Functional design for modification of offshore gas platform to manage bird nuisance: case in Mahakam Delta, East Kalimantan, Indonesia

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Abstract. Since 2014 offshore un-manned gas platforms near Mahakam Delta have been used by hundreds of egrets sleeping/roosting sites, causing nuisance. The objective of the research was to formulate a management plan in general and to plan a functional construction design to modify the existing construction in order to control the bird nuisance. Field visits were conducted in August 2019 and February 2020 to the gas platform complex (i.e. Dx, TMP-2, D), focusing on Dx Platform, of which its operation will be terminated soon. Basically, Dx Platform will be modified as egret’s roosting site. Attractants need to be constructed on Dx Platform, while deterrents should be placed on other adjacent platforms (D and TMP-2). Some suggested attractants are appropriate perch-sites, construction of cover (from strong sea-wind), provision of twigs and branches as nest material, as well as the provision of shallow water and food (fish). Suggestions for deterrents on other platforms are spikes, wire, and some other innovative mechanical/physical devices, and all are tailor-made for platforms. In addition to the Dx Platform modification, in the long term, the root cause of the bird nuisance needs to be tackled, namely the restoration of Mahakam Delta from excessive fish/shrimp ponds development.

1. Introduction
In the Mahakam Delta area (East Kalimantan, Indonesia) there are many riggs (swamp rigs and offshore rigs) managed by PT. Pertamina Hulu Mahakam (PHM). PHM is a subsidiary of Pertamina Group, an Indonesia’s State Oil Company, which focuses on upstream oil and gas mining. The field operation area stretches a vast area in the Mahakam Delta estuary and offshore area. Among their facilities, there are some small unmanned gas platforms (Gathering Satellite Platforms) that have been used by egrets (Egretta intermedia; Figure 1b) as their roosting site.

The platforms that have been used by egrets for sleeping/roosting are located not too far from the land (1.7-3km), easily reachable by the egrets to fly back and forth from the rigs to the mainland every day. In the morning, the egrets leave the rigs to seek food in the wetlands of Mahakam Delta (mainland). The birds fly back to the unmanned rigs in the late afternoon for roosting.

Previous study [1] revealed that a small platform could be used by c. 600 egrets for roosting at night. Egrets that used offshore gas rigs for roosting has not been scientifically reported in Indonesia. Outside Indonesia, there were some records that seabirds, but not egrets, have been used offshore rigs for roosting, including in the Northwest Atlantic [2], North Sea [3], and Bering Sea [4].

The birds that were roosting on gas rigs were considered a nuisance to the PHM Management, due to their faeces and other biological remains. Faeces that accumulated on the various sites of the platform could cause damage and corrosive to the sensitive apparatus. Fallen feathers might clog the sewer, so

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did the regurgitated food (consisted of fishes, shrimp, eels, other macroinvertebrates). The rigs also need to be regularly checked and inspected by workers (operators). There have been some health concerns due to the decomposition of regurgitated food and birds’ faeces, especially in the era of many zoonotic incidents lately. Further, when raining, the faeces might be slippery and could affect the safety of the workers.

Some previous attempts to get rid of the birds, including using light and other deterrent devices, were unsuccessful. Clearly, the egrets did not have any other roosting options in Mahakam Delta due to the highly intensive on-going deforestation of mangrove as their main roosting site [5]. Therefore, PHM has a new plan to convert one of the discontinued-operation gas platforms to an egret’s roosting site, and possibly also breeding site. The objective of the research was to formulate a management plan in general and to plan a functional construction design to modify the existing construction in order to control the bird nuisance, including to design attractant and deterrent devices.

2. Methods
The study was conducted in the Mahakam Delta in East Kalimantan Province, Indonesia. Three gas platforms, namely Dx, TMP-2 and D, were selected as study sites (Figure 1a). The three platforms were essentially located in one complex, adjacent to each other. Each platform is connected to another through a trunkline or a walkway. Field visits were conducted in August 2019 and again in February 2020 to the three-gas platform, focusing on Dx Platform, of which its gas mining operation will be terminated soon.

Management plan in general and a more detailed design was done based on the scientific knowledge of the egret [6, 7], mainly related to the perching ability and roosting (sleeping) behaviour of the bird. Some management plan for egrets in their natural habitats [8, 9] were also studied as additional references. Information related to the platforms that might be linked to the management plan and design were also gathered from the PHM Management Team. The recommendation for the modification was based on the bio-ecological requirements of the egrets and the analysis of the existing construction for birds’ perching and roosting habitat [6-9].

Figure 1. (a) Map of study site in the Mahakam Delta area, East Kalimantan, Indonesia; (b) bird species that create nuisance to the gas platform: the intermediate egret (*Egretta intermedia*)
3. Results

3.1. Management plan

In the future, the Dx Platform will be modified and managed as roosting habitat for birds. There are two challenges in the modification plan: how to attract egrets to roost on Dx Platform, but at the same time has to make sure that the adjacent TMP-2 Platform and D Platform will be free from the egrets. To resolve the situation, to attract the egrets, the D Platform will be managed as a bird-friendly habitat by creating an innovative construction roosting site plan. Meanwhile, on the adjacent TMP-2 and D Platform, some deterrent will be added to discourage the egrets from roosting on those Platforms.

The ‘attractant and deterrent’ management plan is especially important because the D Platform that will be managed as a bird-free platform is closest to the mainland (Table 1), and thus actually more convenient for the bird to roost on the D Platform. Dx Platform, the one that will be managed for the birds, is farther from the mainland, although the distance is still reachable by the egrets.

| Platform | Location (Relative to Each Other) | Management Plan |
|----------|----------------------------------|-----------------|
| D        | At the northernmost of the complex Connected to TMP-2 trough trunklines Closest to the mainland | The gas mining operation will be continued Expected to be the egret-free gas platform |
| TMP-2    | In the middle, between D and Dx Connected with D through trunklines Connected to Dx through walkways and trunklines | Will be continued to serve as a collection point of the gas collected from the surrounding platform Expected to be egret-free gas collection platform |
| Dx       | At the southernmost of the complex Connected with TMP-2 through walkways and trunklines Farthest to the mainland | The gas mining operation will be terminated soon by PHM Management (scheduled in late 2020) Future plan: to be modified for egret’s roosting site |

3.2. Modification of Dx Platform

As mentioned previously, the Dx Platform will be managed as a bird-friendly habitat when the gas mining operation exhausted very soon. Dx Platform basically consisted of two decks, the upper and lower deck. There are many piping constructions on the upper deck. On the lower deck, piping construction is limited, and there are more open areas. The Dx Platform has many smaller gas wells. These adjacent wells are lining up on one direction (south), connected to the main platform through a long walkway. From Dx Platform, there is a long trunkline (big-sized pipes) to transport the gas to the collection point at the TMP-2.

The site that needs to be modified is basically only the lower deck of the main platform (Table 2; Figure 2). On this lower deck, more piping needs to be added as perching sites. The material for piping has to be selected carefully in order to meet the company’s safety requirement, but still suitable as birds’ perch sites. The gas platform is extremely sensitive to fire sparks. Any activity and device that might lead to fire spark will be prohibited.
Table 2. Construction modification for Dx Platform in order to create a bird-friendly habitat.

| Site [Function] | Modification Needed | Ecological Reason |
|-----------------|----------------------|-------------------|
| Main platform, upper deck [primary perching site] | None | The main platform resembled a ‘giant tree’ with decks served as tree canopy layers; complicated piping and railing resembled tree branches, suitable for perching |
| Main platform, lower deck [secondary perching site] | • Additional piping construction | • Piping will be used for perching and cover from strong wind |
| | • Modification of deck floor for small water retainer | • Small ‘pond’ resembles natural wetland habitat; food (i.e., live fishes) can be added if necessary, especially at the initial stage |
| | • Provision of twigs and branches during breeding season on platform floor | • Egret might use the twigs and branches as nest material |
| Adjacent wells (connected to each other) [additional perching site] | None | Each adjacent well resembled ‘small trees’ around the ‘main tree’ (i.e., main platform) |
| Walkways [additional perching site] | None | Railing along walkways can be used as alternative perching sites at an open area |
| Trunklines [additional perching site] | None | Large-sized piping can be used as alternative perching sites at an open area |

Figure 2. Dx Platform to be modified as egrets’ roosting site: (a) adjacent wells; (b) open deck, need to be modified; (c) deck floor that can be modified for a shallow pond; (d) piping and railing on upper deck; (e) walkways and trunklines; (f) twigs on lower deck, a sign of breeding attempt by the egrets.
3.3 Provision of deterrent on D and TMP-2 Platform

Bird deterrents are planned to be added on D and TMP-2 Platform. The previous attempt of to get rid of the birds by using scarecrow, pinwheel, sound, and blue light did not work, as the birds apparently quickly learned to avoid the deterrent. Therefore, more efficient deterrent is needed.

The deterrent will be placed on sites used by egrets for perching. Some suggestions for the deterrents are non-corrosive cables (single or double) for railing and long surfaces, various types of spikes to match with the shape and size of the site or apparatus, wires, and net (Figure 3). All deterrents will be specifically made (tailor-made) to suit with the site or apparatus/equipment. The platform is able to generate electricity by itself, but it is used to operate equipment and for providing some lighting. Thus, all deterrents are non-electric. In addition, deterrent has to be durable to withstand wind, rain, and salinity, made from non-corrosive metal. Plastics are not allowed, as it might generate fire when exposed to strong sunlight on the sea.

Figure 3. Some recommended deterrent for D and TMP-2: (a) single cable for railing; (2) double cable; (c) tunnel spike; (d) zigzag spike; (e) long spike; (f) circular spike; (g) thorn spike; (h) spider spike; (i) net for covering some sensitive area; (j) barb wire.
4. Discussion
Converting a gas platform to a platform that provides perching and roosting site for egrets has never been tried before, at least in Indonesia. In other areas, mainly in the US and European countries, the provision of the roosting sites or nesting sites has been a common practice. A technical manual to build a roost and nest site is widely available (e.g., [10]). Various designs of deterrent devices are also available (e.g. [11]), many are sold commercially. However, those manual and devices are designated for general purposes, which cannot be directly used for the platforms having a unique situation and specific requirement: located offshore, no electricity allowed to power the device, susceptible to corrosion (due to combination of salinity, humidity, rain, direct sunlight), and more importantly, has to fulfill safety of the gas mining operation.

Factors that influencing the presence of an egret (or waterbird species in general) in a certain habitat mainly were habitat size, habitat quality, and distance from roosting area to the nearest foraging areas [12]. As for the roosting tree, the preferred roosting trees for waterbirds in their natural habitat in Indonesia were mostly mangroves, as observed in Pulau Rambut Wildlife Sanctuary in Jakarta Bay Area [13], Pulau Dua in Banten Province [14], Sukamandi in West Java Province [15], and Percut Sei Tuan in North Sumatra Province [16].

Human-made habitat, however, were also can be used by the egrets for roosting, for example in Nusa Dua (Bali Province), where egrets roost in a sewage treatment pond [9], and in Karawang (West Java), where this species roost in a plantation forest within an industrial area [18]. These observations support the conclusion that egrets are easily adaptable to anthropogenic influence [6, 7]. The success of this functional design plan is still difficult to predict. Judging from the worsening condition of the Mahakam Delta, this design plan might work. Even if the habitat restoration of the Mahakam Delta will be initiated soon, it will need 5-6 years for mangroves to grow and able to be used by the egrets for roosting and nesting areas.

Converting a discontinued gas platform to a roosting habitat for egret would offer many advantages to PHM. There will be no cost of rig dismantled, and some portion of the funding can be used to modify the Dx Platform and make a deterrent for D Platform. In addition, by having a bird-friendly gas platform, it will also increase the status of the environmental-friendly gas mining operation.

The production of deterrents and attractants can be done locally. PHM has a workshop nearby, in the South Processing Unit. The basic design and material of the deterrent can be re-design to meet the standard and procedure of the gas operation. Collaboration between gas mining engineering and ecological knowledge is needed in order to produce a suitable design, both in creating egrets’ habitat on Dx Platform and to prevent the birds from roosting on D and TMP-2 Platform.

5. Conclusion
To control the bird nuisance in gas platform, appropriate functional plan and design is needed, by providing bird-friendly habitat in the designated gas platform, and deterrent in the area that suppose to be free from bird nuisance. As this plan has not been practiced in Indonesia and elsewhere, trial and improved approach is needed to obtain the desired outcome.

Reference
[1] Mardiastuti A, Mulyani Y A, Sutrisna T, Hidayat Y, Widodo AS, Agustin I A R, and Santosa E. 2020 IOP Conf. Series: Earth and Environmental Science. (In press)
[2] Baird P H 1990 The Condor. 92 pp 168-771
[3] Tasker M L, Jones P H, Blake B F, Dixon T J, and Wallis A W 1986 Ringing & Migration. 7 pp 7-14 doi: 10.1080/03078698.1986.9673873
[4] Wiese F K, Montevéccchi W A, Davoren G K, Huetmann F, Diamond A W, and Linke J 2001 Marine Pollution Bulletin. 42 pp 1285-1290
[5] Rahman AF, Dragoni D, Didan K, Barreto-Munoz A, and Hutabaray JA 2013 Remote Sensing of Environment. 130 pp 96–107 doi: 10.1016/j.rse.2012.11.014
[6] Telfair II RC, Thompson BC, and Tschirhart L 1997 Nuisance Heronries in Texas:
Characteristics and Management (Texas Parks and Wildlife Tyler, Texas, USA)

[7] Fidorra JC, Frederick PF, Evers DC, and Meyer KD 2016 The Condor. 118 pp 46–56
[8] Mackintosh M, Jones Z, Boelens R, Gray J, and Epp D 2006 Stanley Park Herony Management Plan (Vancouver Board of Parks and Recreation British Columbia, Canada)
[9] Hong Kong Bird Watching Society 2018 Guidelines for Planning and Carrying out Construction Works at Egretries (Hong Kong Bird Watching Society Hong Kong)
[10] Holly L. May, Sheryl Ducummon, Rob Pauline, Charlie Rewa, and Tina Phillips 2001 Artificial Nesting Structures (Fish and Wildlife Habitat Management Leaflet No 20 United States Department of Agriculture Washington, DC USA)
[11] Desoky AESS 2014 Global Journal of Science Frontier Research. 14 pp 41–50
[12] Sebastián-González E and Green A J 2014 Restoration Ecology. 22 3 pp 311–318
[13] Mardiastuti A 1992 Habitat and Nest-site Characteristics of Waterbirds in Pulau Rambut Nature Reserve, Jakarta Bay, Indonesia [Doctoral Dissertation] (East Lansing, USA: Michigan State University)
[14] Elfridasari D, Solihin D D, Soejoedono R D, and Murtini S 2013 Makara J. Sci. 17 1 pp 6–10
[15] Ginoga L N 1999 Pencemaran Insektisida pada Tiga Spesies Burung Air di Areal Persawahan Sukamandi, Subang, Jawa Barat [Magister Theses] (Bogor, Indonesia: Institut Pertanian Bogor)
[16] Putra CA, Hikmatullah D, Prawiradiaga DM, and Harris JBC 2015 Kukila. 18 2 pp 46–59
[17] Dalem AAGR, Sudirga SK, and Burgin S 2011 Kukila 15 pp 66–72
[18] Mardiastuti A, Mulyani YA, and Suratno 2018 IOP Conf. Series: Earth and Environmental Science. 197 p 012024 doi :10.1088/1755-1315/197/1/012024