



Developing a strategy for pangolin conservation in Brunei: Refining guidelines for the release of confiscated animals and gathering baseline data.

Principle Investigator: Louise Fletcher on behalf of 1stopbrunei Wildlife Club

With thanks to The Mohamed bin Zayed Species Conservation Fund



Acknowledgments:

This project would not be possible without the hard work of the members of 1stopbrunei Wildlife Club, in particular Ali Nazri who worked continuously over a six week period to ensure everything was completed in a short time frame. The work would not have been possible without the further support of Muhammad Shavez Cheema, Bud Chapman and Fatin Nabilah.

My appreciation goes to the Forest Rangers at the Tasek Merimbun Heritage Park, in particular Qamarul Islam Mahmud, who accompanied and guided us through the forest in day and nighttime and to Pengiran Muda Omar Ali for granting us permission to work in this protected area.

Guidance and advice has been provided by a wide range of individuals, gratitude extends particularly to: Ulmar Graffe, The University of Brunei Darussalam, Roger Raja and The British High Commission in Brunei Darussalam

None of this work would have been made possible without the dedication and enthusiasm of all the members of 1stopbrunei Wildlife Club: Bazilah Za, Farah Za and Irene Noor Azam.

The implementation of this project would not have been made possible without the support of our donor: The Mohamed bin Zayed Species Conservation Fund.

Statement of need:

The Sunda pangolin is Critically Endangered (IUCN Red List) yet Brunei remains one of the last strongholds for this species. However, Brunei is small country with easily accessible forests which in some instances neighbor urban areas. This has led to an increase in the number of reports of pangolin (and other wildlife) being poached and sold at local markets and via social media. Some of these animals are rescued and released, and to support releases meeting international standards this project worked to refine particular aspects of the procedure. Furthermore, as the country looks to diversify its economy the environmental impact of foreign investment and ecotourism needs to be monitored, this project aimed to collect some baseline data about population abundance and distribution so this can be achieved.

This work leads on from a one week pangolin workshop recently coordinated and run by the Principle Investigator in conjunction with 1stopbrunei Wildlife Club and The British High Commission in Brunei. This involved a stakeholder workshop where a strategic plan was develop for the conservation of the Sunda pangolin and initial field training was conducted for wildlife rangers and young conservationists in the skills requires to survey and monitor for this species.

As it stands there is no baseline data regarding abundance or distribution of pangolin in Brunei. An intensive six week survey using camera trapping, night spotting and interviews with local communities will develop a database and map of pangolin sightings to allow the continued monitoring of this species.

Chapter 1: Review of the Sunda pangolin in Brunei

The pangolin has been reported in all four districts of Brunei, namely Brunei Muara, Tutong, Kuala Belait and Temburong (Figures 1a and b).

This information comes from recent sightings reported by Istopbrunei Wildlife Club members, the public and historical, unconfirmed records from discussions with local communities. Surprisingly, the highest number of recent, confirmed sightings has been from the urban areas in the Brunei Muara district, when the animals are found in houses or seen crossing highways (Figures 2a and b). All the sightings have been at night, five of the confirmed sightings have been between around midnight (Cheema, *Pers. Comm.*).

Istopbrunei wildlife has released 11 pangolins between 2013 and April 2015. Eight of these releases were animals found for sale online and ten were voluntarily handed over after entering people's homes. Monitoring by Istopbrunei Wildlife Club recorded 25 instances of pangolins being sold on social media (Figure 2c) in 2014 and 6 in the first half of 2015 (Cheema, *Pers. Comm.*). Despite petitioning the Sunda pangolin is currently not listed on the Wildlife Act (1984).



Figures 1 and 2. From top left: 1a) the four districts of Brunei. (www.mapsource.com); 1b) map of Brunei showing major protected areas (www.googlemaps.com). Figure 2a) a Sunda pangolin found in a house 2b) a Sunda pangolin as a result of a road traffic accident 2c) a Sunda pangolin being sold via social media.

Chapter 2: Objectives and activities

2.1 Objectives

- Gather baseline data on the distribution of Sunda pangolin in Brunei.
- Refine methods for the release of rescued Sunda pangolins by 1stopbrunei Wildlife Club.
- Provide training to young Bruneian conservationists.

2.2 Activities

1. Locations were mapped of where pangolin have been located and/or released by:
 - (i) Interviewing local people, village headman and long house communities following a semi structured questioning procedure.
 - (ii) Using social media to collate historical records of pangolin sightings
 - (iii) Collating data on the rescues and releases of Sunda pangolin by 1stopbrunei Wildlife Club from 2013-present.

The information included:

- GPS locations of rescues and releases
 - Sex
 - Weight (estimation)
 - Record of injuries
2. Training was provided to local conservationists in surveying techniques for Sunda pangolin
 - (i) Several local conservationists were trained in how to use VHF radio transmitter equipment to located released individuals (homing) or monitor if they were moving from a distance (triangulation).
 - (ii) Two local conservationists were trained in how to set up a camera trapping grid targeting Sunda pangolin and small carnivores and how to collect the memory cards and maintain the cameras.
 3. Suitable locations where pangolins could be released were identified based on the following criteria:
 - a. Identification of large tree hollows or fallen logs for pangolin to sleep in
 - b. Proximity to urban areas
 - c. Evidence of poaching
 - d. Attitude of local villagers/long house communities
 - e. Knowledge on the presence of other pangolins

Table 1: Survey effort July 2015- September 2015 (six week period)

Site	Survey effort			Interviews
	Night survey (hours)	Day survey (hours)	Camera trapping (effective camera trapping nights)	
x	3			
y ¹	16	19	187*	1
z		4.5	24*	1
a	2.5			
b	10			1
c	4	8		
d	9	7		1
e		3.75		
f		2		2
g	8.5			
h				2
i	2	2		

*Cameras are still active. ¹See Figure 4 for layout

A camera trapping grid was established at an area where pangolin had been released and where wild pangolin had been spotted. This is also an area where Istopbrunei Wildlife had invested many years building up a strong relationship with the local Iban tribe who lived at the longhouse.

4. Building of a mini rehabilitation enclosure was continued, this included:

- Filling trenches with concrete to prevent pangolins from digging out
- Building a wall five bricks high to prevent pangolins from climbing on the fencing of the enclosure



Figure 3. Building of a small enclosure where rescued wildlife can temporarily be kept

Chapter 3: Results

3.1 Interviews

The information presented below are notes obtained from semi structured interviews of key people researchers identified as potentially having pertinent information which would support pangolin conservation efforts in Brunei. All interviewees were male as they held prominent roles as village/long house heads and spent the most time in the forest for farming or hunting.

Table 2. Notes from semi structure interviews

No. and date	Job	Gender, age, ethnic background	Pangolin sightings	Pangolin behaviour	Pangolin ecology	Perceived threats
No. 1 22.7.2015	Retired teacher, village head.	Male, 60s. Bruneian	Has been cutting down trees and found them sleeping in the top. Once kept one at his house for one month.	Only seen one individual at a time. Friends have seen one carrying young.	Only seen them sleeping in trees. They prefer trees with lots of lichens growing on them.	In the 70s there were lots of pangolins; in the 80s it started to decline due to local poaching and logging; now if people find pangolins they sell them. Demand is from Malaysia. They are preferred alive but sold in either state. The heart is used for medicinal purposes.
No. 2 22.7.2015	Logger	Male; 40s; Malaysian	Peak time for sightings between 00:00-04:00.	Ants emerge after midnight, then pangolins come out to feed.	Found in cool places - under bridges and in tree hollows.	The interviewee presented three scales taken from the tail, he was told they were good for back pain.
No. 3 30.7.2015	Retired policeman now a farmer (rehabilitation enclosure built on his land)	Male; late 40s, Bruneian	Last sighting 1.5 years ago – at a cemetery on the edge of the forest.			If seen people sell it to Limbang ² or Lawas in Malaysia. People in this village don't hunt it but will sell it if they see one.
No. 4 30.7.2015	Village head		Four years ago he was farming in the forest and used to see pangolin often. Ignored it as he knew it wouldn't cause any harm.			Pangolins are caught in traps set for mouse deer. Sold to sellers in Limbang for 200-300BND
No. 5 1.8.2015	Government job (son of long house headman) ¹	Male, late 40s; Iban tribe.	Many sightings around three years ago, now not so much.			The scales are worth 700RM/kg, but Bruneians don't consume the meat. People used to ignore them – now if sighted they are sold.

No. and date	Job	Gender, age, ethnic background	Pangolin sightings	Pangolin behaviour	Pangolin ecology	Perceived threats
No. 6 6.8.2015	Village elder	Male; 70; Bruneian	Last time two years ago*. Mainly crossing the road at approx. 20:00-21:00. If caught always released. Bigger pangolin seen in forest and smaller at the mangrove boundary.	Seen eating termites and ants and climbing trees to eat weaver ant nests. If it is seen outside of the forest it heads to a house and sleeps underneath.	Pangolin seen at the edge of the mangrove where there is plantation, but not in the mangrove. Sleep in the trees, often under bird nest ferns in living not dead trees. Not seen in fig trees or on the ground.	No one catches pangolin on the island as they know they will be fined.
No. 7 7.8.2015	Driver	Male; late 40s; Bruneian	Regularly sees them on the road outside his house at approx. 21:00.			Has a relative who sells them for 60RM for whole animal. Highest price is 200RM for whole animal. Sold to Malaysia. Sets traps along ant mounds.
No. 8 7.8.2015	Resort manager	Male; Iban	Seen one month ago feeding on flying ants at approx. 21:30		Don't spend every night in the same tree. Thinks population is increasing as they are catching more.	Sold to Limbang for 200RM/kg. Sometimes they then go to Kota Kinabalu or China. People hunting for pangolin but secretly- they set traps for mouse deer but if a pangolin is caught it will be sold on. Won't eat pangolin as it does not look attractive.

¹Interview conducted in English, all others in Malay with a translator.

*Interviewee indicated that they do not go into the forest as much now, which may contribute to the decrease in sightings

²Limbang is a town in part of Malaysia that splits Brunei. The easiest land access to the Temburong district is by driving across Malaysia, which includes driving through Limbang.

3.2 Mapping

Table 3. Information about all Sunda pangolin sightings by or reported to members of Istopbrunei Wildlife Club

Observer	Location	Time (06:00-18:00; 18:00-00:00; 00:00- 06:00)	Weather conditions
Member of public report to Istopbrunei	Rimba Hill, Spg 350 (Kampong Rimba)	18:00-00:00	
Member of public report to Istopbrunei	Stadium pathway (in the capital)	00:00-06:00	
Friend of Istopbrunei member	Anduki area (Belait District)		
Istopbrunei member	Sg Akar Highway	00:00	Clear sky, no wind
Istopbrunei member	Sg Akar Army Camp	00:03	Windy, no rain
Istopbrunei member	University of Brunei campus	22:00	No rain
Istopbrunei member	Kg Kianggeh (graveyard near water village)	00:00	Heavy rain
Istopbrunei member	Kg Katok (near a secondary school)	01:30	
Istopbrunei member	By Brunei immigration building	22:00	
Istopbrunei member	Kg Jerudong	00:30	Windy, no rain

Table 4. Details of all pangolins rescued by Istopbrunei Wildlife between December 2012 and September 2015

Pangolin ID	Date received	Details	Sex
P01M	18.12.13	Shiny panda	Male
P02F	15.3.2014	From a poacher	Female
P03	17.3.2015	Ismal	
P04	1.5.2015	Poacher	
P04M	27.7.2015	Malcom Lim	Male
P06M	26.9.2015	Poacher	Male
P07F	4.10.2015	Huzairie	Female
P08F	1.11.2014	Nur Syiffaa	Female
P09M	22.11.2014	Ms Laila	Male
P10M	17.4.2015	Mr Chan Jalan Kustin	Male
P11M	26.4.2015	Sammy Suhaimi	Male
P12F	5.6.2015	Eugene	Female
P13M	23.6.2015	Ah Loong	Male
P14F (Zymah)	1.7.2015	Tanah Jambu. Sp. 721	Female
P15M Y(i Jiun)	4.7.2015	Sg. Tilong (in front of Mauri)	Male
P16 _Albino	21.8.2015	Sg Akar Highway	

3.3 Radio tracking training

Radio tracking training was provided to members of 1stopbrunei Wildlife Club (Figure 4). Training included techniques of triangulation and homing as well as using a GPS to enable them to find released pangolins and remotely monitor their movements.



Figure 4. Members of 1stopbrunei Wildlife Club being taught how to use radio tracking equipment.

3.4 Post release monitoring

Four pangolins were rescued after the cameras were purchased, for three of the releases camera traps were placed at the release location, to ensure the pangolin came out to feed, if it moved on or if it returned to the same sleeping site. Pangolins generally show a low fidelity to a sleeping location and will not re-use the same den site on consecutive nights. Photographs were obtained for two of the pangolins released, P13M (Figure 5) and P16 (Figure 6).



Figure 5. A camera trap photograph of released pangolin P13M coming out to feed the night after it was released.



Figure 6. A camera trap photograph of released pangolin P16 feeding at the base of a tree hollow where it had been released the night after it had been released.



Figure 7. Evidence of feeding and digging at the release site.

3.5 Identifying suitable release sites

In order for releases to have maximum impact a need exists to identify areas where animals can be released, monitored and a population loosely managed, to the extent that the following are taken into consideration:

1. No males are released within a 1km radius of each other
2. Females are released at locations where males have previously been released
3. Camera trapping can be maintained long term supported with occasional night spotting

Before commencement of the project, a site had already been highlighted as a location suitable for several releases and a long term monitoring scheme. For this reason, camera traps were set up to try and photograph pangolins (Figure 8) as there was *a priori* knowledge they were here and also to begin to gather baseline data on species diversity to enable members to monitor changes long term (see Table 6 for summary). There is also the potential to develop this site as an ecotourism location.

Other areas were evaluated using the criteria stated in 3.4 with specific release locations (i.e. tree hollows and fallen logs) marked on a GPS. The information gathered is summarized in Table 7.



Figure 8. A photograph of a Sunda pangolin on a camera at a location where an animal was previously released.

Table 6. Summary of camera trapping effort

Camera ID	Set camera trap	Take camera trap	Number of Effective Camera Trap Days	Elavation (m asl)	Total no. photos excluding those of research team.	Total no. of animal photos	Species list
Camera_1	15.7.2015	24.7.2015	9	70m	31	3	Bornean yellow muntjac
Camera_2	16.7.2015	29.9.2015	74	104m	356	228	Malay civet, Argus pheasant, bearded pig, Bornean yellow muntjac, short tailed mongoose, greater mouse deer, ground tufted squirrel
Camera_3	23.7.2015	26.9.2015	65	77m	57	22	greater mouse deer, Sunda pangolin, common porcupine, Malay civet, Bornean yellow muntjac, tufted ground squirrel
Camera_4	24.7.2015	1.8.2015	8	35m			
Camera_5	24.7.2015	1.8.2015	8	36m			
Camera_6	2.8.2015			127m			
Camera_7	2.7.2015	1.8.2015	30	119m	33	20	greater mouse deer, pig tailed macaque
Camera_8	2.8.2015	5.9.2015 (last photo)	34	89m	61	40	banded palm civet, bearded pig, Bornean yellow muntjac, Prevot's squirrel, Argus pheasant, common porcupine, thick spined porcupine, yellow throated marten.
Camera_9	2.8.2015	10.9.2015(last photo)	28	169m	167	108	common palm civet, banded palm civet, greater mouse deer, tufted ground squirrel, pig tailed macaque, Bornean yellow muntjac, Argus pheasant, common porcupine, bearded pig, monitor lizard, marbled cat,
Camera_10	1.8.2015	26.9.2015	57	170m	316	212	clouded leopard, pig tailed macaque, Bornean yellow muntjac, bearded pig, thick tailed porcupine, greater mouse deer, tufted ground squirrel.

Table 7. Summary of the release site assessments

Site	Pangolin presence	Sleeping sites	Proximity to urban areas	Attitude of villagers/local community	Comments
z	Unknown	Many large trees, tree hollows and fallen trees	Large areas of inaccessible forest	Many local families have connections to Limbang – a local village where pangolins are traded.	Suitable habitat, but difficult access if confiscations happen outside of the district.
x*	Two released	Secondary forest, young trees mean a lack of suitable sleeping sites	Located in a residential district.	Mixed	There have been a high number of sightings in neighboring urban areas.
a	Unknown	Secondary forest, young trees mean a lack of suitable sleeping sites.	Very close to a highway.	(Old) evidence of poaching and trapping.	Very steep and close to a highway.
e	Discussion with locals indicate the presence of pangolins.	A few suitable sleeping sites were identified (fallen logs).	The island is sparsely populated and this is concentrated around the pier and 3km along the road inland.	No known poaching, a receptive community with which a strong relationship could be established.	Half of the island is mangrove, the rest forest.
f	Unknown.	Several large tree hollows were identified.	Sparsely populated area.	Mist nets have been seen along roads in Labi, however, local longhouses are supportive and no evidence of poaching was seen at the site itself.	This area neighbors forest which is to become part of the Heart of Borneo (a WWF run project).
c	Two released	Some release sites, but a lot of young secondary forest.	The park is large but close to the capital.	The park borders many densely populated residential areas.	Pangolins in this area are sometimes found in residential areas, most report them to 1stopbrunei but others may be sold on line.
d	Two released	Several tree hollows identified	Close to urban area.	Evidence of poaching in C1	Evidence of poaching in some areas, however, other areas (C3) seem well protected.
i	Two released	Tree hollows identified (previous release sites)	Very near to a road.	.	A small area, many locals come here. It was discovered that the car park of the area was frequented by drug dealers, so not a suitable site for future releases.

y

Five released,
one wild
sighting

Primary forest means
there are several
suitable release sites.

Away from urban
areas.

Local longhouse
communities are supportive
of the work Istopbrunei
conduct.

*Releases at this site happened at the very start of the project, when very little was known by the members about the requirements of Sunda pangolin.

Chapter 5: Conclusion and recommendations

5.1 Distribution of Sunda pangolin in Brunei

Pangolin are widely distributed across Brunei. Much of the country is covered in forest, however, assessing the distribution of Sunda pangolin required a multifaceted approach. In the densely populated district of Brunei and Maura (in the north) green spaces and recreational parks are regularly visited by locals and are neighbored by residential areas. Evidence for pangolin presence in this area was primarily confirmed through reported sightings and rescues. The Belait District to the south of the country is covered by the Labi Forest Reserve, an area of primary forest stretching to the Malaysian border. Here pangolin presence was indicated through interview surveys and habitat assessments and confirmed by camera trapping.

From this work alone it is not possible to estimate the density of pangolin in these areas. More confirmed records of pangolin in the Brunei and Maura district should not be taken as an indication that they are present at a higher density than in Labi, however, it does raise some pertinent points relevant not only to pangolin conservation in Brunei but across Southeast Asia.

Some of the green spaces in the Brunei and Maura district are large and if calculations of home ranges for adult male Sunda pangolin were used to estimate population the figures produced would indicate a high density. With ranges (100% minimum convex polygon (MCP)) to date recorded between 8.2ha and 76ha (Lim, 2007) the 1500ha recreational park, Tasek Lama, in the capital Bandar Seri Begawan, would have the potential to support a high number. However, without further investigation into the two main resources important to Sunda pangolin (prevalence of sleeping sites and prey) and better understanding of the arrangement of territories and home ranges and the dispersal of young (especially males) any estimates of density and/or abundance would be inaccurate.

5.2 Release protocols

It is recommended that releases are conducted in the Labi Forest Reserve. The dietary preferences of the Sunda pangolin remain largely unknown, however, older growth forest with decaying wood means easier access to prey items without the energetic costs of digging to deep chambers or foraging over larger areas to meet the individual's need. This, accompanied by an abundance of suitable sleeping sites, would minimize the energetic demand on a newly released individual.

Despite Sunda pangolins showing no strong preference for habitat type and appearing to be a diet generalist (Lim, 2007) stable isotope analysis of the African ground pangolin, *Smutsia temminckii*, recorded as only feeding on five prey species (four ant and one termite) (Pietersen et al. 2015). Without fully understanding the drivers behind this selectivity, releasing in primary forest with high prey diversity ensures pangolins have access to favored food sources. Furthermore, data gleaned from future radio tracking of the individuals will provide a clearer insight into the ecology of these animals in the wild.

The nature of the trade in Brunei means that rescued pangolins are those that have not been in the trade for a prolonged period of time. This means that often the animals are strong and in good health and cases involve dealing with individuals rather than groups of animals. Animals should only be kept until they have produced a fecal sample, where possible the pangolin should be taken out to feed, decaying wood brought to the animal or fruit left in the forest to collect ants that can be provided to the animal.

5.3 Recommendations

- Brunei remains one of only two range countries where the Sunda pangolin is not listed as a nationally protected species. This is a priority for the conservation of this species in Brunei.
- Continue educational activities in the district of Brunei and Maura where a high number of pangolins are often found in people's houses.
- Building simple wooded transport boxes and sleeping boxes to allow easy transfer to of rescued pangolins to release sites.
- Begin collecting ants that can be frozen so that an emergency supply can be on hand to feed rescued pangolins if necessary.

5.4 Future plans

- Survey further to find other locations that are suitable areas for release to avoid saturated the area immediately around the longhouse.
- Work with a local business and the local longhouse to combine camera trapping and ecotourism.
- Test radio tags with a long detection range and test GPS tags where data can be collected using mobile phone signals.
- Work with University of Brunei Darussalam to develop live extract and post mortem protocols to gather important samples (underway).
- At locations where pangolins have been photographed, test the success of various baits and lures.
- Test the use of a pressure pad camera traps.
- Collect ant samples in the areas where roadkill have been located for comparison with the contents of their gut.

References

Challender, D., Nguyen Van, T., Shepherd, C., Krishnasamy, K., Wang, A., Lee, B., Panjang, E., Fletcher, L., Heng, S., Seah Han Ming, J., Olsson, A., Nguyen The Truong, A., Nguyen Van, Q. and Chung, Y., 2014. *Manis javanica*. The IUCN Red List of Threatened Species. Version 2014.3 [online]. Available from: <http://www.iucnredlist.org/details/12763/0> [Accessed: 30th December 2015].

Lim T-Lon, N., 2007. Autecology of the Sunda pangolin (*Manis javanica*) in Singapore. MSc Thesis, National University of Singapore.

Pietersen, D. W., Symes, C. T., Woodborne, S., McKechnie, A E., and Jansen, R. 2015. Diet and prey selectivity of the specialist myrmecophage Temminck's ground pangolin. *Journal of Zoology*.