

HOSTED BY



Contents lists available at ScienceDirect

Journal of Asia-Pacific Biodiversity

journal homepage: <http://www.elsevier.com/locate/japb>

Original article

Pulau Ling: an important seabird hotspot on the east coast of Peninsular Malaysia

Abdulmaula Hamza^{a,*}, Cheeho Wong^b, Amirudin Ahmad^a^aSchool of Marine and Environmental Sciences, University Malaysia Terengganu, Kuala Terengganu, 21030, Malaysia^bSchool of Liberal Sciences, University Malaysia Terengganu, Kuala Terengganu, 21030, Malaysia

ARTICLE INFO

Article history:

Received 18 January 2016

Received in revised form

22 April 2016

Accepted 29 April 2016

Available online 7 May 2016

Keywords:

Breeding

Conservation

Islands

Malaysia

Seabirds

South China sea

ABSTRACT

Pulau Ling is a small rocky island located to the south of Pulau Redang, forming with other southeast small islands, the Redang Archipelago, in the state of Terengganu, Malaysia. The island was highlighted in the early 1950s as an important seabird site, although little was then known on the status of seabirds on the island. Field visits were made between May 2015 and September 2015 to assess the importance of this small island to seabird species. Four tern species were identified: two of them, black-naped tern *Sterna sumatrana* and bridled tern *Onychoprion anaethetus*, were found to breed there, while the other two species, great crested tern *Thalasseus bergii* and roseate tern *Sterna dougallii* were found to use the island as a stopover site without any evidence of breeding. Furthermore, the Pacific Eastern Reef egret *Egretta sacra* (the black morph), was also found to breed on the island. Other species encountered included white-bellied sea eagle *Haliaeetus leucogaster* (recorded once in June 2015, soaring over the island). These preliminary data show the importance of such small rocky outcrops for tropical breeding and migrating seabirds, where food availability and lack of disturbance may be the two main drivers for diversity and survival.

Copyright © 2016, National Science Museum of Korea (NSMK) and Korea National Arboretum (KNA). Production and hosting by Elsevier. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Seabirds breeding in Peninsular Malaysia are confined to a small number of rocky outcrops and small islands. The present status of seabird colonies is not fully known, due to lack of monitoring and the impact of historic taking of eggs and chicks by local fishermen (Gibson-Hill 1950); it is assumed that most of the seabird populations that used to thrive in Malaysia have undergone severe declines in the past 40–50 years. In Malaysia, 31 seabird species are listed in the International Union for Nature Conservation's Red List (Birdlife International 2016); among them, 10 species of tern. Few tern species breed in Malaysia; most are either winter visitors or passage migrants (Jeyarajasingam and Pearson 2012). Gibson-Hill (1950) reviewed the status of Malayan breeding seabirds, and emphasized the importance of rocky outcrops on the east coast of the peninsula for breeding tern species, including black-naped tern *Sterna sumatrana* and bridled tern *Onychoprion anaethetus*. However, lack of seabird monitoring,

both in the past and even up to the present for most of the east coast islands, may have contributed to the general vacuum of information on the marine avifauna of this region of Malaysia. Information on tern colonies in Sabah and Sarawak also indicates similar severe declines: certain Sarawak tern colonies occupied during the 1950s are no longer used and the numbers nesting at Pulau Tukong Ara, the largest known colony in Sarawak declined between the 1950s and 1980s; in that region, only remnant colonies of both black-naped and bridled terns still survive, with limited breeding success (Mackenzie and Salter 1986); later Kheng and Japar (2000) reported an increase in tern populations on Pulau Tukong Area. On the east coast of the peninsula almost nothing has been published on breeding or passing seabirds since the review presented by Wells (1999), which gave a resume of all previous surveys within the country.

Pulau Ling (also known as Pulau Chipor), locally known as Pulau Cupak (05°43' 60" N, 103°01' 01" E) is a bare rocky outcrop, rising about 11 m above sea level. The total surface area exceeds half a hectare (5,542.00 m²) and the perimeter is 443 m (Figure 1). The island is made up of tall granite boulders, accessible only from a lower small beach on its southwest side, and consists of two large rock masses, separated by a deep chasm, separating it into a third of

* Corresponding author.

E-mail addresses: a.hamza@umt.edu.my, abdhamza@gmail.com (A. Hamza).

Peer review under responsibility of National Science Museum of Korea (NSMK) and Korea National Arboretum (KNA).

the area to the northeast and two thirds to the southwest; wave erosion has created a channel crossing the island at the base of this chasm. The lower edges of the island vary in height: while the highest edges are those to the north and northeast, the southern and eastern sides have lower boulders that are used for roosting, indicated by the amounts of white guano covering their surface. A few plants were found at the top of the boulders, benefiting from depressions that trap rainwater. These plants can be used by chicks to avoid aerial predators and heat stress during daytime. Being closer to the open sea (compared to the other islands near Pulau Redang), this island belongs more to offshore waters than the other islands, with fewer disturbances from divers and tourist boats.

The island is located within a short distance of the Redang Island Marine Park, established in 1994 to conserve ~500 species of corals and the thousands of fish and invertebrates living among them. The boundary of the marine park was established by a line linking all points two nautical miles from the shore (low water mark) of Pulau Redang, Pulau Lima, Pulau Ekor Tebu, and Pulau Pinang (Comley et al 2004; Mohd Rusli et al 2008), that is, Pulau Ling was not included within the marine park area, and is not yet legally protected.

Materials and methods

Boat visits to Pulau Ling were conducted between May 2015 and September 2015. Surveys were made in the morning or late afternoon, when most birds were expected to be on or near the island. At a distance from the island, a rough estimate of roosting birds was made for each visit; then flush counts were made upon landing on the site (Walsh et al 1995). Counts of nests found were also made; nests were marked using serial numbers, and location sketches were drawn for each visit. Follow-up of nests was made during the subsequent visits, to follow the fate of each nest.

Results and Discussion

Breeding seabirds

During the present survey, the area was visited six times between May 2015 and September 2015. The first signs of breeding

behavior were observed in late May, while the first nest was found during the second visit in the second week of June. The following species accounts give detailed information collected for each species encountered on the island.

Black-naped tern *S. sumatrana*

Resident tern, regular in some parts of the country, but heavily pressured during the breeding season and generally in decline (Wells 1999). The most common tern species in the Redang Archipelago from May to October (Gibson-Hill 1950). At Pulau Ling, ~25 individuals were observed roosting on May 21, 2015, with another group foraging within 200 m of the south of the island (Figure 2). A first nest with a single egg was found at the top of the northwest side of the island, on bare rock, without any nest ornamentation. Then more nests were recorded from the same area and from the other side of the island during the following visits between June 2015 and September 2015. Total nests for the 2015 season: 18 nests, with 24 eggs. About 66.7% of nests ($n = 12$) were single egg nests, while the remaining 33.3% were two egg nests; overall clutch size = 1.34 eggs/nest. Egg dimensions (length and breadth) varied; with an average of 39.40 mm × 29.05 mm. Egg color was generally pale with dark brown spots and markings.



Figure 2. Birds of Pulau Ling: black-naped tern with nestlings *Sterna sumatrana*.

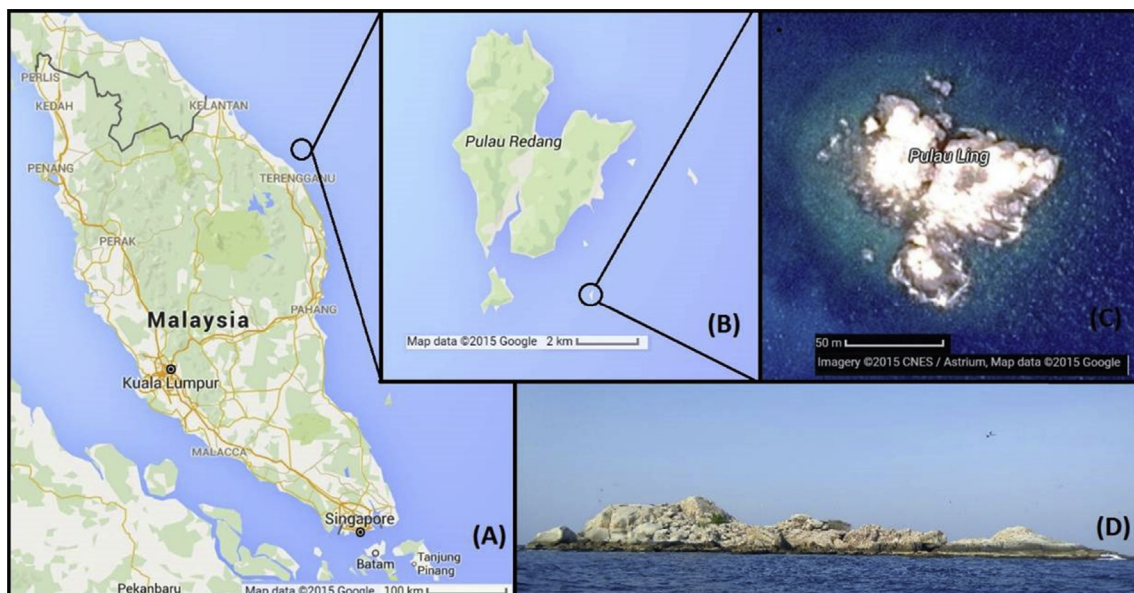


Figure 1. Location map of Pulau Ling on the east coast of Malaysia, South China Sea.

Pairs of adult black-naped terns recorded on the island increased from 13 pairs in May to 40 pairs in August and ultimately to 100 pairs by September (Table 1). Although great care was taken to observe and record all nests of the species here, it was always the case that the island hosts far more pairs than nests, suggesting that some individuals were either non-breeding sub-adults or might be breeding elsewhere in the Redang Archipelago, and that Pulau Ling was used as a roosting or resting site during daily foraging trips.

Bridled tern O. anaethetus

The most common seabird species at Pulau Ling, with counts > 250 pairs during the early breeding season in May and June (Figure 3). However, in contrast to black-naped tern (above), for which the number of pairs increased as the season progressed, the numbers of bridled terns kept decreasing as the breeding season advanced, to reach as few as 75 pairs by September; this may indicate the importance of Pulau Ling as a stopover site on migration (for other species as well, see below). The breeding habits of bridled terns are slightly different from those of black-naped tern, as they prefer to lay their eggs in sheltered and higher locations, such as rock crevices and cavities, which means that finding their nests is not an easy task. Some nests were positioned on steep cliffs or on small outcrops of rock in the higher area of the northern side of the island. Nests that were exposed on the top of a boulder were made of small pebbles in a circular shape; while others were hidden under boulders to a depth of 100 cm [maximum depth of 50 cm reported in Wells (1999)]. We were able to count only nine single egg nests, with egg dimensions averaging 45.45 mm × 32.14 mm. Egg coloration here was predominantly cream in color, elliptical in shape; eggs were clearly larger in size than those of black-naped terns (Figure 4). Breeding success seemed low, as we recorded only one nest hatching. Fledging success was not followed up.

Roseate tern Sterna dougallii

Resident breeder, common on small islands on the east coast of Malaysia (Wells 1991). Gibson-Hill (1950) reported the presence of colonies on Pulau Yu between Pahang and Johor, and at Tokong Burung near Pulau Tenggol, in Terengganu. Colonies ranged at that time between 10 pairs and 40 pairs, but breeding has not been reported since the late 1960s (Wells 1991). Although no breeding colony was found at Pulau Ling or the nearby islets of the Redang Archipelago, we have noted some 20 adult roseate terns in breeding plumage at Pulau Ling, on the afternoon of August 15, 2015 (Figure 5). This suggests that they might have originated from a northern colony in or from some undiscovered small colony within the east coast region. Further field work would be needed to confirm such assumptions, as no recent data are currently available on the historic breeding near Pulau Tenggol (65 nm south east), which needs further investigation in the



Figure 3. Birds of Pulau Ling: bridled tern *Onychoprion anaethetus*.



Figure 4. Comparison in size and coloration pattern between eggs of black-naped tern (above) and bridled tern (below).

coming seasons. There were similar solitary observations of roseate terns off Redang Island in late May 1978 (Wells 1991), which may either support the thesis of an unknown breeding site, or show the importance of this region as a stopover or potential breeding site for the species.

Eastern reef egret Egretta sacra

Resident waterbird, more associated with small islands than the mainland coast (Wells 1999). The black morph of this resident species can be seen in many areas within the Redang Archipelago; at Pulau Ling it was usually encountered feeding (Figure 6) or flying away as we landed on the site. During the first visit in May 2015,

Table 1. Seabird species counts from Pulau Ling, Malaysia (May–September 2015).

Trip date/counts	Black-naped tern	Bridled tern	Great crested tern	Roseate tern	Eastern reef egret	White-bellied sea eagle	Remarks
23 May 2015	25 ^a	>500	0	0	5	0	^a Mating behavior noted
13 Jun 2015	40 ^b	>500**	0	0	4	1	^b Egg-laying initiation
10 Jul 2015	23	300	0	0	5	0	
6 Aug 2015	50	80	0	20	6	0	
15 Aug 2015	100	80	0	4	2	0	
4 Sep 2015	200	150	12	0	6	0	

SD = standard deviation.



Figure 5. Birds of Pulau Ling: roseate tern *Sterna dougallii*.

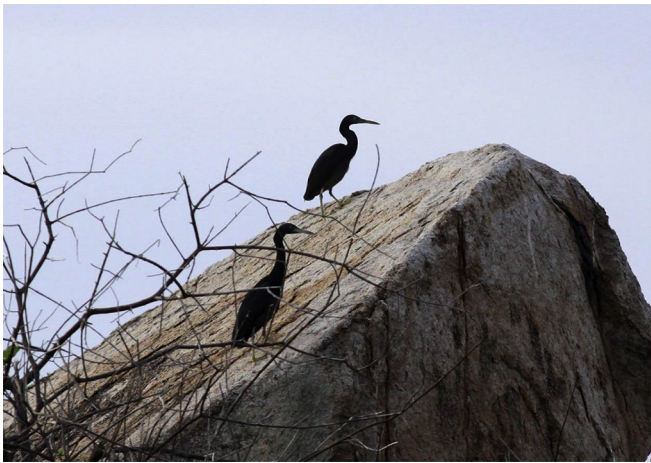


Figure 6. Birds of Pulau Ling: eastern reef egret *Egretta sacra*.

one active nest with a single egg [usually 2 or 3 eggs, but up to 6 in Sarawak (Gibson-Hill 1950)] was found. Egg coloration was pale bluish green. Egg measurements were not taken. The nest was found on the west side of the island (Figure 7), laid between three boulders with over-lay rock cover (~40 cm wide and ~50 cm deep). The nest was in the form of a cup made of dry sticks and grass. The number of adult egrets counted at this island varied from two to four pairs. The species was reported as breeding mainly in small islands around Peninsular Malaysia, with no detailed accounts for population size or trends.



Figure 7. Single-egg nest of the eastern reef egret *Egretta sacra*.

Non-breeding seabirds

Great crested tern *Thalasseus bergii*

Non-breeding visitor and passage migrant in Malaysia. On the east coast it can be seen from July to January in good numbers (Wells 1999) On September 4, 2015, we observed 12 great crested tern *T. bergii* (Figure 8); they were roosting at the lower edge of the granite boulders near the water surface, with a large group of black-naped terns ($n = 120$). The same birds were sighted again the next morning, suggesting that they were wintering visitors. The species is classified as a winter visitor in Malayan waters, with no breeding records (Gibson-Hill 1950), and the known breeding sites in the Gulf of Thailand have declined severely (Wells 1991; Wells 1999).

White-bellied sea eagle *Haliaeetus leucogaster*

Resident, regular and common, breeding on islands (not Ling) and some coastal areas (in 2014, 1 active nest was observed by the 1st author on Bidong Island and another on Pulau Douyong, Terengganu). On Pulau Ling, one adult bird was observed circling the island area during the second visit on June 13; the same bird seems to roost on high trees at the mouth of the Pulau Redang village jetty area.

Threats

The following observed threats could have negative impacts on the limited populations of seabirds at Pulau Ling, and might be common to the whole Redang area.

Egg taking

One of the historic causes of seabird decline and extinction for many species in Southeast Asia was egg taking by local fishermen (Croxall and ICBP 1991; Gibson-Hill 1950; Kheng and Japar 2000; Wells 1999). In Redang Archipelago, this practice still seems to be happening, even with the declaration of most islands in the archipelago as parts of the Redang Marine Park. When we compare the number of black-naped and bridled terns to the number of nests we recorded during this study, it shows clearly that something is happening to hundreds of nests that we found empty with only nest decoration remaining (Figure 9). Some nests that we had marked on one visit, as a newly laid clutch, could not be found on the next visit after < 2 weeks. We have not conducted systematic interviews with fishermen on this matter (which might be needed in future), but the two locals who used to take us to the island denied that there was collection of eggs. Additionally, a community conservation researcher informed us that the practice of egg collection used to be conducted several years ago, by the village boys who visit the different islands off Redang to collect eggs for fun. This issue needs also to be further investigated, and the marine park with the local

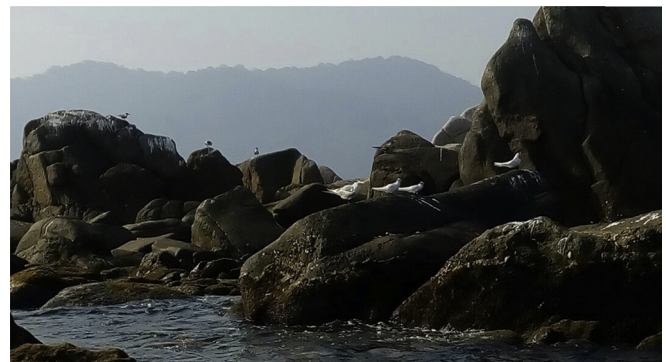


Figure 8. Birds of Pulau Ling: great crested tern *Sterna bergii*.



Figure 9. Remains of nest decoration after removal of eggs.

authorities should take appropriate action to prevent further deterioration of the limited seabird population in the area.

Pollution

Pulau Ling is the furthest island to the southeast of the Redang River mouth, facing both the open sea and the other small islands of Redang Archipelago. Several types and amounts of anthropogenic pollutants were present on the island (Figure 10). These include urban waste materials, such as plastic bottles, plastic bags and discarded foam used in fishing buoys, abandoned fishing nets, wooden objects and other man-made objects. Most of these seem to be drifting to the island with water currents either from Redang Island or from offshore. In addition, we have noted widespread oil pollution (tar balls) that melts on and between boulders and covers some rocky formations on the island. This poses a lethal threat to newly hatched nestlings and to other forms of marine life in and around the island. The impact of such pollution is poorly studied. Tar balls are caused mainly by discharging of ballast waters, washing cargo tanks of oil tankers or leaks of oil during offshore oilrig operations. Further studies should target the extent and impacts of this pollution on the marine life of the whole east coast region.

Tourism (impact and opportunity)

Redang Archipelago is one of the major tourist attractions of Malaysia; there are 16 chalets and resorts with ~900 rooms, with a

golf course (Mohd Rusli et al 2008). Several studies have been conducted on the use of natural resources and local perception of tourism in Redang (Fisher et al 2008), the contribution of tourism to the local community (Mohd Rusli et al 2007, Mohd Rusli et al 2008), and the perception of tourists of Redang Island Marine Park (Mohd Rusli 2010). However, we found no research article tackling the impact of tourist activities on the quality natural marine ecosystems or species. Tourism can provide several benefits for conservation of marine biodiversity in this region; one of the alternatives to the problem of declining fish stocks is to use fishing boats for seabird watching operations. This needs further collaboration between the Marine Park, the chalets, and local fishermen.

During the current study we have several times noticed snorkeling tourists in large groups (> 30) in concentrated activity in shallow waters near several islands in the Redang Archipelago, including Pulau Ling. This snorkeling, conducted outside the marine park, may not follow the eco-friendly international snorkeling guidelines. In fact we are not confident that all snorkeling operators are aware of such regulations and guidelines and how much tourists are informed about them before they plunge into the shallow waters with high biodiversity.

Another aspect of tourism is the amount of traffic within the waters of the Redang Archipelago, and whether species such as terns are resilient enough to cope during the breeding season with such continuous noise. Impacts can also threaten other marine organisms sensitive to noise such as cetaceans.

Finally direct disturbance of breeding colonies can be made by any human intrusion into the colony area; we have noticed in Perhintian Islands (north) for example some tourist snorkelers walking in the tern colony without being aware of the amount of damage they can cause to such fragile habitats in this region of the world.

Egg/chick predation

Although we have not seen any rat predation of eggs or chicks at Pulau Ling, a precautionary investigation of rat presence on all sectors of Redang Island Archipelago should take place. Rats can cause severe damage to seabird colonies, and the position of Pulau Ling, not far from the main Redang Island and its resorts, may pose the question of the existence of rats on it or on any other island nearby. Rat control and eradication is a main step towards better conservation of seabird colonies on these islands.

Although none of the seabird species found at Pulau Ling are globally endangered, such small hubs in seabird habitats within Southeast Asia are important regionally, in an area where seabird



Figure 10. Pollution types washed up on the island.

populations have been severely impacted by human consumption and climatic instability (which makes their breeding season controlled by the stable weather of spring and early summer).

Conclusion

Although none of the seabird species mentioned above are globally endangered, the present study represents an update on a series of species and their breeding phenology in east coast Peninsular Malaysia, where information on seabirds is scarce.

Such an update was needed since the latest published information on both species and site dates from several decades ago. Our data show that Pulau Ling is a regionally important breeding and stopover site for several tern species; it definitely needs further protection to maintain its rich marine biodiversity including its avian fauna. The nearby islands and rocky outcrops need to be investigated for a potential breeding colony of roseate tern and other species that used to breed in this area since the 1950s. Habitat quality and chick food availability at Pulau Ling are the main drivers for the survival of these birds; however, the continuation of egg taking by locals could drive a limited population to extinction if strict measures are not taken to save both species and habitat. The impacts of snorkeling and diving tourism on marine habitats, and the resulting disturbance of seabirds, need to be studied. The Marine Park boundaries should include all small islands of the Redang Archipelago, and further surveys of flora and fauna of those small islands are needed to support such inclusion. The egg-taking practice (if it still exists) needs to be addressed by the conservation community in East Coast Malaysia; being the main driver to severe decline of most seabird populations in this region.

There is a need to study the current seabird populations on islands within the Pahang-Johor area, as no recent update exists of the status of several seabird species there.

Acknowledgments

This research was conducted thanks to University Malaysia Terengganu (UMT) Grant NRGs/2015/53131/8 to study Seabird

diversity of Setiu, South China Sea. Thanks to Associate Professor Juanita Joseph of UMT- Seat Turtle Unit in Cagar Hutang and her team at Redang Station for providing local information and lodging at the field station. Thanks to Mazrul Aswady Mamat, Edriss Ahmed and Badr Salem for helping with the field work. Thanks to Mr. Anuar McFee and Mr. Michael Smart and the two anonymous reviewers for their comments and suggestions on the first version of this paper.

References

- BirdLife International. 2016. *Country profile: Malaysia*. Available at: <http://www.birdlife.org/datazone/country/malaysia> [Date accessed: 5 January 2016].
- Comley J, Walker R, Wilson J, et al. 2004. *Malaysia Coral Reef Conservation Project*. Pulau Redang.
- Croxall JP, International Council for Bird Preservation. 1991. *Seabird status and conservation: a supplement*. International Council for Bird Preservation.
- Fisher JB, Nawaz R, Fauzi R, et al. 2008. Balancing water, religion and tourism on Redang Island, Malaysia. *Environmental Research Letters* 3:024005.
- Gibson-Hill CA. 1950. Notes on the sea birds breeding in Malayan waters. *Raffles Museum* 23:5–64.
- Jeyarajasingam A, Pearson A. 2012. *A field guide to the birds of peninsular Malaysia and Singapore*. Oxford University Press.
- Kheng SL, Japar A. 2000. Current status of the tern colony at Pulau Tukong Ara. *Hornbill* 4:168–176.
- MacKenzie NA, Salter RE. 1986. Tern nesting and distribution along the coast of western Sarawak. *Malayan Nature Journal* 39:165–275.
- Walsh PM, Halley DJ, Harris MP, et al. 1995. *Seabird monitoring handbook for Britain and Ireland: a compilation of methods for survey and monitoring of breeding seabirds*. Peterborough, United Kingdom: JNCC/RSPB/ITE/Seabird Group.
- Wells D. 1991. Status and conservation of seabirds breeding in Malaysian waters. *Seabird status and conservation: a supplement*. In: Croxall JP, editor. *ICBP Technical Publications*. Cambridge, U.K.: International Council for Bird Preservation. pp. 213–223.
- Wells D. 1999. *The birds of the Thai-Malay Peninsula. Vol. 1, non-passerines*. New York: Academic Press.
- Mohd Rusli Y. 2010. Tourists' perception and opinion towards ecotourism development and management in Redang Island Marine Parks, Malaysia. *International Business Research* 4:62.
- Mohd Rusli Y, Ahmad S, Mohd Farid M, Alias R. 2007. Local economic benefits of ecotourism development in Malaysia: The case of Redang Island Marine Park. *International Journal of Economics and Management* 1 (3):365–386.
- Mohd Rusli Y, Ahmad S, Alias R. 2008. How much does ecotourism development contribute to local communities? An empirical study in a small island. *ICFAI Journal of Environmental Economics* 4 (2):54–67.