

**ASSESSING THE TRADE
IN PIG-NOSED TURTLES
CARETTOCHELYS INSCULPTA IN
PAPUA, INDONESIA**

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and Ron Lilley**

A TRAFFIC REPORT

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Cover: A young Pig-nosed Turtle

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Elizabeth A. Burgess and Ron Lilley



A Pig-nosed Turtle swimming. Photo credit: Wildlife Reserves Singapore / David Tan

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ABBREVIATIONS AND ACRONYMS

BKSDA	<i>Balai Konservasi Sumber Daya Alam</i> (Natural Resources Conservation Agency of Indonesia: provincial offices of PHKA (see below))
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
IUCN	International Union for Conservation of Nature
LIPI	<i>Lembaga Ilmu Pengetahuan Indonesia</i> (Indonesian Institute of Sciences: Indonesia's CITES Scientific Authority)
IDR	Indonesian Rupiah
PHKA	<i>Perlindungan Hutan dan Konservasi Alam</i> (Directorate General of Forest Protection and Nature Conservation: Indonesia's CITES Management Authority)
PNG	Papua New Guinea
TAM	Traditional Asian Medicine
USD	United States Dollar

EXECUTIVE SUMMARY

The Pig-nosed Turtle *Carettochelys insculpta*, also known as the Fly River or Pitted-Shell Turtle, is a taxonomically distinct, large freshwater chelonian restricted to the river systems of northern Australia and southern New Guinea (divided politically between Papua New Guinea (PNG) and Papua Province, Indonesia). The high international demand for Pig-nosed Turtles in the exotic pet trade, food market and traditional medicine practices has driven the intensified exploitation of this species in Papua. Despite being afforded legal protection in Indonesia and being listed in Appendix II of CITES, the Pig-nosed Turtle is increasingly being targeted in the province of Papua, Indonesia for international wildlife trade. This study highlights an urgent need for the existing laws and regulations concerning Pig-nosed Turtle trade to be rigorously enforced to curtail the illegal harvest and trade.

Surveys on the trade of Pig-nosed Turtles throughout the Indonesian province of Papua were carried out in November and December 2010 to coincide with the Pig-nosed Turtle nesting season (September to February). Pig-nosed Turtles were primarily collected by Papuan villagers who source eggs of this species by excavating nests on the banks of rivers and swamps. Predominant collection areas lie in the Asmat region of Papua, although more expansive collection areas also exist further east and north of Merauke near the PNG border. Village collectors sell the wild harvested Pig-nosed Turtle eggs directly to traders operating in villages (typically non-Papuan immigrant traders settled in the region). There was also a growing trend towards incubating the collected eggs in ex-situ hatcheries located within Papuan villages, which was favourable among local collectors and traders because live hatchling turtles can command a higher price than eggs. Pig-nosed Turtles from Papua are traded as live pets, for meat consumption as well as for medicinal purposes. One respondent reported a company in Jayapura that purchases hatchling Pig-nosed Turtles for drying and then grinding into a powder for export to China, and resale in the traditional medicine trade.

Local Papuans realize that the natural resources around them have a high value to outsiders, and what previously was opportunistic hunting for daily needs has become a large-scale exploitation of Pig-nosed Turtles. Turtle traders have also significantly influenced remote communities in Papua by bringing in and bartering with modern commodities (such as outboard boat motors) and provisions (such as useful equipment, supplies, fuel and foodstuffs). This survey found that local people were actively encouraged by immigrant traders to harvest and independently incubate eggs for trade, and that immigrant traders often organized and co-ordinated egg-collecting trips further upriver using motorboats. Improved transportation (e.g., motorboats and access to fuel) in the region have increased the accessibility of more remote river systems, and thereby expanded the harvest potential of Pig-nosed Turtles in Papua. Turtle buyers offering trade in rural communities, combined with a recent shift to a cash economy (cf. subsistence economy), has created strong incentives for local Papuans to trade in Pig-nosed Turtle eggs and hatchlings.

Eggs and hatchlings of Pig-nosed Turtles are smuggled from remote source villages (via boat or small aircraft) to centralized trade hubs within Papua, including the towns of Agats, Merauke, Timika and Jayapura. From Papua, turtles were typically smuggled westward into major domestic trade destinations in Indonesia, including Jakarta, Surabaya and Probolinggo in Java, Makassar (Ujung Pandang) in south Sulawesi, and Denpasar in Bali. This survey also found that Pig-nosed Turtles could be bought through a growing online marketplace, with sellers located in Indonesia as well as in the United States and the United Kingdom. Along this international trade chain, the value of Pig-nosed Turtles increased exponentially: hatchlings were generally sold in Papuan villages for USD 0.56–1.33 each; in domestic trade hubs such as Jakarta and Surabaya for USD 3.30–8.33 each; and on international markets for USD 39–56 each.

Thirty-two seizures of Pig-nosed Turtles, between 2003 and 2012, were compiled in this study, including more than 81,689 individual turtles. Most seizures (75% of reported cases) occurred early in the calendar year (i.e., between January–March) towards the end of the nesting season for Pig-nosed Turtles, suggesting that traders are moving shipments as soon as the turtles are hatched. Available seizure data suggests that Pig-nosed Turtles are being traded in large quantities, with consignments averaging 2817 ± 3701 turtles per seizure. Highlighting the enormity of this illegal trade was one seizure that rescued 12 247 Pig-nosed Turtles in Timika, Papua en route to Jakarta. Most enforcement actions and confiscations occurred at points of export from Indonesia, with little documented enforcement at the source of eggs collection. Undoubtedly, the swamps and river systems where turtles are sourced are vast and the villages involved in the trade are remote, making enforcement efforts for Pig-nosed Turtle trade geographically challenging. Nonetheless, the lack of

enforcement, and potential corruption, at the source of trade means that the exploitation of wild Pig-nosed Turtles populations proceeds unhindered.

All of the egg collections and ex-situ hatchery operations observed during this survey were illegal, relying on wild harvested eggs for commercial sale. An apparent problem for addressing trade issues in Papuan villages is that many local people are confused by the concept of ‘captive breeding’ and are freely collecting eggs without remorse. Inadequate enforcement of Indonesia’s legislation to protect Pig-nosed Turtles from wild harvest in Papua is a major factor contributing to the excessive exploitation. Anecdotal information implies that while there have not been any quotas issued for taking Pig-nosed Turtles or their eggs from the wild, there are a few traders licensed to breed and export Pig-nosed Turtle in Indonesia. How they would have acquired breeding stock is not clear. Yet, according to the CITES Trade Database (WCMC), Indonesia has only ever legally exported one shipment of 57 Pig-nosed Turtles for the purpose of trade in 2006 to the US (these animals were declared as being Farmed). It is suspected that illegal smuggling is an easier and cost-cutting option, and therefore the preferred route for traders.

The trade threat to Pig-nosed Turtles is further compounded by the high mortality rate reported in smuggling operations, with available data from reported seizures showing that on average 18% of turtles die in a shipment. Turtles that are found alive by authorities in confiscated shipments are held in a temporary holding facilities or rescue centres. Surviving confiscated turtles were sometimes repatriated back into the wild in Papua by Indonesian Customs and local government BKSDA officials – often with financial aid from industries within Papua. The environmental risks and financial costs associated with maintaining, translocating and reintroducing seized Pig-nosed Turtles are substantial, particularly for cases where turtles are seized outside of Papua and/or large numbers of turtles are involved.

Results of this study have shown that the exploitation of Pig-nosed Turtles in Papua, Indonesia has reached a level that requires immediate action. High international demand for Pig-nosed Turtles, combined with an organised and influential global wildlife trade network within Indonesia, unregulated harvesting of eggs, an increased potential to collect eggs in previously inaccessible swamp habitat in Papua (i.e., using motorboats, improved regional infrastructure), growing socio-economic incentives for rural Papuans to harvest turtles for income and a lack of enforcement at the source of wild harvests, are contributing to unprecedented levels of exploitation of Pig-nosed Turtles throughout its Papuan range. Unless actions are taken to mitigate the high demands of consumer nations and to fully enforce the legal protection of Pig-nosed Turtles within Indonesia, the current unabated harvest regimes observed in rivers throughout Papua will lead to significant population declines of Pig-nosed Turtles (see Eiseberg et al., 2011). For the effective protection of the Pig-nosed Turtle in Papua, TRAFFIC recommends the following:

- **Protected status:** Indonesia’s national laws are sufficient to protect Pig-nosed Turtle populations, however the implementation and enforcement of these laws are currently not effective. Authorities in Indonesia (BKSDA, PHKA, quarantine, Customs personnel and police) should be alerted to the continuing illegal trade of Pig-nosed Turtles from Papua Province. Traders found with Pig-nosed Turtles must be prosecuted to the full extent of the law by Indonesian authorities.
- **Community involvement and awareness:** Community education and awareness programs should to be initiated to engage local Papuan people in the protection of Pig-nosed Turtles, and such campaigns should be supported by BKSDA and PHKA, in collaboration with relevant NGOs. It is fundamental that local communities throughout the province of Papua are not only made aware of the protected status of Pig-nosed Turtles and the risk of over-exploitation, but that communities become actively engaged in conserving remaining local populations. Importantly, socioeconomic issues need to be further assessed in rural Papuan communities to confront the escalating pressure to use natural resources for income. A dedicated investigation should be conducted examining viable solutions for generating alternative income opportunities for local Papuans in remote villages. Such outreach initiatives should be promoted among policy-makers for economic/social development in Papua and any international development agencies focusing on this region of Indonesia.

- **Enforcement of national legislation:** No specimen of Pig-nosed Turtle should be harvested and/or traded without permits in Indonesia, and offenders should be charged and prosecuted in full accordance with the law. Enforcement efforts should be especially increased at the source of collections (i.e., targeting middlemen dealers operating in rural Papuan communities), as well as at points of exit along the trade chain, such as Indonesian domestic ports and/or airports - Agats, Merauke, Timika and Jayapura (in Papua Province), plus Jakarta and Surabaya (Java), are known ports of export for a high frequency and volume of illegally traded Pig-nosed Turtles. These ports should receive priority attention from enforcement officials, such that shipments transiting through these locations should be rigorously inspected by BKSDA, Customs, port authorities, quarantine officers and police.
- **International trade:** The CITES Management Authority of Indonesia (PHKA) should enforce national legislation prohibiting the export of Pig-nosed Turtles. Inspectors in key countries and territories, including Singapore, Malaysia, Thailand, mainland China and Hong Kong, should be vigilant for Pig-nosed Turtles (a very distinctive turtle species, unlikely to cause identification problems in enforcement) being smuggled amongst other cargo, e.g., timber trade. Increased vigilance on the part of Indonesian and international Customs and quarantine officers is necessary to intensify checks at transit points, and these inspections should be especially attentive between January–March when new hatchlings are increasingly trafficked.
- **Capacity building:** Awareness campaigns on Pig-nosed Turtle trade need to be conducted and skills to enforce the laws should be strengthened for all concerned agencies (PHKA, BKSDA, quarantine, Customs, airport and seaport cargo personnel, police). Enforcement officers should be continually trained in species identification, conservation status of species, CITES regulations and the management of CITES Appendix II listed species through the efforts of inter-agency cooperation involving CITES authorities, NGOs and academia. Identification material (including turtle identification guide translated in multiple languages are available at that following link <http://www.traffic.org/home/2008/2/1/turtle-identification-guide-launched.html>) and information regarding the turtle trade from Indonesia and potential smuggling methods should be made available to concerned agencies. Importantly, motivation and willingness to enforce the illegal trade in Indonesian turtles should to be encouraged and promoted from within the agencies concerned.
- **Repatriation:** Health, condition and population origin of confiscated live turtles should be examined by PHKA, LIPI and other relevant authorities, prior to release back into the wild, in order to minimise risks of disease transfer, disruption of population genetic integrity and negative effects on local fauna and flora (refer to CITES Resolution Conf. 10.7 (Rev. CoP15) and IUCN, 1998). In this manner, release programmes should be organised in consultation with a range of experts and stakeholders, including government personnel, management agencies, non-government organisations, universities, veterinary institutions, zoos and funding bodies. Repatriation events should provide opportunities for tagging individual turtles and conducting various scientific research to better understand the biology of Pig-nosed Turtle populations. The establishment of a holding facility for confiscated Pig-nosed Turtles in Papua should be considered.
- **International consumer demand:** Public awareness of the illegalities of and the risks related to trade in Pig-nosed Turtles needs to be increased because harvesters and traders in Papua are responding to an international market demand for consuming turtles or keeping turtle as pets. PHKA, BKSDA, international CITES MAs and other agencies involved in confiscating Pig-nosed Turtles are strongly encouraged to issue press releases and official statements providing information on trade volume, destinations and prosecutions to raise awareness of the issue. Online news articles and media coverage on seizure cases of Pig-nosed Turtles in Indonesia, and internationally, are important for communicating the illegal trade, and its conservation threat, to the global public (particularly online users).
- **Captive breeding in Indonesia:** Anecdotal information implies that there may be one or more traders licensed to breed Pig-nosed Turtles in captivity, in Java. Nonetheless, Pig-nosed Turtles in Indonesia are being illegally harvested and smuggled in such large quantities that enforcement authorities are recommended to seize all trade in this species. Should commercial captive breeding or ranching operations be legitimately developed in Indonesia, a strategic plan must be devised by PHKA and LIPI Authorities to ensure that the breeding stock is acquired legally, and that dealers do not launder wild-caught specimens into legal trade.

- **Conservation strategy:** As an urgent priority, a species conservation and management plan for Pig-nosed Turtles in Indonesia needs to be designed and implemented, with involvement from all relevant government agencies, research scientists and NGOs. This strategic plan should take into consideration all of the above mentioned recommendations and draw on information on Pig-nosed Turtle population declines reported by Eisemberg *et al.* (2011) in the Kikori region, Papua New Guinea. Furthermore, there should be a call for further research on the Pig-nosed Turtle to determine the extent of its range in Papua, population abundances, harvesting pressures, and appropriate conservation management.

INTRODUCTION

Freshwater turtles are traded worldwide for their meat, as ingredients in Traditional Asian Medicines (TAM), and as exotic pets (Auliya, 2003; Milner-Gulland *et al.*, 2003; Gong *et al.*, 2006; Shepherd and Nijman, 2007; Chen *et al.*, 2009; Stengel *et al.*, 2011; Lyons *et al.*, 2013). Across Asia, exorbitant numbers of turtles are sourced for trade (Compton, 2000), such that the turtle decline has been called a ‘crisis’ (van Dijk *et al.*, 2000). Overexploitation is a significant threat to turtles because wild populations are harvested unsustainably and/or illegally (Nijman and Shepherd, 2007; Eisemberg *et al.*, 2011), resulting in many species becoming threatened (see Compton, 2000; Turtle Conservation Fund, 2002; Turtle Conservation Coalition, 2011). The supply and demand of freshwater turtles appears to be increasing throughout South-east Asia (TRAFFIC, 2001; Nijman and Shepherd, 2007) due to the high species diversity on offer and an increase in the number of suppliers targeting turtle species (Shepherd *et al.*, 2004). Southeast Asian economies, in particular Indonesia, export large numbers of wild-caught turtles each year (Nijman and Shepherd, 2009; Natusch and Lyons, 2012; Lyons *et al.*, 2013). It is suspected that extensive trade in turtles from Indonesia is supplying international pet markets (Samedi and Iskandar, 2000; Shepherd and Nijman, 2008; Stengel *et al.*, 2011; Lyons *et al.*, 2013), and unsustainable harvests may already be threatening Indonesian freshwater turtle populations (Rhodin and Genorupa, 2000; Iskandar and Erdelen, 2006; Shepherd and Nijman 2007; Eisemberg *et al.*, 2011). One of the most heavily exploited turtle species from Indonesia is the Pig-nosed Turtle *Carettochelys insculpta* (van Dijk *et al.*, 2000; Arida and Ibarrondo, 2007).

The Pig-nosed Turtle (also known as the Fly River Turtle or Pitted-Shell Turtle) is the only surviving species of the once widespread family Carettochelyidae (Engstrom *et al.*, 2004; Fujita *et al.*, 2004; Iverson *et al.*, 2007; Barley *et al.*, 2010), and is unlike any other species of freshwater turtle. It possesses broad paddle-like flippers resembling marine turtles, rather than clawed feet as in other freshwater turtles (Rivera *et al.*, 2012). The Pig-nosed Turtle gets its common name from the placement of its nostril at the end of a prominent fleshy, trunk-like snout (Ramsey, 1886; Georges *et al.*, 2008; see photo). These turtles lack the characteristic hard scutes of most turtles and instead have a soft-pitted skin over their shell. The edges of the carapace are stiff and connected to the plastron by a strong bony ridge, which is in contrast to the pliable edging of soft-shelled turtles (Family Trionychidae). The upper surface and flipper colour of Pig-nosed Turtles may be grey to olive in colour, and the pale lower surface is white to yellowish. It is a large turtle species, reaching up to 56 cm in carapace length and attaining a maximum weight of 22.5 kg (Georges and Rose, 1993). Adult males can be distinguished from females by much larger tails which have a vent located near the tip (Georges *et al.*, 2008).

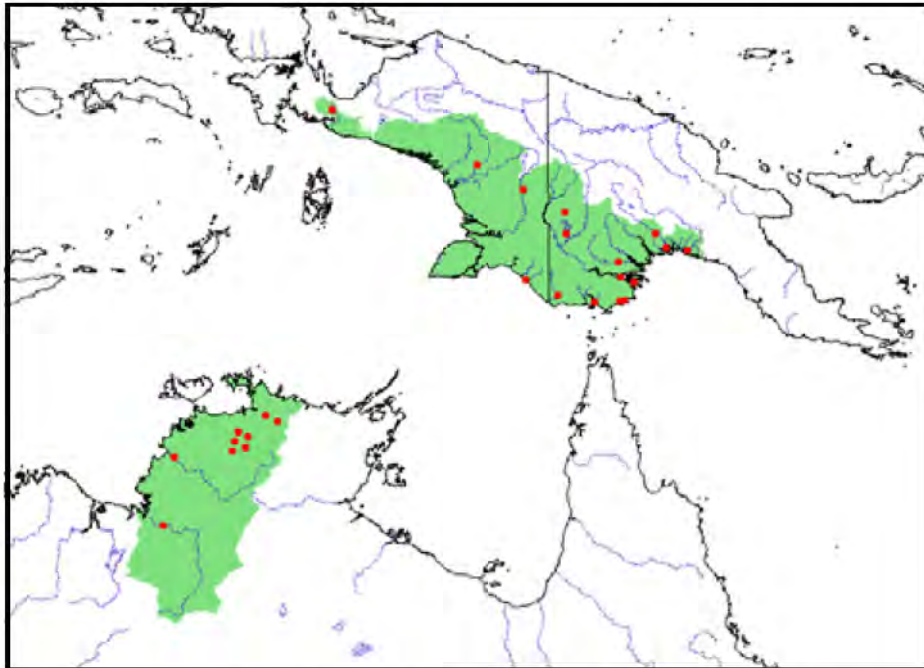


Photo credit: Ron Lilley

An adult Pig-nosed Turtle (carapace length 40 cm) showing the characteristic ‘trunk’ with nostrils – the ‘pig-nose’ from which it gets its name. The white mark behind its eyes are characteristic of the species.

Figure 1

Distribution of Pig-nosed Turtles in southern Papua, Indonesia and Papua New Guinea, and north-western Northern Territory, Australia. Red points denote occurrence records. Green shading denotes projected distribution based on regional watershed (Source: Georges *et al.*, 2008 with permission).



The distribution of Pig-nosed Turtles (Fig. 1) is restricted to the wet-dry tropical regions of northern Australia and southern New Guinea (divided politically between Papua New Guinea (PNG) and Papua Province, Indonesia) (Georges and Kennett, 1989; Georges and Rose, 1993; Rhodin and Genorupa, 2000; Georges *et al.*, 2006, 2008). The Australian Pig-nosed Turtle population is completely isolated from the Papua New Guinean and Papua Province populations. Typical habitat for Pig-nosed Turtles includes freshwater rivers, estuaries, lagoons, lakes, swamps and pools in waterways that are generally heavily forested (Georges and Rose, 1993). Pig-nosed Turtles are largely restricted to an aquatic habitat, because its paddle-like flippers and lack of a hard, protective shell are not suited to traversing land. Males never leave the water and females only do so to nest on the riverbanks during the seasonal breeding period (Georges and Kennett, 1989). During the dry season (July-November in Australia; September-February in New Guinea), females lay their white, hard-shelled eggs on sandy riverbanks above the shoreline (Georges and Kennett, 1989; Georges *et al.*, 2008; Eiseberg *et al.*, 2011). Like other turtles, this species takes a long time to reach maturity, has high juvenile mortality and long adult survivorship, meaning recruitment of Pig-nosed Turtles is slow.

The Pig-nosed Turtle is listed as Vulnerable in the IUCN Red List (IUCN, 2013), with major threats to populations including exploitation for international live animal trade and subsistence hunting, as well as habitat loss and degradation. Highly prized as food, these turtles are caught and their eggs are collected for consumption by local villagers or for trade in local markets (Maturbongs, 1999; Samedi and Iskandar, 2000; Georges *et al.*, 2008; Eiseberg *et al.*, 2011). However, a growing demand for this species in global markets has intensified the harvest of Pig-nosed Turtles. The taxonomic distinctiveness and limited distribution of Pig-nosed Turtles have engendered immense interest in this species from turtle collectors (Maturbongs, 1999; Samedi and Iskandar, 2000; Natusch and Lyons, 2012; Lyons *et al.*, 2013) and, more recently, food markets where large turtles of other species are becoming harder to obtain (Rhodin and Genorupa, 2000; van Dijk *et al.*, 2000). Conservation concern for Pig-nosed Turtles surmounts because this species exhibits slow maturation rates, has such a restricted distribution (Georges *et al.*, 2008), and is subject to intense wild harvest pressure (see Moll and Moll, 2004). Local villagers have reportedly been harvesting Pig-nosed Turtle eggs from nests at near 90% efficiency (Pauza, 2003). Yet, the negative population impacts of such heavy exploitation of younger life stages in long-lived species may progress undetected for many years or decades before populations collapse (Browne and Hecnar, 2007). Concrete data on population declines of Pig-nosed Turtles have largely been lacking because population abundance and trends are poorly known for most regions. However, a report from the Kikori region, Papua New Guinea, has provided the first direct evidence that Pig-nosed Turtle populations are suffering severe declines due to overharvesting (Eiseberg *et al.*, 2011).

Harvest of Pig-nosed Turtles appears to have recently intensified in Papua Province, Indonesia (Samedi and Iskandar, 2000; Arida and Ibarondo, 2007). This intensification is believed to be driven by the aim of supplying hatchlings to the international pet trade (Maturbongs, 1999; Shepherd and Nijman 2007, 2008; Stengel *et al.*, 2011; Natusch and Lyons, 2012; Lyons *et al.*, 2013); with the Pig-nosed Turtle one of the most common species to be found in Malaysian, Singaporean and Thai pet markets (Goh *et al.*, 2007; Nijman and Shepherd 2007; Shepherd and Nijman, 2008). Traditionally, the local people of Papua only occasionally captured adult turtles, and took relatively few eggs for personal consumption (Maturbongs, 1999). However, more recent estimates indicate that 1.5–2 million eggs are harvested annually from rivers in Merauke regency of Papua (Samedi and Iskandar, 2000), with further collections of 500,000 eggs annually occurring in other rivers (Maturbongs, 1999). It is likely that trade networks that have been established across Indonesia are leading to unprecedented levels of harvest in Pig-nosed Turtles. Additionally, the potential for reaching and harvesting previously inaccessible swamp habitat for Pig-nosed Turtles has significantly improved, with local villagers and outside traders using more efficient transportation (i.e., motorboats cf. paddling dugout canoes). Furthermore, warfare and hostility between certain tribal groups and towards foreign outsiders has largely been quelled, such that previously restricted and inaccessible lands in Papua are now more reachable (Maturbongs, 1999; J. Maturbongs, pers. comm., 2011). This region has also been affected by a shifting emphasis from a subsistence economy to a cash economy, as more villagers come to engage in resource development through mining, forestry development and associated infrastructure development. Thus, remote Papuan villages have begun to replace their traditional barter economy with a monetary one that facilitates trade with outsiders. A cash economy can have devastating impacts on harvested species because of the profits and gainful opportunities derived from a global market (TRAFFIC, 2008). Thus, assessing the impact of harvesting wildlife in remote locations of developing countries is essential because of the value of natural resources to local economies (see Berkes, 2004).

Indonesia has become an epicentre for illegal wildlife trade (Iskandar and Erdelen, 2006; Nijman and Shepherd, 2009; Lyons and Natusch, 2011; Natusch and Lyons, 2012; Nijman *et al.*, 2012; Lyons *et al.*, 2013), with its high species diversity, vast archipelago and lack of effective enforcement. Harvest pressures on Pig-nosed Turtles have escalated in recent decades to levels widely perceived as endangering the species over much of its range (Eisemberg *et al.*, 2011), particularly in Papua, Indonesia (Arida and Ibarondo, 2007). Papua is one of the most resource-rich provinces of Indonesia due to its natural reserves of minerals (silver, copper and gold), oil and gas, and production of timber and fish products. These resources are continually being tapped for export and trade, yet our knowledge of the biology and sustainability of many species inhabiting Indonesia's remote provinces is poor (Burnett, 2007). Understanding trade dynamics are of critical importance for conserving Pig-nosed Turtles, because of the suspected unsustainable harvest of eggs and hatchlings in Papua, coupled with an increasing level of international trade in turtles from Indonesia (Natusch and Lyons, 2012; Nijman *et al.*, 2012; Lyons *et al.*, 2013). This report examines the trade in Pig-nosed Turtles from Papua, Indonesia, and offers recommendations to mitigate the illegal harvest and overexploitation of this species.



Photo credit: Ron Lilley

Young Pig-nosed Turtles have a serrated edge to the shell, a dorsal ridge, and two claws on each flipper. The plastron (underside) is pink and the shell is still flexible while the turtle is young. Captive animals frequently show signs of bite marks, emaciation, and algal growth, such as on the animal on the left

Legislation

Indonesia has comprehensive national legislation for the protection of wildlife, which includes an extensive quota system to regulate the exploitation of species not listed as protected. Most freshwater turtles native to Indonesia are allowed, under permit, to be traded for domestic and international markets. However, the Pig-nosed Turtle is one of only six freshwater turtle species listed as protected under Indonesia's national legislation *Peraturan Pemerintah No. 7/1999*, and as such, trade in this species is prohibited. For other turtle species not listed as protected (see Stengel et al., 2011), trade is restricted by harvest and export quotas which are set on an annual basis via a meeting of various stakeholders, including PHKA (*Perlindungan Hutan dan Konservasi Alam*: Directorate General of Forest Protection and Nature Conservation, CITES Management Authority of Indonesia), LIPI (*Lembaga Ilmu Pengetahuan Indonesia*: Indonesian Institute of Sciences, CITES Scientific Authority of Indonesia), relevant non-government organisations and licensed wildlife traders (under national legislation *Peraturan Pemerintah No. 8/1999*). Under this trade quota system, hunters and traders are required to have permits for capturing, transporting, selling and exporting wildlife within Indonesia (Decree of the Ministry of Forestry No. 447/Kpts-11/2003). Furthermore, individuals or companies intending to harvest wildlife must be licenced by the provincial office of PHKA (i.e., Natural Resource Conservation Agency, BKSDA: *Balai Konservasi Sumber Daya Alam*) where the harvest is to take place, and may not exceed the allocated harvest quota for each of the provinces. Similarly, all individuals or companies breeding turtles for export must be registered with the PHKA and/or BKSDA. In principle, all wildlife trade in Indonesia should be officially registered and recorded with Authorities (i.e., PHKA and/or BKSDA). Since Pig-nosed Turtles are listed as protected, no capture or export quotas are set and no utilisation of any form is allowed for this species, except with special permission from the Minister and under consent of the Scientific Authority (LIPI) for special circumstances (such as research and captive breeding).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), adopted in 1973, aims to protect species from the detrimental effects of international trade by establishing a legal framework for preventing or controlling trade. CITES regulates trade in wildlife by including species on one of three appendices, with Pig-nosed Turtles listed in Appendix II of CITES since 2005. Species listed in Appendix II are not necessarily threatened with extinction but are at risk of becoming so unless trade is strictly regulated. In this manner, Pig-nosed Turtle specimens would only allowed to enter international trade under specific controlled circumstances, which are mediated by the granting of an export permit or re-export certificate issued by the CITES Management Authority of the exporting country. Such export permits may only be issued if the specimen was legally obtained and if the export will not be detrimental to the survival of the species. Indonesia became a Party to CITES in 1979, along with all other range countries of Pig-nosed Turtles, Australia and New Guinea (both since 1976), meaning that any trade in Pig-nosed Turtles should be internationally monitored and regulated. Parties are obliged to develop national legislation to effectively implement the obligations of the Convention including setting sustainable quotas for Appendix II species. Indonesia's legislation is considered adequate to regulate trade in wildlife (Category 1; CITES *CoP16 Doc. 28 Annex 2 (Rev. 1)*). Export of CITES II-listed species is only allowed for if it is not in violation of the country's national legislation. The protected status of Pig-nosed Turtles and prohibition of trade constitutes Indonesia's strict domestic measures to protect this species.

METHODS

Surveys were carried out in the Indonesian province of Papua in November and December 2010 to coincide with the middle of the Pig-nosed Turtle nesting season (September-February). The villages of Merauke, Kepi, Senggo, Agats and Timika were visited to gather data on the turtle trade (Fig. 2). Interviews were carried out in both English and Indonesian with wildlife collectors, local government agency officers (i.e., BKSDA) and reptile dealers. From these sources, information was obtained on the source of Pig-nosed Turtles, collection methods, levels of trade at the source and trade dynamics. Interviews were mostly conducted openly, although in some instances there was suspicion and hostility towards subtle interview questions; particularly in Senggo, which is considered a hub for illegal trade in other products, such as parrots, reptile skins and gaharu wood (Agarwood).

Websites were investigated as potential sources of turtle trade using search terms that included the various common/local names for Pig-nosed Turtle (i.e., Pig-nosed Turtle, Pig-nose Turtle, Pignosed Turtle, Pitted-shelled Turtle, Fly River Turtle, New Guinea Turtle, New Guinea Plateless Turtle (English); *Kura-kura Moncong Babi*, *Labi Labi Moncong Babi*, *Kura-kura Irian*, *MonBi* (Indonesian); *O Bifu Bu* (Asmat, Papua); *Piku*, *Ouo* (Pidgin English, PNG)). For each advertisement, data on specimen size, origin of turtle, location of seller and list price were recorded, if possible. Internet searches were opportunistic and confined to websites readily accessible to the public (i.e., unrestricted websites). Therefore, findings do not represent the entirety of website sales and are presented only to highlight the potential availability of Pig-nosed Turtles through online trade.

Seizure data were obtained from various sources including newspaper articles, government reports, non-government organizations (NGOs) and open sources, such as the Internet and other media. It is important to note that the seizure data compiled in this study was not intended to be an exhaustive list of cases involving Pig-nosed Turtles. Rather the information in this report was intended to highlight trade volumes, comment on enforcement efforts, raise further public awareness of Pig-nosed Turtle trade and recommend solutions to mitigate the illicit trade in Pig-nosed Turtles.

Local currency of Indonesian Rupiah (IDR) was converted into US Dollar (USD) equivalents using the exchange rate USD 1 = IDR 9000.

Figure 2
Map of Papua, Indonesia and Papua New Guinea border with major towns and cities.



RESULTS AND DISCUSSION

In Papua, the Pig-nosed Turtle inhabits the mangrove and freshwater swamps of rivers on the south-western lowland regions of the island of New Guinea (Fig. 1; Georges et al., 2008). The distribution of Pig-nosed Turtles covers the Papuan regencies of Merauke (Merauke City), Asmat (Agats), Mappi (Kepi), Boven Digoel (Tanah Merah), Mimika (Timika) and Dogiyai (Kigamani). In particular, the Asmat Regency of Papua has been a major source of turtle trade (Maturbongs, 1999; Arida and Ibarondo, 2007; Baibaba, 2012), with Pig-nosed Turtles found throughout the vast river systems of Vriendschap (Vrinskap), Eilanden, Brassa, Lorentz, Seketwa, Heron, Catalina and other tributaries in the region.

Pig-nosed Turtle trade in Papua mostly involves the collection and/or incubation of wild harvested eggs by locals living near breeding sites for sale to middlemen traders. This survey found that local Papuans seldom harvested Pig-nosed Turtles or their eggs for consumption, instead preferring to sell them for money or exchange them for goods from outside the village. The majority of eggs harvested in Papua were either sold directly to traders (who then transported the eggs to other Indonesian cities (e.g., Surabaya and Probolinggo in East Java) for incubation) or incubated within the collector's local village so that the hatchlings could be later sold to traders. Local Papuans typically did not target adult Pig-nosed Turtles, and usually only acquired larger turtles opportunistically as by-catch in their fishing nets (local fisherman, pers. comm., 2010). Only one Pig-nosed Turtle carapace and skull were recorded during this survey, and these items were observed hanging on the wall of a private residence in Senggo (see photo). The carapace was painted with bright yellow glossy paint, and the owners considered this piece merely as a decorative ornament for their home (R. Lilley, pers. obs., 2010). However, some take of adult Pig-nosed Turtles has been previously documented as part of subsistence hunting (Baibaba, 2012). A significant concern with harvesting adult turtles is that females are more heavily targeted than males, since females are exposed on sandbanks when laying their eggs during nesting seasons. In contrast, adult male turtles never leave the water, making them more difficult to hunt according to one trader. Such sex-biased harvesting of adult Pig-nosed Turtles has caused the sex ratio of some populations to be skewed towards males i.e., one female for every three males (Baibaba, 2012).



Photo credit: Ron Lilley

A single Pig-nosed Turtle carapace and skull was seen hanging on a wall in Senggo. The carapace was painted bright yellow with gloss paint. No other examples of this type of 'ornament' were seen anywhere else during the 2010 visit.

Pig-nosed Turtle eggs were collected for sale to locally-based immigrant traders (known as *'pendatang'*) who have settled in the region from outside Papua; some of these immigrant traders have lived in the area for more than 20 years. Non-Papuan immigrant traders were known to actively encourage local people to harvest eggs of wild Pig-nosed Turtle populations. Some traders even organised trips for local collectors to travel further upriver by negotiating to pay for boat fuel and deducting expenses for food and other provisions from final payments. Collecting trips to upstream Pig-nosed Turtle nesting areas could involve up to 30 boats with three personnel in each boat, according to one respondent in Kepi. In more remote villages higher upstream (e.g., Senggo), traders have resourcefully discovered that commodities such as shallow draft boats and basic five horsepower outboard motors (known locally as *'ketinting'*; considerably less expensive and more expendable than high-powered outboard motors known as 'Johnson') can be used as barter for acquiring Pig-nosed Turtles from village people. In particular, there was a high demand among villagers for *'ketinting'*; these basic motors are mounted on the side of the boat and have a long propeller shaft that can be easily raised during very shallow water crossings or when passing through dense, floating aquatic weed (such as Water Hyacinth *Eichhornia* spp.) that congests many of the waterways in Papua. Acquiring such commodities have enabled egg collectors from remote villages to travel much farther and/or more efficiently upriver than was previously possible by rowing and punting heavy traditional dugout canoes. The extent of egg collection was formerly (circa prior to 1996/97) limited by a lack of transportation to gain efficient access to remote collection sites. Local and immigrant traders have learned that by exchanging boats (including larger, faster boats) and fuel for turtle eggs, collectors will be provided with a means of reaching riverine areas that were previously inaccessible. Similarly, in Papua New Guinea, the provision of useful equipment, supplies and foodstuffs into remote villages have allowed the river systems to be passable to greater levels of exploitation of natural resources including turtles (Rose et al., 1982). These exchanges of commodities have significantly increased the potential for egg collection throughout Papua (R. Lilley, pers. obs., 2010). In the same manner, middlemen traders interested in purchasing Pig-nosed Turtles from villagers are also progressively travelling further upstream in larger, faster boats that enable them to reach more remote areas to source eggs and hatchlings. Thus, villages situated in remote tributaries of Papua are increasingly being encroached by trade opportunities and incentives to harvest wild resources, such as Pig-nosed Turtles. Evaluations suggest that the majority of profits were gained further along the trade chain (see **Prices**), with local communities in Papua receiving comparatively low, short-term benefits from egg harvesting.

'Uang RESPEK' (respect money)

During the period that this survey was conducted, many towns and villages were receiving monetary benefits distributed by the Indonesian government to promote the economic development of Papuan communities. Under this government programme, known as Rencana Strategis Pembangunan Kampung/RESPEK (or Strategic Village Development Plan), each village within the province of Papua receives a block grant of IDR 100 million (USD 11 111) to use within the community for development purposes. This provision of funds across Papua aims at improving the welfare of the Papuan people and facilitating community groups in developing a sustainable management of natural resources. At the time of this survey, a number of towns and villages in the Asmat region had not yet received their 'uang respek'. Without these funds, some villagers said they would remain dependent on the sale of turtles, gaharu wood (Agarwood), crocodile skins, and other wildlife products to make their living. Nonetheless, people interviewed held hope that once they received their share of 'uang respek', they would be less reliant on the sale of wildlife and other natural resources for income. This benefits programme was created in 2007, however the impacts upon Papuan communities and the management of natural resources in the region (including Pig-nosed Turtle harvesting pressures) are yet to be determined.

Egg collection

Egg collection occurs primarily in areas near riverside settlements; with collectors departing from their villages in search of nests along sandbanks of prominent rivers and tributaries, and then transporting the eggs by boat back to their villages. Main collection areas for Pig-nosed Turtles in Papua spanned the Vriendschap River in Asmat, including Buetkuar River near Vriendschap swamp and Kampung Waganu (BKSDA, 2010). Interviewed sources identified other vulnerable locations for Pig-nosed Turtles further east towards the Papua-PNG border (Fig. 2), including Torasi District, Mindiptana District, Geten Tiri, Tanah Merah, Asiki, the Digul River in Kau District, Waropko District, Ulilin, Bupul, Sota, Wanggo, Muting and Sungai Bian; all of which lie north or northwest of Merauke. Anecdotal reports from a trader also suggested female turtles may nest on beaches along the south Papuan coast, such as Pulau Kimaam and the Kurik district.

Local knowledge indicates that gravid female Pig-nosed Turtles emerge onto the sandbanks to lay their eggs late at night (estimated at between 10 pm and midnight). Therefore, collectors waited until the turtles have finished egg-laying before heading out early the following morning (3–4 am) to harvest the eggs. Buried nests were located by searching for fresh crawl tracks left by the nesting female and then probing the sand using long metal rods or knives. Egg harvests in Papua mostly occurred between mid-August and December (i.e., likely peak breeding period), with further incubation of eggs to produce hatchlings for sale requiring another 65 to 75 days (i.e., hatchling availability between mid-October and February). According to one Papuan trader, a gravid female Pig-nosed Turtle was considered to nest three times during a breeding season: the first clutch 25–30 eggs, the second clutch 15–17 eggs, and the third clutch only 5–7 eggs were laid. Similar seasonal patterns were also reported for female Pig-nosed Turtles in Australia, which produced two clutches within a season with a tendency to produce more eggs (i.e., 1 or 2 more eggs) in the first clutch (Doody *et al.*, 2003); notably, clutch size was smaller (10 ± 2 eggs, range 1–15 eggs) than reported by the Papuan trader. Taking advantage of collecting eggs from earlier nesting females (with a potentially greater clutch size) would increase the harvest per nest. Furthermore, Doody *et al.* (2003) also found that female turtles showed gregarious behaviour when nesting (with up to 16 females observed on one beach), and denser nest aggregations may increase the risk of exploitation by collectors. Harvesting pressure on Pig-nosed Turtle eggs is high, especially considering that: all eggs within a nest were collected; collection occurred throughout the nesting season; and there was a potential for all clutches laid by a breeding female to be harvested within a season (i.e., females are unmarked and collection is unregulated).

Although local village people undertook most of the egg collection in Papua, one respondent witnessed a helicopter landing on a remote sandbank during the nesting season in 2008. In this instance, several people got out of the helicopter to gather turtle eggs, a female turtle and “some rocks” – all of which were loaded onto the helicopter before departing. The respondent was mystified as to who these people were, and how they could afford to use a helicopter to collect turtle eggs (Anon., pers. comm., 2010). The use of highly sophisticated and expensive transportation to gain access to remote nesting habitats was likely motivated by the high demand and lucrative profits in Pig-nosed Turtle trade.



Photo credit: Ron Lilley

The Papuan swamps have hundreds of rivers meandering through dense forest (left). Pig-nosed Turtles lay their eggs on sandbanks on the inner bends of these rivers (right).

Eggs of Pig-nosed Turtles are collected in large numbers in Papua, and it has been estimated that 1.5 –2 million eggs were being collected each year in some regions (Samedi and Iskandar, 2000). Observations during the present survey indicate that quantities of harvested and/or incubated eggs are potentially even higher than previously estimated (R. Lilley, pers. obs., 2010). The high prevalence of eggs and hatchlings observed in villages visited and the testimonies of interviewed traders regarding volumes, suggest that increasing quantities of Pig-nosed Turtles are being taken from the wild every year in Papua (R. Lilley, pers. obs., 2010). This unreported and unregulated harvest of Pig-nosed Turtle nests is unsustainable (see Eisemberg *et al.*, 2011) and may not ensure recruitment in the population. After 12 years in the Pig-nosed Turtle business, one trader commented that he had not noticed a significant decline in turtle population numbers or supply, and believed that nesting turtles were still as numerous. In his opinion, the river systems were so vast and the sandbanks were so numerous that only a small proportion of the total numbers of eggs were being collected. He hoped that the Indonesian law would change so that he could get a license to legally collect eggs, hatch turtles and sell turtles (Anon., pers. comm., 2010). However, these reports are anecdotal, and the concern is that it will be a few decades before population declines are obvious in this long-lived species (see Moll and Moll, 2004; Browne and Hecnar, 2007; Eisemberg *et al.*, 2011).

Ranching

Ranching operations incubating Pig-nosed Turtle eggs harvested from the wild were frequently observed across Papua. Collected eggs were taken back to the village to be placed in large trays and layered with sand, with up to five layers deep. Although eggs are easier to transport than live turtles, traders claim they hatchlings can be sold for significantly higher prices than eggs. Such financial incentive has motivated many Papuan collectors and immigrant traders to incubate Pig-nosed Turtle eggs in ex situ hatcheries, which are typically located within villages near collection sites. During this survey, one village hatchery (owned by a non-Papuan immigrant trader) was observed to hold up to 5000 incubating eggs and a further 2000 hatchlings kept in small artificial ponds maintained in outhouses. The facility appeared to be well managed and orderly, with clean water in the tanks and no evidence of fungal infections or bite marks on captive hatchling turtles from aggressive conspecifics. The quality and source of the sand used in for ex-situ incubation is apparently critical to hatching success. Therefore, sand was taken from the nesting areas during egg collection and brought back to the villages to incubate the eggs; hatching success rate declined when sand from non-breeding areas was used. According to one trader, it was estimated that village traders successfully hatched between 7000–10 000 turtles from 10 000–12 000 eggs collected within a season, yielding a hatching success rate of approximately 70–80%. One informant reported that five local traders in the area were incubating 3000–5000 eggs each. It was estimated by another respondent that there could be 10 000–30 000 eggs in the village at any one time, and a total of 50 000–60 000 eggs collected every year in the area.



Photo credit: Ron Lilley

Turtle hatchery showing the boxes used for incubation (left) and thousands of eggs waiting to hatch (right). The eggs are in layers three to five deep.

Local traders are experienced in regulating hatchling emergence in ex-situ hatcheries, and they use this knowledge to make their business more efficient. When the incubating turtles are fully developed, they will stay inside the egg in hibernation until conditions are suitable for emergence (Doody et al., 2001). Hatching may be triggered when the eggs are flooded with water or by a sudden drop in air pressure signalling an approaching storm. Thus, traders wait until a firm purchase order for Pig-nosed Turtles is in place before they sprinkle water on the developed eggs, stimulating the turtles to hatch within a few hours. Using an environmental trigger to initiate hatching means that all the eggs hatch at the same time, which can help facilitate trade exchanges. For example, delaying hatching (for up to 50 days (Georges and Rose, 1993)) until the arrival of a buyer can save the seller husbandry costs to maintain the turtles (such as artificial pond space, feeding and cleaning). A more recent strategy used among local traders was to stagger sales of Pig-nosed Turtle over a period of time. That is, traders would sell a portion of the eggs immediately upon collection, incubate the remaining eggs for hatchling sales, and even to continue rearing a few hatchlings for longer periods until money was needed.

There was a growing awareness among local Papuans that the market demand for Pig-nosed Turtles is always high, even outside of the nesting season. Hatchlings kept for longer periods in captivity were mostly fed Water Spinach *Ipomoea aquatica*, known locally as 'kankung', which naturally grows along the riverbanks in Papua. Traders preferred not to keep Pig-nosed Turtles for too long in captivity before selling them because the turtles can become aggressive and inflict bite wounds on each other due to overcrowding. Maintaining frequent turnover reduces the risk of damage to turtles from conspecifics, infections or diseases from improper husbandry, and discovery of the hatchery by authorities. Some traders were aware that when incubating eggs and maintaining hatchlings there was a risk of being apprehended by enforcement authorities during the time it takes for the turtle eggs to hatch (~2 months). To avoid detection, hatcheries are well hidden within villages. Furthermore, traders were known to make payments to corrupt officials to prevent confiscation of eggs by authorities. Immigrant traders (middlemen) also encouraged Papuan villagers to hatch the eggs themselves and sell the resulting live hatchlings at higher asking prices, thereby allowing the middleman trader to potentially evade detection by authorities during the incubation phase (i.e., eggs remained in the possession of the local Papuan collector for longer).



Photo credit: Ron Lilley

Freshly watered eggs and a single egg to show size. Note the red pen mark on the top to indicate which way up it was laid.



Small containers in a hatchery containing about 50 hatchling turtles in each container.

Another significant problem in addressing trade issues in Papuan villages arises because many local people misunderstand the concept of ‘captive breeding’. Local people often believed that hatching eggs taken from the wild was considered as ‘captive breeding’ and lawful (R. Lilley, pers. obs., 2010; BKSDA, pers. comm., 2010). All of the ex-situ hatcheries observed during this survey were not legitimate captive breeding operations, since these hatcheries rely on wild harvested eggs to incubate hatchlings for commercial sale. Pig-nosed Turtles are protected from harvest under Indonesia law, and the act of taking eggs from the wild for rearing (known as ‘ranching’) is still considered illegal. None of the hatcheries observed in this study had permits authorised by BKSDA to conduct their ranching operations. Anecdotal information from interviewed sources indicated that a few traders in Papua were carrying out captive breeding of Pig-nosed Turtles under legal licence. Claims were made that at least three traders in Jakarta were also captive breeding Pig-nosed Turtles, and offering them for sale according to a permitting and quota system. However, further information on the full status of these captive breeding operations could not be verified.

The effectiveness and veracity of these operations needs to be investigated, to ensure that captive breeding or ranching operations are not providing a cover for wild-caught turtles to be laundered and sold as ‘captive bred’ (e.g., Nijman and Shepherd, 2009; Lyons and Natusch, 2011). To address this problem, several BKSDA staff in Agats and Merauke (Basra, pers. comm., 2010) voiced the need for a more “persuasive” rather than “repressive” approach. To this end, BKSDA Papua was proposing to develop community-based ‘captive breeding’ schemes that will produce legitimate second-generation offspring for trade (BKSDA Agats, pers. comm., 2010). In 2011, a trial project was set up in Agats, with two ponds stocked with adult Pig-nosed Turtles and maintained by the local community. However, the project failed owing to deficient conditions to promote breeding, such as inadequate space, poor water circulation, insufficient food, and even mortalities of adult turtles after several months (Wibisono, in litt., 2012). A lack of funds and husbandry experience may have severely hampered this trial project. Moreover, there is serious concern that many breeding farms in Indonesia are being used to launder illegally caught wildlife under the guise of being captive-bred (Auliya, 2003; Nijman and Shepherd, 2009; Lyons and Natusch, 2011). According to the CITES Trade Database (WCMC), Indonesia has only ever legally exported one shipment of 57 Pig-nosed Turtles for the purpose of trade in 2006 to the US. Thus, it is suspected that illegal smuggling is an easier and cost-cutting option, and therefore the preferred route for traders (see **Seizures**).



Photo credit: Ron Lilley

Larger partly covered ponds in a hatchery containing 1000 hatchlings.

Trade dynamics within Papua

The large-scale trade of Pig-nosed Turtle eggs in Papua was considered to have escalated since 1996, according to a former trader from Jinak, Asmat. Field survey and interview results by Maturbongs (1999) also suggested that egg collection expanded significantly in the Vriendschap River region from 1997. This expansion of Pig-nosed Turtle trade was thought to be due to an influx of traders from outside Papua, particularly traders originating from Toraja and Ujung Pandang in Sulawesi. By 2000, turtle eggs were being transported in significant numbers on ships bound for Surabaya or Jakarta, with an estimated 800 eggs per bucket and up to 22 buckets on board i.e., a total of 17 600 eggs in one shipment (Anon., pers. comm., 2010). In the past, eggs were transported in buckets, with up to five layers of eggs separated by layers of sand. However, large drum containers are now preferred when transporting eggs and/or hatchling turtles by ship, because the drums are more durable over longer distances and are capable of holding greater volumes of specimens as well as allowing for other products to be added to disguise the presence of eggs or turtles. Traders preferred not to box more than 5000 eggs together in a single container, because of higher egg mortalities associated with transportation in large containers. Hatchling turtles transported on boats were packed into boxes, with each box containing large numbers of individual turtles; hatchlings were thought by traders to be able to survive inside these dense boxes for up to a week (see **Survivorship and Repatriation**).

Pig-nosed Turtles were smuggled from remote villages via motorboat or small airplanes to more centralised locations in Papua for domestic and international export. These trade hubs were typically situated on the south coast of Papua, including Agats, Merauke and Timika as well as Jayapura in the north. In particular, traders from Merauke and Timika often travel upriver by motorboat purchasing eggs and/or hatchlings from remote villages. Pig-nosed Turtles have been smuggled out of Papua via several routes, including from the villages of Kimaam, Jinak, Binam and Senggo via Agats and Atsi near the coast, and predominantly via Timika, Merauke, and Jayapura out of Papua, and on to Surabaya in Java and several other cities in Indonesia (Arida and Ibarondo, 2007). The ports of Fakfak in the west and Kaimana on the south coast of West Papua may also be potential export locations for smuggled turtles. Four major trade hubs (Agats, Merauke, Timika and Jayapura) and their potential export facilities for smuggling Pig-nosed Turtle shipments are discussed:



Photo credit: Ron Lilley

Trading vessels such as this can make their way upriver from the coast as far as Senggo.

Agats

Due to extraordinary tides and location, the coastal town of Agats is built on wooden posts and raised walkways in case of river flooding that can inundate the entire area. It is a known major trade hub and transit point for many commodities, including turtles. Enforcement raids have recently occurred on several vessels transiting through Agats. As a result, traders indicated that the transfer of turtles and other contraband between vessels now takes place further east upstream of Agats in the vast river delta, particularly around the town of Atsi/Atsj. Here, the river splits into numerous smaller tributaries intersected by islands making it easy to become disorientated and hide in the extensive mangrove forests, which can be used to tactically evade patrol vessels (Anon., pers. comm., 2010).

In the past, the main trade route involved collectors transporting Pig-nosed Turtle eggs and hatchlings downstream from the Vriendschap tributaries to Agats, where consignments were transferred at the dock to larger export vessels (e.g., timber trade vessels). However, traders now prefer not to stop in Agats because there is a higher risk of vessels being inspected by authorities. Instead, medium-sized transport vessels (< 10 tonnes) are now travelling further upriver to reach villages towards the pier at Binam in Suator District, which is as far inland as large boats can travel. Vessels are restricted to less than 10 tonnes in size because such vessels only require a permit issued by the kabupaten (i.e., regency or municipality) Office of Transport; whereas, vessels over 10 tonnes require a permit from the Provincial Office of Transport, which is likely to be more thoroughly scrutinised. A district license granted to vessels less than 10 tonne allows them to carry goods to Timika or Agats, and authorities are considered to be largely unconcerned about what medium-sized vessels are transporting (Anon., pers. comm., 2010). Once loaded, these vessels then return downriver to convene offshore with larger seagoing ships that export the turtles out of Papua, bypassing Agats.

Furthermore, 30 minutes travel by motorboat away to the west of Agats is the airstrip at Ewer, which can accommodate small utility aircraft. Flights arriving and departing Ewer are typically irregular and dependent on weather conditions, but nonetheless, chartered aircraft can be used to gain access to swamps inland (e.g., Timika). A lack of security at these local airports means that quantities of turtles could be smuggled undetected by authorities (R. Lilley, pers. obs., 2010).



Photo credit: Ron Lilley

Transfers of goods take place between smaller and larger (seagoing) vessels like these around Agats.

Merauke

Merauke is a fairly prosperous city, renowned as the most eastern settlement in Indonesia. Situated near the PNG border and possessing both an airport and a seaport, Merauke is an important trade hub for wild fauna and flora (Rhodin and Genorupa, 2000), including cross-border trade of Pig-nosed Turtles. Villagers living close to the southern PNG-Papua border have been reported to stockpile Pig-nosed Turtles for trade along the coast with traders from Merauke (Rhodin and Genorupa, 2000). Pig-nosed Turtles are caught in the north or northwest of Merauke in the districts of Torasi, Mindiptana, Geten Tiri, Tanah Merah, Asiki, the Digul River in Kau district, Waropko, Ulilin, Bupul, Sota, Wanggo, Muting and Sungai Bian. At least five wildlife traders were known to operate legitimate operations in Merauke (Anon., pers. comm., 2010), which received animals from inland sources along the Maro River. One dealer was attempting to hatch and rear freshwater turtles, such as long-necked turtles *Chelodina* spp. and short-necked turtles *Emydura* spp., at a small-scale hatchery equipped with only basic facilities that were not ideal for incubating eggs (R. Lilley, pers. obs., 2010). Attempts to incubate Pig-nosed Turtles were not observed in Merauke during this survey, although all traders interviewed expressed an interest to do so if given the necessary technical skills and support.

Flights frequently depart from Merauke airport bound for the capital city of Jayapura and other Papuan towns in the west, including Biak, Manokwari and Sorong (a major export point for wildlife). According to traders, flights from Merauke via Jayapura to Ujung Pandang (Sulawesi) are a known trade route for smuggling turtles out of Papua.

Amamapare and Timika

Amamapare is a port town and an important industrial centre in Papua, particularly for international mining companies. From nearby mines, copper-gold concentrate is delivered directly via pipelines into Amamapare, where the concentrate is processed and shipped to smelters around the world. Further vessels also dock in at Amamapare en route westwards from Merauke and Agats, making this town a significant trading location. Several Pig-nosed Turtle seizures have been made in Amamapare. Approximately one hour inland from Amamapare is the town of Timika, which lies 60 km south of Tembagapura and the largest copper and gold mine in Papua. Reportedly, Timika airport has been used by traders to smuggle Pig-nosed Turtles (Anon., pers. comm., 2010).

Jayapura

Jayapura is located on the northern coast of Papua close to the Papua-PNG border. As the capital city of Papua Province, Jayapura is a significant trade hub for many goods including wildlife. One respondent during this survey reported a company in Jayapura that purchased hatchling Pig-nosed Turtles for drying and then grinding into a powder for export to China, and resale in the traditional medicine trade. Importantly, the illegal export of powdered turtles could potentially be harder to detect by enforcement authorities than smuggled eggs or live turtles. The city is serviced by Port Jayapura, which has harbour facilities to hold large merchant vessels, and by Sentani airport, which has domestic commercial and private flights departing frequently. Increasingly, more independent aircraft companies have been expanding their flight paths to service remote southern Papua (e.g., Sawa Erma) from Jayapura, such that these air routes may allow turtle shipments to be flown directly north rather than being shipped downriver to southern coastal ports.

Export out of Papua

From Papua Province, it is likely that most turtles are smuggled to western Indonesia using cargo ships, as well as aircraft and passenger ferries. According to informants, major domestic destinations for Pig-nosed Turtle eggs and hatchlings from Papua, include Jakarta, Surabaya and Probolinggo in Java, Makassar (Ujung Pandang) in south Sulawesi, and Denpasar in Bali. It is probable that these destinations act as temporary transit points for eggs to allow them to hatch and grow before re-exporting the hatchlings further along the trade chain. From these cities, Pig-nosed Turtles are then smuggled internationally to Malaysia, Singapore, Thailand, mainland China and Hong Kong.

Undoubtedly, Jakarta remains the major hub in Indonesia for illegal trade in wildlife, particularly for threatened freshwater turtles species in the pet trade (Shepherd and Nijman, 2007; Stengel *et al.*, 2011). Pig-nosed Turtles have been commonly observed for sale in Jakarta, with live specimens selling for USD 18–104 (Shepherd and Nijman, 2007; Stengel *et al.*, 2011). However, most Pig-nosed Turtles smuggled from Papua to Jakarta, and other cities in western Indonesia, were not sold domestically, but smuggled to other international destinations. In particular, Bangkok, Thailand is known to be a significant hub for the sale of freshwater turtle species, many of which are prohibited from trade. Buyers from other parts of Asia, especially Japan, Malaysia and Singapore, are known to purchase large numbers of turtles (including Pig-nosed Turtles) from dealers in Bangkok to supply the demand for live pets (Shepherd and Nijman, 2008).

Reportedly, a prominent trade route involved transporting Pig-nosed Turtle eggs and hatchling by cargo ship or public ferry from Merauke or Timika via Surabaya (Java) to Batam Island in the Singapore Strait. Batam Island in western Indonesia is only a short boat trip (45 min) from Singapore, and serves as a key transit point for boats and small aircraft travelling from Indonesia to Singapore or Malaysia. Commuters from Singapore and Malaysia seemingly pass unhindered through Customs in Batam, which presents little difficulty in transporting illegal wildlife products (e.g., marine turtle eggs in hand luggage) (R. Lilley, pers. obs., 2009). Consignments smuggled internationally from Batam Island in Indonesia into Singapore or further into Malaysia were then able to be re-exported from Singapore or Malaysia to mainland China and Hong Kong. More direct routes of international exportation from Papua were possible; for example, a respondent reported that turtles were occasionally smuggled from Papuan coastal towns on commercial Korean cargo ships transporting timber.

Local traders interviewed in Papua during this survey were of the opinion that the majority of eggs and hatchlings from Indonesia were being exported mainly to China, Japan and Singapore. Several international markets for Pig-nosed Turtles have been reported (see **Seizures**), including pet trade in Europe (Auliya, 2003), United States (Goh and O’Riordan, 2007), Japan (Kameoka and Kiyono, 2005; TRAFFIC, 2005; Ishihara *et al.*, 2010), Singapore (Goh and O’Riordan, 2007), Malaysia (Sharma and Tsien, 2000; van Dijk, *in litt.* to U.S. Fish and Wildlife Service, 2001), Thailand (Nijman and Shepherd, 2007; Shepherd and Nijman, 2008), mainland China, Taiwan and Hong Kong (Gong *et al.*, 2009), as well as food and medicinal markets in mainland China and Hong Kong (Lau *et al.*, 2000; Cheung *et al.*, 2006; Cheung and Dudgeon, 2006; Gong *et al.*, 2006).

Photo credit: Ron Lilley



Young Pig-nosed Turtles for sale in a Jakarta animal market.

Prices

Papuan villagers exchanged their harvests of Pig-nosed Turtle eggs and incubated hatchlings for money as well as commodities, including sugar, coffee, rice, instant noodles, cigarettes, fuel, boating parts. With no roads and few airstrips, most villages in Papua rely on river transportation for the supply and trade goods (including Pig-nosed Turtles), which significantly increases the value of commodities due to fuel expenses to power engines upriver.

At the collection source, eggs were sold for IDR 1000–5000 (USD 0.11–0.56) each to traders within the village. Eggs were also bartered for various supplies provided by outside traders, such as instant noodles, kitchen utensils, gardening tools, tobacco and even outboard motors. Papuan communities are accustomed to barter trade (since a monetary economy has only been recently introduced), such that outside traders offering a vast array of commodities to remote locations were presented with willing dealers among local villagers (R. Lilley, pers. obs., 2010). In the past, local Papuan collectors were often paid a per diem rate for their labour rather than being paid per egg collected. Local traders employed villagers for IDR 10 000 (USD 1.11) per day to carry out the labour of harvesting Pig-nosed Turtle eggs on organised collection trips. However, deducted from this wage was IDR 6000 (USD 0.67) for two meals, IDR 1000 (USD 0.11) for coffee and IDR 2000 (USD 0.22) for cigarettes each day, leaving a net income of IDR 1000 (USD 0.11) per day (Maturbongs, 1999).

Hatchlings of Pig-nosed Turtles were generally sold in villages, near where the eggs were collected, for IDR 5000–12 000 (USD 0.56–1.33). One bulk consignment of 10 000 hatchlings was reportedly sold in a village, with each turtle costing IDR 15 000 (USD 1.67) equating to a total deal worth IDR 150 million (USD 16 667). The price paid for eggs and hatchling turtles in locations upriver near collection sources were often similar, despite the difference in effort between collecting unhatched eggs and incubating successful hatchlings. However, traders were often reluctant to pay higher prices for hatchlings in remote villages because of mortality risks during transport down river. Eggs of Pig-nosed Turtles were considered to be hardier than hatchlings in surviving the long, arduous journey from remote Papuan villages to markets in Java and elsewhere.

Traders purchasing hatchlings from village sources act as middlemen, and the hatchlings are resold for IDR 30 000–35 000 (USD 3.33–3.89) each (i.e., at least 150% mark-up in price from village purchases). According to one respondent in the Asmat region, the price of hatchling Pig-nosed Turtles within Indonesian markets has substantially increased over the last few years, i.e., IDR 25 000 (USD 2.78) per hatchling in 2010, IDR 30 000–35 000 (USD 3.33–3.89) per hatchling in 2011, and up to IDR 50 000 (USD 5.56) per hatchling in 2012 (Wibisono, pers. comm., 2012). Profits in selling Pig-nosed Turtle hatchlings were found to exponentially increase further along the trade chain. For example, traders in Surabaya, Jakarta and Bandung (wildlife trade hubs in Java, Indonesia) were paying IDR 50 000–75 000 per hatchling (USD 5.56–8.33) and then reportedly re-selling their purchased stock within Indonesia for IDR 100 000–200 000 (USD 11–22) (BKSDA Merauke, pers. comm., 2010), suggesting further another substantial >100% mark-up of price between middlemen. Internationally, Pig-nosed Turtle hatchlings were reportedly sold to customers for as much as IDR 350 000–500 000 (USD 39–56) each (i.e., at least 2800% price mark-up from hatchling bought from a village trader), with markets in Singapore (via Batam) and mainland China typically paying IDR 250 000–350 000 (USD 28–39) per hatchling (BKSDA Merauke, pers. comm., 2010). Increasingly higher profits along the trade chain are undoubtedly driving the trade of Pig-nosed Turtles, with significant financial incentives for income-poor egg collectors in source locations through to lucrative dealers selling turtles in international markets.

In summary, Papuan villagers receive a very minor proportion of the final sale value of Pig-nosed Turtles, despite the relatively high price and demand for this species in the international pet trade. Nonetheless, local Papuans have realized that the natural resources around them are of value to outsiders and that engaging in trade exchanges can supplement their livelihoods. The result of these incentives is that what previously was opportunistic hunting for a daily need in Papuan villages has turned into large-scale extraction of resources.

‘Glass Turtles’

A high demand for albino and leucistic Pig-nosed Turtles (known as ‘*monbi leucistic*’ in the Indonesian trade) was recorded during this survey. These rare individuals have inherited a genetic combination that causes a reduction or lack of pigmentation. Albino and leucistic Pig-nosed Turtles appear ‘glass-like’, and their desirability among collectors commands significantly higher prices than normal pigmented individuals. For example, a ‘glass’ Pig-nosed Turtle can sell for IDR 200 000 (USD 22; cf. USD 0.56–1.33 per normal hatchling) per hatchling in source villages in Papua. One village trader reportedly hatched five albino turtles from 6000 eggs in 2007, such that these genetically unique individuals are extremely rare. He sold each albino turtle for IDR 25 000 (USD 2.78; i.e., twice the price of a normal hatchling), but in retrospect, he realized that he could have sold them for many times that price (i.e., > 15 times higher in price). The value of ‘glass’ Pig-nosed Turtles has encouraged some local traders to incubate more eggs with the hope of improving their likelihood of hatching an albino or leucistic individual (R. Lilley, pers. obs., 2010). One trader estimated a probability of getting one ‘glass’ turtle out of 5000 successfully hatched individuals. However, one nesting site near Senggo in Mapi Regency was believed by traders to have a greater prevalence of albino or leucistic Pig-nosed Turtle hatchlings than other areas. As a result, foreign buyers (typically Chinese nationals) were said to target this location every year to purchase eggs collected from this genetic population, with the hope of hatching a ‘glass’ turtle (Anon., pers. comm., 2010). Turtle traders in Papua have been told by foreign buyers that ‘glass’ turtles are especially ‘lucky’ for owners, and that these turtles are also perceived to have medicinal properties or magical powers. The inflated market price of ‘glass’ turtles compared to genetically normal individuals appears to be another influential factor driving the trade by motivating villagers to collect and incubate excessive volumes of eggs to chance hatching a profitable rare mutation.

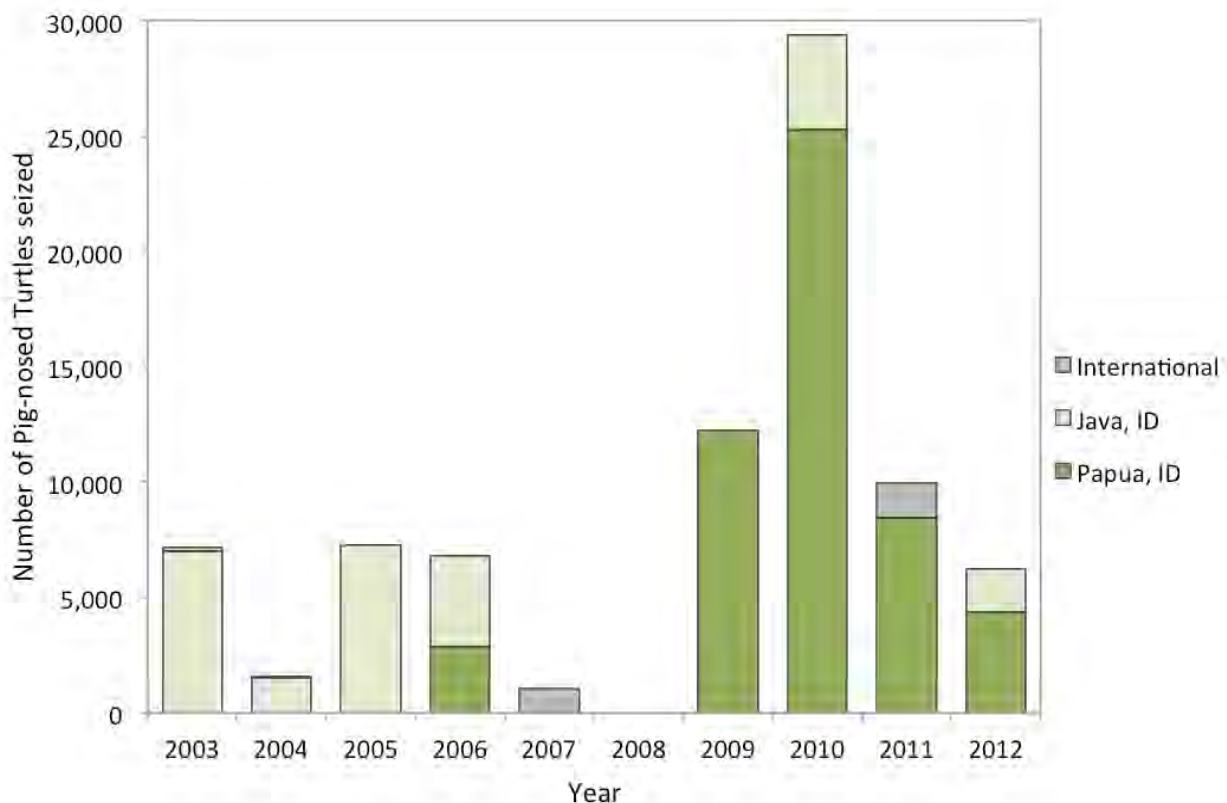
Internet sales

Live Pig-nosed Turtles were available for sale through numerous websites, with 17 cases recorded in this study spanning 2001–2012. Online sellers were located in Indonesia (11 cases; including Jakarta and Yogyakarta in Java, Bangka-Belitung Islands off Sumatra, Palu in Sulawesi) as well as internationally (three cases from US and three cases from UK). Turtles were sold in all sizes from hatchlings to adult specimens, which included some specimens being sold as pets that were no longer wanted by the owner. Prices varied considerably from USD 6 and up to USD 900 for a single Pig-nosed Turtle, with specimen size and/or age, seller’s location (i.e., Indonesia cf. non-range country) and motives for selling (i.e., pet owner cf. commercial seller) likely to influence the asking price. Turtles were sold through online auction sites, specialist sites for reptile or pet enthusiasts, and forums. Details provided on website advertisements indicated that much of the Pig-nosed Turtle trade online is driven by the international pet market. Online trading marks a major shift in the way wildlife dealers are promoting the sale of Pig-nosed Turtles within Indonesia as well as abroad. Internet sales are likely to make it easier for sellers and buyers of live wild Pig-nosed Turtles (and potentially their derivatives) to contact each other, further globalising and facilitating illegal trade in wildlife.

Seizures

Thirty-two cases involving the seizure of Pig-nosed Turtles worldwide were compiled in this study, with these cases reporting more than 81 689 individual turtles in the illegal trade over the decade (Fig. 3). Most of the seized Pig-nosed Turtle trade (65% of seized trade volume) was apprehended within Papua Province, with this high volume of trade totalling 53 273 turtles from just 12 cases (4439 ± 4734 turtles per seizure case). Throughout Java another 25 685 turtles were reportedly confiscated in 13 seizures (2140 ± 2583 per seizure case), which were mostly apprehended in Jakarta, Surabaya and Yogyakarta. Outside of Indonesia, another 2731 turtles were found in seven shipments (546 ± 430 per seizure case) apprehended in overseas countries, most of which reported Indonesia as the source country of Pig-nosed Turtles (see details below). Importantly, these seizures represent only a fraction of actual trade in Pig-nosed Turtle, since much of the trade occurs unreported and undetected. Nonetheless, available seizure data clearly shows that Pig-nosed Turtles were being traded in extremely large quantities, with consignments averaging 2817 ± 3701 turtles per shipment. Further highlighting the enormity of this illegal trade was one seizure occurring in Timika, Papua in 2009, which rescued 12 247 Pig-nosed Turtles (more than four times higher than average seizure numbers) bound for Jakarta.

Figure 3
Number of Pig-nosed Turtles seized from 32 cases of illegal trade within Indonesia and abroad (2003-2012). Note: seizure and trade volumes compiled here are unlikely to be exhaustive.

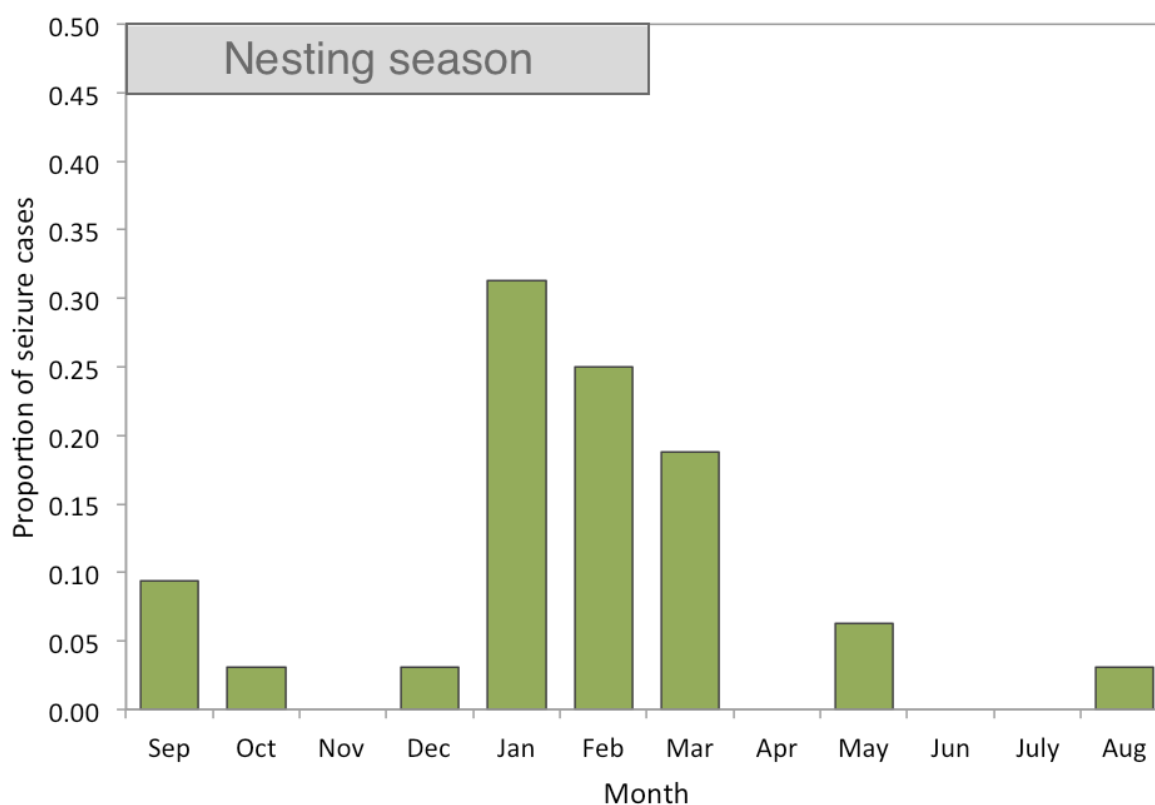


From the cases compiled in this study, most seizures (75%) occurred early in the calendar year (i.e., between January–March) towards the end of the nesting season for Pig-nosed Turtles in Indonesia (Fig. 4). Similarly, all reported seizures in this study involved hatchling or young turtles rather than eggs, suggesting that the trade was mostly intercepted once eggs were hatched and transported out of local villages. The locations of seizures showed that enforcement of Pig-nosed Turtle trade focused on transit or export points in Papua (i.e., away from the collection source) and Java, Indonesia (i.e., significant wildlife hub and with infrastructure for overseas export). In Papua, most seizures of Pig-nosed Turtles were conducted by BKSDA and police at key transit points in Merauke, such as Mopah Airport (at least seven cases, totalling 8251 hatchlings) and the seaport (one case involving about 12 000 hatchlings).

Four seizure cases, totalling 33 022 Pig-nosed Turtle hatchlings, occurred in the town of Timika but no specific location details were reported except for one case that seized 10 914 hatchlings from a private residence. Further along the trade chain, shipments of Pig-nosed Turtles were seized by Indonesian Customs and Excise officers, Quarantine officers and/or BKDSA officers at Soekarno-Hatta International Airport in Jakarta (at least nine cases, totalling 9528 hatchlings), Juanda International Airport in Surabaya (at least one case involving 1882 hatchlings), Tanjung Perak Port in Surabaya (at least two cases, totalling 14 275 hatchlings) and Adisucipto International Airport in Yogyakarta (one case of unreported quantity). Certainly, Papuan and Indonesian authorities have made efforts to combat the illegal trade of Pig-nosed Turtles in Indonesia. However, these confiscations are likely to represent only a fraction of the trade; especially considering the volumes of turtles being smuggled and that on average only three successful seizures of Pig-nosed Turtle reportedly occur each year in Indonesia.

Fewer reported seizures of Pig-nosed Turtles occurred outside of Indonesia. Attempted imports of Pig-nosed Turtle shipments were successfully seized by Customs and/or wildlife protection officials in the United States (four cases), Hong Kong (two cases) and Thailand (one case). Most international seizures were intercepted in airports as the perpetrator smuggling the turtles inside personal luggage and resourcefully concealing them to avoid detection, e.g., hidden in household items or produce boxes. In other cases, Thai authorities successfully detected a suitcase containing 1043 Pig-nosed Turtle on a public bus bound for Bangkok. Two cases containing ten and 193 Pig-nosed Turtles sent via postal mail were detected in the United States. International countries highlighted as destinations for Pig-nosed Turtle consignments, included Thailand (three cases, totalling 16 151 turtles), Taiwan (two cases, totalling 15 108 turtles), Hong Kong (three cases, totalling 4859 turtles), Japan (four cases, totalling 1516 turtles), mainland China (one case of 700 turtles), Republic of Korea (one case of 717 turtles) and United States (four cases, totalling more than 203 turtles). Unfortunately, the detection rate for international illegal trade of Pig-nosed Turtle, as a CITES Appendix II-listed species, remains very low. No import permit is necessary for species under Appendix II (although some countries have taken stricter measures than required by CITES), and thus detection of illegal Pig-nosed Turtle trade needs to be effective at the point of export.

Figure 4
Proportion of compiled seizures of Pig-nosed Turtles reported in each month of the year, relative to the nesting season (September–February)



Survivorship and repatriation

During the course of smuggling operations the mortality rate of Pig-nosed Turtles was high, with seizure cases finding that on average $18 \pm 5\%$ of turtles packaged in a shipment died during transit. When a shipment of Pig-nosed Turtle is successfully apprehended, any turtles found alive by authorities are placed in temporary holding facilities or rescue centres - including the Indonesian Wildlife Rescue Centre Network (*Pusat Penyelamatan Satwa* (PPS)), Tegal Alur Wild Animal Rescue Center, Cikananga Wildlife Center, Yogyakarta Animal Protection Center, Surabaya Zoo, Prigen Safari Park and PT Freeport Indonesia (a mining company in Papua that has developed an endemic wildlife repatriation program) in Indonesia, as well as Kadoorie Farm and Botanic Garden in Hong Kong. These husbandry facilities are faced with significant challenges to accommodate and care for confiscated Pig-nosed Turtles due to the exceptionally large number of turtles seized in a single shipment (i.e., on average 2817 individuals). Thus providing appropriate care, including available holding facilities, provision of food, adequate space, and prevention of disease, can be especially problematic for Pig-nosed Turtles seized from trade.

After a rehabilitation period (varying from months to years), surviving turtles from trade confiscations are often released back into the wild in Papua. This is known as repatriation, the intentional release of individuals of a species into an area formally or currently occupied by that species. For example, 7000 Pig-nosed Turtles retrieved from trade were repatriated into their habitat in rivers in Timika; 3000 in Omawita and Fanamo, Mimika; 2861 in Lorentz National Park, Mimika; and 516 in Mawati River, Papua in 2006. Nearly 11 000 turtles were released in the Otakwa River, Lorentz National Park, Mimika in 2009; 12 000 and another 2000 turtles were released in the Kali Wanggo tributary, Maro River, north of Meruake; and some 11 000 turtles were released in the Wania River in Papua in 2010. The release of confiscated Pig-nosed Turtles back into the wild was generally conducted by local government BKSDA officials and Indonesian Customs, often with further financial and in-kind assistance provided by mining industries in Papua (BKSDA Merauke pers. comm., 2010). The financial costs associated with maintaining, translocating and reintroducing seized Pig-nosed Turtles back into the wild are substantial, particularly for cases where the animals have been seized outside of Papua and/or large numbers of turtles are involved. With the increasing occurrence of Pig-nosed Turtle repatriation, it is recommended that protocols for quarantine, screening procedures and treatment of turtles be followed to ensure a viable, free-ranging population (see IUCN, 1998). In this manner, release programmes should be organised in consultation with a range of experts and stakeholders, including government personnel, management agencies, non-government organisations, universities, veterinary institutions, zoos and funding bodies. Furthermore, repatriations also provide an opportunity for tagging individual turtles and conducting scientific research to better understand the biology of Pig-nosed Turtle populations.



Photo credit: Kadoorie Farm & Botanic Garden

Kadoorie Farm and Botanic Garden holding a shipment of seized baby Pig-nosed Turtles (left) before packing them for repatriation back to Papua province, Indonesia (right) in 2014.

Undoubtedly, a coordinated management system needs to be enacted to deal with the large number of confiscated turtles in Indonesia. As enforcement efforts towards Pig-nosed Turtle trade continue to improve, it is predicted that tens of thousands of turtles seized by authorities may need to be temporarily held in rescue centres and holding facilities. Confiscation is not enough and ultimately, adequate husbandry facilities are needed to be able to care for high volumes of live turtles. The establishment of a holding facility for confiscated Pig-nosed Turtles in Papua should be considered. Such a facility could advocate for Pig-nosed Turtle conservation and build public awareness among local communities, as well as assisting further scientific research of this species.



Photo credit: Kadoorie Farm & Botanic Garden

Local community in Bupul Village, Indonesian Papua joining the release of Pig-nosed Turtles in 2011.

CONCLUSION

The principal threat to Pig-nosed Turtles in Papua is an illegal export trade, with many local people in the Asmat region, and throughout the tributaries of southern Papua, engaging in the collection and/or incubation of eggs from the wild for sale to immigrant traders who then re-sell and/or export the turtles outside of Papua. This study found that local people in Papua increasingly regard the harvest of Pig-nosed Turtle eggs from the wild as an income-generating activity. In the past, collection of this species by Papuan people was primarily for subsistence food or from incidental by-catch. However since the late 1990s (Maturbongs, 1999), there has been a large-scale harvest and trade of Pig-nosed Turtles in Papua for global markets, despite laws in place protecting the species. Immigrant traders are increasingly influencing Papuan people that live in remote riverside villages, by promoting and offering financial or barter exchanges for Pig-nosed Turtles. Therefore, when trade-driven opportunities (i.e., high international demand for Pig-nosed Turtles) are presented to rural communities, the primacy of people's immediate livelihood override conservation concerns.

This report highlights that various factors have interplayed to contribute to the intensified harvest of Pig-nosed Turtles in Papua:

- Increasing demand for Pig-nosed Turtles in global markets of pet, food and medicinal trade;
- Shifting emphasis from a subsistence economy to a cash economy in Papua;
- Presence of middlemen traders (typically Javanese transmigrants) in rural communities, who actively encourage local people to harvest turtles from the wild (e.g., providing financial incentives, organising collection trips);
- Papuan people succumbing to mounting pressures to take advantage of revenue opportunities afforded by turtle trade;
- Increased access to Pig-nosed Turtle habitats and trade routes, through improved transportation (e.g., motorboats, fuel, supplies) and infrastructure (e.g., port development, airports).

It was impossible to quantify what percentage of turtle trade was observed in rural Papuan villages or represented in seizure cases apprehended by authorities in this study. Nonetheless, this study reports that Pig-nosed Turtles are being collected in extremely large numbers from Indonesia to supply international markets, and that this trade continues mostly unabated at source locations (e.g., Vriendschap River system in Asmat region), trade hubs (e.g., Agats, Merauke, Amamapare, Timika, Jayapura), export (e.g., Jakarta, Surabaya) and import points (e.g., Singapore, Malaysia, Thailand, mainland China, Hong Kong, Taiwan, Japan). Organised syndicates throughout Indonesia are amassing large numbers of Pig-nosed Turtle hatchlings from remote source locations with the intent to smuggle them overseas for sale on illegal markets. The continuing international demand for Pig-nosed Turtles and increasing incentives for Papuan people to harvest this natural resource are threatening wild populations of this species in Papua, Indonesia. Ultimately, Pig-nosed Turtles are protected under Indonesian law and listed under CITES (since 2005), and a greater enforcement effort to combat this high volume illegal trade in Papua is required. Without mitigation of the high demands of consumer nations, efforts towards community outreach in rural Papua and adequate enforcement and protection by Indonesian authorities, illegal over-exploitation will continue to be a serious threat to this unique species, the Pig-nosed Turtle.

RECOMMENDATIONS

- **Protected status:** Indonesia's national laws are sufficient to protect Pig-nosed Turtle populations, however the implementation and enforcement of these laws are currently not effective. Authorities in Indonesia (BKSDA, PHKA, quarantine, Customs personnel and police) should be alerted to the continuing illegal trade of Pig-nosed Turtles from Papua Province. Traders found with Pig-nosed Turtles must be prosecuted to the full extent of the law by Indonesian authorities.
- **Community involvement and awareness:** Community education and awareness programs should be initiated to engage local Papuan people in the protection of Pig-nosed Turtles, and such campaigns should be supported by BKSDA and PHKA, in collaboration with relevant NGOs. It is fundamental that local communities throughout the province of Papua are not only made aware of the protected status of Pig-nosed Turtles and the risk of over-exploitation, but that communities become actively engaged in conserving remaining local populations. Importantly, socioeconomic issues need to be further assessed in rural Papuan communities to confront the escalating pressure to use natural resources for income. A dedicated investigation should be conducted examining viable solutions for generating alternative income opportunities for local Papuans in remote villages. Such outreach initiatives should be promoted among policy-makers for economic/social development in Papua and any international development agencies focusing on this region of Indonesia.
- **Enforcement of national legislation:** No specimen of Pig-nosed Turtle should be harvested and/or traded without permits in Indonesia, and offenders should be charged and prosecuted in full accordance with the law. Enforcement efforts should be especially increased at the source of collections (i.e., targeting middlemen dealers operating in rural Papuan communities), as well as at points of exit along the trade chain, such as Indonesian domestic ports and/or airports - Agats, Merauke, Timika and Jayapura (in Papua Province), plus Jakarta and Surabaya (Java), are known ports of export for a high frequency and volume of illegally traded Pig-nosed Turtles. These ports should receive priority attention from enforcement officials, such that shipments transiting through these locations should be rigorously inspected by BKSDA, Customs, port authorities, quarantine officers and police.
- **International trade:** The CITES Management Authority of Indonesia (PHKA) should enforce national legislation prohibiting the export of Pig-nosed Turtles. Inspectors in key countries and territories, including Singapore, Malaysia, Thailand, mainland China and Hong Kong, should be vigilant for Pig-nosed Turtles (a very distinctive turtle species, unlikely to cause identification problems in enforcement) being smuggled amongst other cargo, e.g., timber trade. Increased vigilance on the part of Indonesian and international Customs and quarantine officers is necessary to intensify checks at transit points, and these inspections should be especially attentive between January–March when new hatchlings are increasingly trafficked.
- **Capacity building:** Awareness campaigns on Pig-nosed Turtle trade need to be conducted and skills to enforce the laws should be strengthened for all concerned agencies (PHKA, BKSDA, quarantine, Customs, airport and seaport cargo personnel, police). Enforcement officers should be continually trained in species identification, conservation status of species, CITES regulations and the management of CITES Appendix II listed species through the efforts of inter-agency cooperation involving CITES authorities, NGOs and academia. Identification material (including turtle identification guide translated in multiple languages are available at that following link <http://www.traffic.org/home/2008/2/1/turtle-identification-guide-launched.html>) and information regarding the turtle trade from Indonesia and potential smuggling methods should be made available to concerned agencies. Importantly, motivation and willingness to enforce the illegal trade in Indonesian turtles should be encouraged and promoted from within the agencies concerned.

- **Repatriation:** Health, condition and population origin of confiscated live turtles should be examined by PHKA, LIPI and other relevant authorities, prior to release back into the wild, in order to minimise risks of disease transfer, disruption of population genetic integrity and negative effects on local fauna and flora (refer to CITES Resolution Conf. 10.7 (Rev. CoP15) and IUCN, 1998). In this manner, release programmes should be organised in consultation with a range of experts and stakeholders, including government personnel, management agencies, non-government organisations, universities, veterinary institutions, zoos and funding bodies. Repatriation events should provide opportunities for tagging individual turtles and conducting various scientific research to better understand the biology of Pig-nosed Turtle populations. The establishment of a holding facility for confiscated Pig-nosed Turtles in Papua should be considered.
- **International consumer demand:** Public awareness of the illegalities of and the risks related to trade in Pig-nosed Turtles needs to be increased because harvesters and traders in Papua are responding to an international market demand for consuming turtles or keeping turtle as pets. PHKA, BKSDA, international CITES MA and other agencies involved in confiscating Pig-nosed Turtles are strongly encouraged to issue press releases and official statements providing information on trade volume, destinations and prosecutions to raise awareness of the issue. Online news articles and media coverage on seizure cases of Pig-nosed Turtles in Indonesia, and internationally, are important for communicating the illegal trade, and its conservation threat, to the global public (particularly online users).
- **Captive breeding in Indonesia:** Anecdotal information implies that there may be one or more traders licensed to breed Pig-nosed Turtles in captivity, in Java. Nonetheless, Pig-nosed Turtles in Indonesia are being illegally harvested and smuggled in such large quantities that enforcement authorities are recommended to seize all trade in this species. Should commercial captive breeding or ranching operations be legitimately developed in Indonesia, a strategic plan must be devised by PHKA and LIPI Authorities to ensure that the breeding stock is acquired legally, and that dealers do not launder wild-caught specimens into legal trade.
- **Conservation strategy:** As an urgent priority, a species conservation and management plan for Pig-nosed Turtles in Indonesia needs to be designed and implemented, with involvement from all relevant government agencies, research scientists and NGOs. This strategic plan should take into consideration all of the above mentioned recommendations and draw on information on Pig-nosed Turtle population declines reported by Eiseberg et al. (2011) in the Kikori region, Papua New Guinea. Furthermore, there should be a call for further research on the Pig-nosed Turtle to determine the extent of its range in Papua, population abundances, harvesting pressures, and appropriate conservation management.

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