could be change opportunity shall to use toward conservation program of species and habitat, also as a part as community empowerment around the study areas \[19\]; 2). Regulation regarding conservation species and habitat will achieved if the study area established as essential ecosystem areas by government (central and regional), it is refers to the another similar areas that was establish as essential ecosystem in East Java Province; 3). Adjust the conservation education at school as a part of the extra class material. Village government need support various stakeholders to realize their urge, and it is best opportunity to improve communication both the stakeholders. At the past time, only Pangkah Wetan has mangrove tourism program. Village government with youth organization could be add the water birds-watching in these program that way is to be easy toward apply in the conserve activities.

There are several threats in order to carry out the conservation program i.e. 1). Mangrove conversion to be fish-shrimp ponds areas, it could be threat to waters quality and decreasing the pelican’s habitat \[20\]; 2). Trees-mangrove cutting still occur until at the past time of study, its influence the ecological function of mangrove ecosystem like sedimentation trap as feeding ground substrate \[21, 22, 23\]; 3). Water birds hunting, common species are hunted from Ardeidae, Raliidae and Anatidae family. Even though the pelican is not yet to be hunt, but has worries at the next time it will be hunt target. The hunting occurs because there are demand of water bird meats by community out of the study areas, low awareness and no regulation about conservation the habitat and species in this study \[8\].

These factors have been scoring, and had current position at quadrant two or it has coordinate (0.8,-0.6), it has meaning there still strength to conserve the habitat and species of Australian Pelican’s in this areas, but still have threats to this strength. In other words, there isn’t real conservation effort that was
carried out by each stakeholders are identified in this study. Following is quadrant matrix for each strange-weakness-opportunities-threats element (Figure 3).

Figure 3. Matrix quadrant the external and internal factors following SWOT analysis

Conservation strategy would be used in this study are: 1) Strength-weakness (SW) strategy, using the strength to reduce or eliminate weaknesses. The alternative this strategy is drive the community who have awareness to engage others community; drive the village government to restrict human interference who would be damage the ecosystem through the regulation regarding land use; this strategy also called with ‘conservative strategy’; 2). Strength-opportunity (SO) strategy, using strength to optimize the opportunity with collaborative management through decided this areas to be essential ecosystem areas; 3). Weakness-opportunity (WO) strategy, optimize the opportunity to minimize the weakness, this alternative strategy are improve the environmental education and material about the ecology of habitat and species to school community in the study areas; others chosen like promote the water birds watching into mangrove ecotourism program both the village study; improve the communication and coordination among the stakeholders; and create a regulation to preventing birds hunting by village government; 4). Weakness-threats (WT) strategy, minimize the weakness to avoid threats, alternative this strategy like monitoring co-together with stakeholders especially academic, young community, natural resource conservation office and village government to prevent the land conversion, bird hunting and human interference at feeding ground of Australian Pelican’s, this strategy also called with term ‘defensive strategy’.

4. Conclusion
Pelican habitats in mangrove ecosystem of Bengawan Solo Estuary will sustain if supported with management board who have specific at conservation program and activities in this areas. Collaborate management shall to build among the regional government (Village, District and Regency), university and company through a legally effort called with management of essential ecosystem.

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