

**A Survey to Determine the Conservation Status of Endemic
Chelonians in Northern Sulawesi, Indonesia**

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Report to:

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30 September 2006

**ATCN NOTE: This report has been edited to exclude all GPS
references to capture sites**

EXECUTIVE SUMMARY

Three species of non-marine chelonians are known to occur in Sulawesi, including the widespread Malayan box turtle (*Cuora amboinensis*) and two endemic species, the Sulawesi tortoise (*Indotestudo forstenii*) and Sulawesi forest turtle (*Leucocephalon yuwonoi*). Very little is known regarding the current conservation status, distribution, or ecology of either *Indotestudo forstenii* or *Leucocephalon yuwonoi* in the wild. This is particularly alarming given that both species are being collected in large numbers to supply international pet markets, with lesser numbers channeled into food and medicinal markets. *Indotestudo forstenii* and *L. yuwonoi* are listed on Appendix I and II, respectively, of CITES and both are protected and managed under Indonesian law through export quotas. However, indications are that for a variety of reasons, these export quotas are regularly exceeded and an extensive, largely illegal trade in endemic Sulawesi turtles exists.

Based on the recognition that urgent action is required in the face of threats posed by over-harvesting and habitat destruction, we initiated a project in 2006 with the following objectives: 1) train local WCS field staff and university students in turtle survey methodology; 2) determine the distribution of *I. forstenii* and *L. yuwonoi* in northern Sulawesi (Gorontalo and Northern Provinces), 3) determine if *I. forstenii* or *L. yuwonoi* are present within any protected area of this region, 4) identify populations of *I. forstenii* and *L. yuwonoi* suitable for long-term life history studies by Indonesian graduate students, 5) gather sufficient data to assess the current conservation status of *I. forstenii* and *L. yuwonoi*, 6) make conservation recommendations to Indonesian and International authorities based on our findings, and 7) determine the feasibility of establishing a local rehabilitation and captive breeding center for *I. forstenii* and *L. yuwonoi* in Sulawesi.

This project and consisted of two phases: an initial round of village interviews during June to gather preliminary data and identify sites suitable for further investigation, and a follow-up field survey in July. Preliminary interview teams questioned 113 individuals at localities scattered throughout northeastern Minahasa. During the follow-up survey we visited 19 villages and conducted additional interviews along with diurnal and nocturnal field surveys. We received numerous reports of turtles other than *Cuora amboinensis* occurring in northern Sulawesi. Linguistic diversity and local folk taxonomies made it difficult to determine which species of turtle informants were describing. However, almost without exception villagers were familiar with *C. amboinensis* and adamantly maintained that at least one additional species of turtle occurred in their area. Collectively these reports suggest that *Indotestudo forstenii* and *Leucocephalon yuwonoi* are more widely distributed in northern Sulawesi than previously believed. Numerous respondents also described a turtle known locally as the “white turtle”. We were unable to ascertain whether the white turtle is a local designation for *L. yuwonoi* or refers to a hitherto undescribed taxon.

We examined a single living *I. forstenii* during our survey that was being held by a villager in Wanggarasi Timur pending sale to a wildlife trader. Villagers found the tortoise in secondary forest on the edge of an agricultural field after being alerted by their

dog. This record represents an eastward range extension of approximately 100 km from previously reported populations on Cape Santigi in Central Sulawesi.

Although we failed to locate *L. yuwonoi* during nocturnal surveys of seemingly suitable habitat, our interview data suggest it has a much wider geographic distribution than the few currently available records would indicate. We received reports of turtles fitting the description of *L. yuwonoi* from villages throughout Gorontalo and Northern Provinces. Clearly the distribution of *L. yuwonoi* in Sulawesi warrants further investigation and must be resolved before effective conservation efforts can be initiated.

We captured 12 *C. amboinensis* during nocturnal surveys for *L. yuwonoi*, and villagers provided another 20 living and one dead *C. amboinensis*. Our field observations and interview data indicate that *C. amboinensis* can occur in almost any wetland habitat in northern Sulawesi. We found them in swift-flowing rocky streams, small spring fed rivulets, *Nippa* swamps, village ponds, rice-field ditches, and grass-dominated wetlands. Our captures, the relatively large number of specimens we obtained from villagers, and local perceptions of abundance collectively indicate that *C. amboinensis* remains common throughout the area we surveyed in northern Sulawesi.

Interview data that we collected strongly suggest that endemic chelonians occur in at least two protected areas of northern Sulawesi: Dumoga-Bone National Park and Panua Nature Reserve. However, owing to the confusion surrounding local folk taxonomies, it is imperative that these anecdotal reports be confirmed with specimens or voucher photographs before these locality records are accepted. Nonetheless, these results are particularly significant because the occurrence of endemic chelonians has yet to be verified in any protected area of Sulawesi.

Subsistence and commercial harvesting of turtles appears minimal in northern Sulawesi. With the exception of ethnic Chinese, very few people in northern Sulawesi consume tortoises or freshwater turtles. During our field survey we met only one individual who admitted to eating turtles, although several others were reputed to do so. This appears to be the result of a strong cultural bias against consuming turtle flesh among both Christians and Muslims in the region.

The situation regarding the commercial harvest of turtles is less clear, but we found nothing to suggest widespread exploitation was underway. Limited commercial harvesting has occurred in the Dumoga River Valley and near Gorontalo, although different buyers were involved. A turtle trader appears to be active in Marisa, although visits to outlying villages seem to be erratic and to our knowledge, large volumes of turtles are not being purchased. Nowhere did we encounter professional turtle collectors in northern Sulawesi. The present harvest seems to be largely the result of opportunistic encounters; i.e., people collect turtles when they chance upon them while engaged in other pursuits. It is important to note however, that the situation with regards to commercial harvest could change rapidly as stocks of wild turtles are decimated in South and Central Sulawesi and traders seek new populations to exploit.

Finally, we visited a wildlife rehabilitation center near Manado operated by the Gibbon Foundation (GF) and Balai Konservasi Sumbar Danga Alam (BKSDA). The mission of the center is to rehabilitate animals (primarily birds and mammals, but also reptiles) confiscated by government conservation authorities with the eventual goal of repatriation to the wild. The objective of our visit was to assess the possibility of collaborating with the center to establish a turtle rescue program and captive assurance colonies for endemic Sulawesi chelonians. However, several potential drawbacks to this plan must be considered. Foremost are stipulations of their government license prohibiting the center from engaging in the captive propagation of any species. Furthermore, the GF facility is located at a rather remote site and closed to the public; consequently opportunities to develop effective conservation education and outreach programs are extremely limited. In light of these considerations, probably the most feasible plan is for WCS to independently develop a turtle rescue center with assurance colonies. A sufficiently large parcel of land can be obtained relatively cheaply and the technical expertise for training Indonesian keepers is available through the Reptile Department at the Bronx Zoo. Arrangements could be made with the GF and BKSDA to stock the assurance colonies with animals confiscated from wildlife traders.

Based on the project described herein, these specific recommendations are suggested as a first step towards implementing effective conservation measures for the endemic *L. yuwonoi* and *I. forstenii* in northern Sulawesi.

I. Training and capacity building

1. Conduct additional WCS training workshops for Indonesian biologists.
2. Involve government conservation staff in WCS training workshops, particularly those individuals tasked with stewardship of protected areas in Sulawesi. Training should emphasize the essential role played by protected areas in chelonian conservation. Furthermore, once trained, protected area staff will form a network of first tier investigators able to collect on-site data regarding the population status, distribution, and natural history of these poorly known endemic chelonians. A similar approach has proven useful in turtle conservation efforts in Myanmar.
3. Support Indonesian graduate students conducting field projects on chelonians in Sulawesi. John Tasirin can identify suitable candidates at local universities and make recommendations regarding support.

II. Field surveys, and *in situ* and *ex situ* conservation

1. The distribution of both *L. yuwonoi* and *I. forstenii* in northern Sulawesi must be resolved before effective conservation measures can be implemented. To this end, we recommend a vigorous follow-up of the initial survey efforts described in this report. Particular emphasis should be placed on verifying anecdotal reports concerning the occurrence of *L. yuwonoi* and *I. forstenii* in Dumoga-Bone National Park and Panua Nature Reserve with voucher photographs or actual specimens. WCS field staff working with the

Maleo conservation programs are based in the communities surrounding Dumoga-Bone National Park. These individuals are in an excellent position to verify local reports. Moreover, efforts should be made to determine if local reports of the “white turtle” refer to *L. yuwonoi* or a hitherto undescribed taxon.

2. Investigate the possibilities of establishing local community-based turtle conservation projects on Pundtu Daa Island near Wanggarasi Timur Village, and Toluan Village. The latter site is especially promising as the village administration has already established a marine turtle conservation program and expressed a desire to expand this project to include freshwater turtles and tortoises.
3. Establish a WCS turtle rescue center and assurance colonies of *L. yuwonoi* and *I. forstenii*. This facility should be located on the outskirts of Manado where land can still be obtained relatively cheaply. Technical expertise for training Indonesian staff is available through the Bronx Zoo. The possibility of signing a memorandum of understanding between WCS, Gibbon Foundation, and Balai Konservasi Sumbar Danga Alam to supply confiscated turtles for stocking the assurance colonies should be explored. Finally, public education programs must be a major emphasis of the rescue center.

III. Trade, exploitation, and education

1. Institute village-level monitoring of harvest and trade. An effective small-scale program could be implemented using WCS field staff already working with Maleo conservation projects in villages on eastern and western periphery of Dumoga-Bone National Park.
2. Collaborate with Wildlife Crimes Unit to monitor regional trade. If large numbers of turtles are being transported to urban centers for export, these will undoubtedly be intercepted at WCU checkpoints.
3. Collaborate with TRAFFIC on monitoring export trade from northern Sulawesi.
4. Develop local educational programs that stress the uniqueness and legal status of Sulawesi chelonians in addition to fostering a greater awareness of the island's natural heritage.

TABLE OF CONTENTS

	<u>Page</u>
Executive summary	2
List of appendices	7
Introduction	8
Study area	13
Methods	14
I. Village interviews	14
II. Field surveys	15
Results and discussion	15
I. Preliminary interview surveys	15
II. Field surveys	16
III. Exploitation and trade	21
Recommendations	22
Acknowledgements	23
Literature cited	24
Appendix 1	27
Appendix 2	30
Appendix 3	31
Appendix 4	34
Appendix 5	36
Appendix 6	38
Appendix 7	49

LIST OF APPENDICES

Appendix	Content
1	Itinerary for Steven G. Platt
2	List of training and survey participants.
3	Summary of training course, recommendations, and syllabus.
4	Summary of a visit to the Gibbon Foundation wildlife rehabilitation center and recommendations for establishing a WCS turtle rescue center and assurance colonies of endemic Sulawesi chelonians.
5	Translated questionnaire used by WCS staff during preliminary interview surveys conducted in June 2006.
6	Summary of field surveys conducted from 7 to 29 July in Gorontalo and Northern Provinces of Sulawesi. Surveys are summarized chronologically by location. Morphometric data for all specimens examined are included in copies of field notes deposited in the Campbell Museum, Clemson University, Clemson, South Carolina, USA.
7	Gazetteer. Place names in agreement with Nelles [®] map of Northern Sulawesi. Local names (spelled phonetically) used for places not shown on maps. Coordinates determined with A Garmin [®] 12 GPS unit.

INTRODUCTION

The fauna of Sulawesi (formerly Celebes) is considered among the most distinctive in Indonesia, with high levels of endemism among terrestrial mammals, amphibians, and invertebrates (Whitten et al., 1987; Gillespie et al., 2005). Three species of non-marine chelonians are known from Sulawesi, including the widespread Malayan box turtle (*Cuora amboinensis*; Figure 1) and two endemic species, the Sulawesi tortoise (*Indotestudo forstenii*) and Sulawesi forest turtle (*Leucocephalon yuwonoi*) (de Rooji, 1915; Iverson, 1993; McCord et al., 1995). Very little is known regarding the current conservation status or ecology of either *Indotestudo forstenii* or *Leucocephalon yuwonoi* in the wild.

Indotestudo forstenii (Figure 2) is the only tortoise occurring east of Wallace's Line (Hoogmoed and Crumly, 1984) and virtually nothing is known regarding its life history or ecology in the wild (Platt et al., 2001). Indeed, *I. forstenii* is considered one of the world's rarest and least studied tortoises. Earlier reports that populations of *I. forstenii* on Sulawesi originated from the introduction of *Indotestudo travancorica* by early seafarers (Hoogmoed and Crumly, 1984) are now considered erroneous, and morphological and genetic data indicate the two species are quite distinct (Pritchard, 2000; Klemens and Amato, unpubl. data). The historical and current distribution of *I. forstenii* on Sulawesi remains ill-defined; 14 museum specimens exist but only five of these are accompanied by meaningful locality data (Table 1). Five specimens collected prior to 1900 originated from Halmahera (1) and Sulawesi (4). Of the latter, two lack specific locality data, while two were collected from the northern Minahasa Peninsula of Sulawesi. More recently, Platt et al. (2001) obtained three shells from the Cape Santigi region of Central Sulawesi and six preserved juveniles of unknown provenance from a reptile dealer in Jakarta. Additionally, Groombridge (1982) reported a population near the Morowali Reserve in Central Sulawesi where three wild tortoises and a village captive were observed, and Ian Ives (pers. comm.) encountered several captive tortoises in the Palu Valley and received reliable reports from hunters suggesting *I. forstenii* remains rather common in this region. Little is known about the habitat requirements of *I. forstenii*. Platt et al. (2001) found three intact *I. forstenii* shells among rock outcrops in second-growth forests growing on the steep hillsides of Cape Santigi. Likewise, local hunters in this area reportedly found tortoises by searching crevices and rock overhangs (Platt et al., 2001). Ives (pers. comm.) found *I. forstenii* among xerophytic scrub vegetation in the dry Palu Valley.

Leucocephalon yuwonoi (Figure 3) was initially described in 1995 as *Geoemyda yuwonoi*, but subsequently reassigned to the monotypic genus *Leucocephalon* by McCord et al. (2000). The species description is based on seven specimens purchased by Indonesian animal dealer Frank Yuwono at a local market in Gorontalo (Northern Sulawesi), and an additional specimen purchased in Poso (Central Sulawesi) (McCord et al., 1995). *Leucocephalon yuwonoi* has rarely been observed in the wild by biologists and very little is known about its distribution and natural history. Platt et al. (2001) encountered two adults during a nocturnal search of a tributary of the Kanggol River.

These turtles were found in shallow, rocky pools of a small stream with abundant woody debris; the surrounding habitat was dense second-growth forest (Platt et al., 2001). Feces from one turtle contained leaves and a previously undescribed species of nematode, *Falcaustra kutcheri* (Burse et al., 2000); unidentified fruits, possibly *Ficus* sp. were recovered from the second turtle (Platt et al., 2001). *Leucocephalon yuwonoi* are thought to forage on fallen fruit in the streambed and surrounding forest (Hagen and Ching, 2005). In 2002 Hagen and Ching (2005) returned to the same stream visited by Platt et al. (2001) and collected four *L. yuwonoi* during 4.5 hours of searching. Feces recovered from a wild-caught juvenile contained insect parts, confirming juvenile carnivory as suggested by previous observations of captives (Hagen and Ching, 2005). Riyanto (in press) searched several locations in Central Sulawesi during 2002 and found *L. yuwonoi* inhabiting small, heavily vegetated lowland creeks adjacent to agricultural lands and second-growth forests. Captive *L. yuwonoi* are reportedly excellent climbers, semi-aquatic, and herbivorous (McCord et al., 1995), but difficult to maintain for extended periods (Innis, 2003; Rick Hudson, pers. comm.). Females deposit one or two large eggs once each year (Innis, 2003; Riyanto, in press); otherwise almost nothing is known regarding the reproductive biology of this species.

Despite the lack of data on wild populations, and their apparently limited geographic distribution and endemic status in Sulawesi, both *I. forstenii* and *L. yuwonoi* are collected in large numbers primarily to supply international pet markets, with lesser numbers channeled into food and medicinal markets. This is particularly alarming with regards to *L. yuwonoi* as the species is extremely difficult to maintain in captivity and even well equipped zoos and knowledgeable breeders have experienced only limited success at long-term propagation. *Indotestudo forstenii* and *L. yuwonoi* are listed on Appendix I and II, respectively, of CITES (www.cites.org). Furthermore, both species are protected and managed under Indonesian law through export quotas (Samedi and Iskandar, 2000; Platt et al., 2001; Hagen and Ching, 2005). However, indications are that for a variety of reasons, these export quotas are regularly exceeded and an extensive illegal trade in endemic Sulawesi turtles exists.

Given the paucity of baseline data, conclusions regarding the impact of the current trade on wild populations of *I. forstenii* and *L. yuwonoi* must remain somewhat speculative. However, the scant field data available (Platt et al., 2001; Hagen and Ching, 2005; Riyanto, in press) and the knowledge that with few exceptions, chelonian populations cannot sustain even minimal levels of harvest (Congdon et al., 1993), strongly suggest that the widespread harvest of turtles currently underway in Sulawesi threatens the continued survival of both *I. forstenii* and *L. yuwonoi*. Most telling are reports from local villagers who consistently maintain that turtles are becoming increasingly difficult to find in some regions of Sulawesi (Platt et al., 2001). In addition to over-exploitation, wild populations of *I. forstenii* and *L. yuwonoi* are threatened by widespread habitat destruction attributable to commercial logging, small-scale shifting cultivation, large plantation projects, and transmigration schemes designed to resettle people from Java to other less populated islands of the Indonesian archipelago (Platt et al., 2001). Alarming, deforestation rates in Sulawesi are among the highest in the world (Whitten et al., 1987; Myers, 1992).

Table 1. Museum specimens of the Sulawesi tortoise (*Indotestudo forstenii*) for which locality data are available. BMNH = Natural History Museum, London. AMNH = American Museum of Natural History, New York.

Museum number	Year	Location
BMNH 1872.4.6.116	1872	Boliahoeta [=Mount Boliahutu] near Salamatta, Celebes.
BMNH 1896.12.9.1	1896	Buol, North Celebes.
AMNH 145099-101	1998	Cape Santigi Peninsula, Central Sulawesi.

Based on the recommendations of previous workers for additional field surveys (Platt et al., 2001; Hagen and Ching, 2005; Kuncoro, 2005; Riyanto, in press) and the recognition that urgent action is required in the face of threats posed by over-harvesting and habitat destruction, we initiated a project in 2006 with the following objectives: 1) train local WCS field staff and university students in turtle survey methodology; 2) determine the distribution of *I. forstenii* and *L. yuwonoi* in northern Sulawesi (Gorontalo and Northern Provinces), 3) determine if *I. forstenii* or *L. yuwonoi* are present within any protected area of this region, 4) identify populations of *I. forstenii* and *L. yuwonoi* suitable for long-term life history studies by Indonesian graduate studies, 5) gather sufficient data to assess the current conservation status of *I. forstenii* and *L. yuwonoi*, 6) make conservation recommendations to Indonesian and International authorities based on our findings, and 7) determine the feasibility of establishing a local rehabilitation and captive breeding center for *I. forstenii* and *L. yuwonoi* in Sulawesi.

The following report details field work conducted in northeastern Sulawesi during June and July 2006. My itinerary and a list of participants in the training course are presented in Appendix 1 and 2, respectively. A discussion of the training with recommendations and a course syllabus is presented in Appendix 3. Our visit to a wildlife rehabilitation facility operated by the Gibbon Foundation is described and recommendations for establishing a WCS turtle rescue center with assurance colonies are provided in Appendix 4.

STUDY AREA

This project was conducted in Gorontalo (12,215 km²) and Northern (15,272 km²) Provinces of the Minahasa Peninsula in northeastern Sulawesi (Embassy of the Republic of Indonesia, 2006). Major population centers include Manado, Gorontalo, Kotamobagu, and Bitung. The Minahasa Peninsula is characterized by steep mountains rising to over 1,000 m in some places, with deep valleys and high plateaus. The peninsula is seismically active and earthquakes are frequent occurrences; six active volcanoes are

found in the vicinity of Manado. Rainfall is highly variable owing to the perpendicular orientation of the steep mountains to prevailing winds resulting in localized “rain shadows”. In general, the northern coast of the peninsula receives the greatest annual rainfall; in most areas rainfall averages about 150 mm each month (Fontanel and Chanefort, 1978). The region experiences a dry season from June through mid- to late October, although this varies depending on local topography.

The vegetation of Sulawesi is imperfectly known; fewer herbarium specimens have been collected on the island than any other region in Indonesia (Whitten et al., 1987). According to a forest cover map presented by Whitten et al. (1987), the vegetation of the Minahasa Peninsula is classified as lowland and hill forests with scattered areas of distinct forest types growing on ultrabasic and volcanic soils, and limited tracts of montane vegetation occur at high elevations. Owing to a long history of human disturbance, many areas are now dominated by second-growth vegetation or *alang-alang* (*Imperata cylindrica*) grassland. Dry areas are characterized by open scrub dominated by drought tolerant species, cactus and grasslands, including the invasive *I. cylindrica* (Whitten et al., 1987).

Protected areas of the Minahasa Peninsula that potentially harbor populations of *I. forstenii* or *L. yuwonoi* include Dumoga Bone National Park, and Tangkoko, Dua Sudara, Gunung Lokon, Panua, and Tanjung Panjang Nature Reserves. Significantly, the occurrence of either species has yet to be confirmed in any protected area of Sulawesi (Platt et al., 2001; Hagen and Ching, 2005; Riyanto, in press.).

METHODS

This field component of this project consisted of two phases: an initial round of village interviews followed by a more intensive field survey of selected sites.

I. Village interviews

Village interviews were conducted by local WCS field staff from the Manado Office of the WCS Indonesia Program during mid- to late June 2006. The objective of these interviews was to identify areas where wild populations of *I. forstenii* and *L. yuwonoi* are likely to occur, and based on this information compile a list of potential sites to be surveyed in July. Owing to time and logistic constraints, interviews were restricted to the eastern-most region of the Minahasa Peninsula (Provinces of Gorontalo and North Sulawesi). Significantly however, this area has been largely over-looked by previous workers (Platt et al., 2001; Hagen and Ching, 2005; Riyanto, in press) and almost nothing is known regarding the regional occurrence of chelonians. Interview teams consisted of 1 to 2 individuals. Teams targeted hunters, farmers, and others who spend considerable time in potential turtle habitat and are likely to have knowledge of the local chelonian-fauna. Each person was read a list of questions from a prepared questionnaire (Appendix 5). If the person had experience with local turtles, they were presented with a photo array

showing the three species of turtles found in Sulawesi and asked to indicate which species occurred locally. Interview teams also searched local markets for turtles.

II. Field surveys

Village interviews and field surveys were conducted in Gorontalo and Northern Provinces of Sulawesi during July 2006. We visited villages and agricultural hamlets and questioned villagers, farmers, and other knowledgeable individuals regarding the local occurrence of turtles, levels of exploitation, collecting methods, traditional use, and general natural history. Such individuals are typically an excellent source of information on the local chelonifauna (Thirakhupt and van Dijk, 1994; Platt et al., 2004). In addition to questioning villagers, we conducted field surveys for turtles using the species-specific methodologies described below:

a. *Indotestudo forstenii*

We accompanied local villagers to suitable habitat and searched for tortoises by investigating likely places of concealment, e.g., clumps of bamboo, dense thickets, etc. We attempted to conduct searches during the morning (0800 to 1100) or late afternoon (1500 to 1800), but often this proved difficult owing to the schedules of local guides. If available, we used village hunting dogs to search for tortoises. Our previous work in Myanmar indicates that dogs are much more efficient at locating concealed tortoises than humans (Platt et al., 2003a).

b. *Leucocephalon yuwonoi*

We conducted nocturnal searches for *L. yuwonoi* in low to high gradient rocky streams using MagLite® Flashlights and headlamps. Particular attention was devoted to searching deep pools and streamside vegetation. This method has proven highly effective during other surveys (Platt et al., 2001; Hagen and Ching, 2005). We also conducted diurnal searches of streamside vegetation.

RESULTS and DISCUSSION

I. Preliminary interview surveys

Preliminary interview teams questioned 113 individuals during June 2006 at a number of villages in northeastern Minahasa. Floodwaters from unseasonably heavy rains prevented access to many areas near Gorontalo. Respondents indicated that all three species of turtles known from Sulawesi are present in the eastern Minahasa Peninsula. However, species identification was complicated by the linguistic diversity of the region (e.g., 10 distinct languages are spoken in Minahasa and Gorontalo in addition to Bahasa Indonesia) and the plethora of unique, and often ambiguous names in local folk taxonomies.

II. Field surveys

We visited 19 villages in northern Sulawesi, and conducted village interviews and field surveys from 7 to 30 July 2006 (Appendix 6 and 7). During our interviews of villagers, farmers, and other knowledgeable individuals, we received numerous reports of turtles other than *Cuora amboinensis* being found in northern Sulawesi. Because of the linguistic diversity in this region and unique local folk taxonomies, it was generally difficult to determine which species of turtle our informants were describing. Moreover, even when informants were presented with photo arrays, it often proved difficult to resolve the confusion over species identifications. However, almost without exception our informants were familiar with *C. amboinensis* and adamantly maintained that at least one additional species of turtle occurred in their area. Although local folk taxonomies should be interpreted with caution and confirmation of species identifications must await the collection of voucher specimens or photographs, collectively these reports suggest that *I. forstenii* and *L. yuwonoi* are more widely distributed in northern Sulawesi than previously believed. Furthermore, our interviews suggest *L. yuwonoi* is not restricted to riparian forests along small creeks; informants reported encounters in coastal palm swamps, grass swamps, hillside bamboo forests, and even dry scrub.

A number of people we interviewed in Wanggarasi Timur and surrounding villages, and Bolontio, Tulabolo, and Toluan Villages mentioned the local occurrence of a “white turtle”. Initially we assumed this was a reference to *Leucocephalon yuwonoi*, possibly based on the white head coloration of the male (Figure 3). However, after viewing our photo array these individuals stated that the white turtle definitely was not among those species pictured. At this time we are unable to ascertain whether the “white turtle” is a local designation for *L. yuwonoi* or refers to a hitherto undescribed taxon. Most informants report that “white turtles” occur in mesic habitats such as grass swamps, small wetlands, or springheads.

Our informants also contributed information on the natural history of *I. forstenii* and *L. yuwonoi* based on personal field observations. Rattan cutters in Pinogu Village reportedly observed a group of four *L. yuwonoi* feeding on a *Colocassia* tuber after first excavating a shallow hole to expose the root. Villagers in Wanggarasi Timur observed *I. forstenii* consuming monkey feces and grubs from rotting logs. The former undoubtedly contains undigested vegetation and fruit pulp that can be utilized by tortoises. Two bird trappers in Panua (Maleo) Village encountered *I. forstenii* grazing on grass and sedges on the forest floor. Such observations are particularly valuable given that virtually nothing is known regarding the ecology of these species in the wild.

We examined a single living *I. forstenii* during our survey (Figure 2). This adult male tortoise was being held by a villager in Wanggarasi Timur pending sale to a dealer in Marisa. The carapace measured 26.3 cm and lacked a nuchal scute. It was captured in April 2006 in the hills above the village. On 17 July 2006 we accompanied a group of villagers to the capture site (XXXXXXGPSXXXXXX), located on a steep slope at an

altitude of 130 m (Figure 4). Villagers found the tortoise in secondary forest on the edge of an agricultural field after being alerted by their dog. The forest surrounding the capture site is characterized by a dense understory beneath a relatively open canopy. This locality record represents an eastward range extension of approximately 100 km from previously reported populations on Cape Santigi in Central Sulawesi (Platt et al., 2001). Voucher photographs (CUSC 2328) of this tortoise are archived in the Campbell Museum, Clemson University, Clemson, South Carolina.

We failed to find *L. yuwonoi* during nocturnal surveys of seemingly suitable habitat, but our interview data suggest it is much more widely distributed than the few available collection records would indicate. Currently, *L. yuwonoi* is believed restricted to Donggala County in Central Sulawesi, being found from Cape Santigi to Lore Lindu National Park; the easternmost known populations occur in the Cape Santigi region (Hagen et al., in press). However, we received reports of turtles fitting the description of *L. yuwonoi* from villages throughout Gorontalo and Northern Provinces. Furthermore, the type specimens of *L. yuwonoi* purchased by Frank Yuwono from a market in Gorontalo may have originated locally rather than in Central Sulawesi as generally assumed (e.g., Hagen et al., in press). Clearly the distribution of *L. yuwonoi* in Sulawesi warrants further investigation and must be resolved before effective conservation efforts can be initiated.

We captured 12 *C. amboinensis* while searching for *L. yuwonoi* at night, and villagers provided another 20 living and one dead *C. amboinensis*. The latter was obtained from a farmer in Obuy Pusian Village after being unearthed from the perimeter of his field. The ethnic Mongondow inhabiting this area believe that *C. amboinensis* are endowed with the ability to ward off floodwaters. To protect their homes and property, they chop off the legs of a living *C. amboinensis* to prevent it from fleeing, and bury the turtle with its plastron facing the anticipated path of the floodwaters. According to the local belief, the plastron will deflect the approaching floodwaters, which pass around the turtle and the farmers' property rather than over it. Turtles also have religious significance to Hindu transmigrants from Bali that settled the Dumoga River Valley. Many households in Hindu villages maintain small, walled shrines where turtles are kept for religious reasons.

Our field observations and village interview data indicate that *C. amboinensis* can occur in almost any wetland habitat in northern Sulawesi (Figure 5). We found them in swift-flowing rocky streams where swimming turtles could make little headway against the strong current, small spring fed rivulets, *Nippa* swamps, village ponds, rice-field ditches, and grass-dominated wetlands. The feces of two *C. amboinensis* that we collected near Manado contained the remains of vegetation and fruit. Patterns of carapacial scarring observed on several *C. amboinensis* were consistent with reports of fire damage to *Terrapene carolina* (Dodd et al., 1997). Similar fire scars were likewise reported on *C. amboinensis* during an earlier investigation (Platt et al., 2001) and are thought to result from burns sustained when fast moving wildfires sweep over turtles that are buried under leaf litter or grass. Based on our experience, *C. amboinensis* is quite cryptic and even where common can be difficult to locate. Most of the specimens we

found during nocturnal surveys were concealed under cover of some sort; e.g., mud, leaves, rocks, submerged palm fronds, etc. Interestingly, there seems to be a widespread belief among rural villagers in northern Sulawesi that *C. amboinensis* produces nocturnal vocalizations audible to the human ear. Our field observations and the ease with which we found *C. amboinensis*, the relatively large number of specimens we obtained from villagers, and local perceptions of abundance collectively indicate that *C. amboinensis* remains common throughout the area we surveyed in northern Sulawesi. We caution against complacency however, as *C. amboinensis* is heavily exploited central and southern in Sulawesi at levels that are almost certainly unsustainable (Platt et al., 2001; Chris Shepherd, TRAFFIC, pers. comm.). Once turtle stocks in those regions become depleted, it is likely that wildlife traders will turn their attention to northern Sulawesi.

Our field surveys were somewhat hampered by the fact that there is no regional tradition of turtle hunting in northern Sulawesi. Very few people eat turtles and we encountered no one who regularly hunts turtles on a professional basis. Although there is a limited commercial harvest in the region (see below), most collecting appears to be the result of opportunistic encounters rather than purposeful hunting or trapping. During previous turtle surveys in Southeast Asia, we have relied heavily on professional or subsistence hunters to locate specimens, identify habitat, and provide input on local population trends (e.g., Platt et al., 2003a, 2003b, 2003c, Stuart and Platt, 2004, Platt et al., 2005); however, this option was unavailable during our work in Sulawesi.

Interview data that we collected strongly suggest that endemic chelonians occur in at least two protected areas of northern Sulawesi: Dumoga-Bone National Park and Panua Nature Reserve. Rattan cutters reportedly encountered *L. yuwonoi* while working in Dumoga-Bone National Park. Data from the Dumoga River Valley on the eastern border of the park suggest that in addition to *L. yuwonoi*, *I. forstenii* also occurs in the park. In Panua Nature Reserve, bird trappers reported capturing both *L. yuwonoi* and *I. forstenii* in bird snares on several occasions. However, owing to the confusion surrounding local folk taxonomies, it is imperative that these anecdotal reports be confirmed with specimens or voucher photographs before our locality records are accepted. Nonetheless, our findings are particularly significant because the occurrence of endemic chelonians has yet to be verified within any protected area of Sulawesi.

In addition to Dumoga-Bone National Park and Panua Nature Reserve, local reports also suggest that an endemic chelonian occurs on Pundtu Daa Island, a village-level protected area near Wanggarasi Timur. This large (ca. 5 km²) island is reserved for fuelwood cutting and extraction of non-timber forest products, and appears relatively undisturbed. Local villagers maintain that *L. yuwonoi* occurs on the island, but the xerophytic vegetation seemed more typical of *I. forstenii* habitat. Regardless, the villagers were adamant that a turtle occurred on the island that was not *C. amboinensis*. Because the island is already afforded some degree of protection, it might be possible to work with area villagers to survey and protect turtles. Likewise, we noted considerable local enthusiasm for turtle conservation at Toluan Village. This village is located on a *Chelonia mydas* nesting beach and villagers recently developed a community-based marine turtle conservation plan with the assistance of several international and national

conservation NGO's. Similar to Pundtu Daa Island, villagers maintained that at least one other freshwater turtles is locally present besides *C. amboinensis*, although the identity of this species remains unresolved. The village chief expressed interest in expanding the marine turtle conservation program to include freshwater turtles, an opportunity that should be pursued.

III. Exploitation and trade

Subsistence and commercial harvesting of turtles appears minimal in northern Sulawesi. This contrasts markedly with the situation in South and Central Sulawesi where massive quantities of turtles are currently being exported to foreign food and medicinal markets (Chris Shepherd, TRAFFIC, pers. comm.). With the exception of ethnic Chinese, very few people in northern Sulawesi consume tortoises or freshwater turtles. During our field survey we met only one individual who admitted to eating turtles, although several others were reputed to do so. This appears to be the result of a strong cultural bias against consuming turtle flesh among both Christians and Muslims in the region.

The situation regarding the commercial harvest of turtles is less clear, but we found nothing to suggest widespread exploitation was underway. Several people in the Dumoga River Valley noted that a Chinese businessman from Kotamobago visited the area to purchase turtles during 2002-03; however, the visits inexplicably ceased and villagers no longer collect turtles to sell. A similar situation was noted in villages near Gorontalo, although different buyers were involved. A turtle trader appears to be active in Marisa, although visits to outlying villages seem erratic and to our knowledge, large volumes of turtles are not being purchased. As previously mentioned (see above), nowhere did we encounter professional turtle collectors in northern Sulawesi. The limited harvest seems to be the result of opportunistic encounters; i.e., people collect turtles when they chance upon them while engaged in other pursuits.

On a final cautionary note, it is possible that villagers elected to conceal information regarding wildlife trade or provide false or inaccurate information during our interviews. However, we believe this is unlikely as villagers had nothing to gain by providing false or misleading information. Moreover, the ease with which we found *C. amboinensis* in agricultural fields and even villages, suggest that turtles in this region have not been subjected to intensive levels harvest. *Cuora amboinensis* is heavily exploited elsewhere in Sulawesi and would be unlikely to persist in anthropogenic habitats if it were being exploited. In conclusion, we stress that our findings should not be taken as a reason for complacency. It is important to note that situation with regards to commercial harvest could change rapidly as stocks of wild turtles are decimated in South and Central Sulawesi and traders seek new populations to exploit.

RECOMMENDATIONS

Based on the project described herein, these specific recommendations are suggested as a first step towards implementing effective conservation measures for the endemic *L. yuwonoi* and *I. forstenii* in northern Sulawesi:

I. Training and capacity building

1. Conduct additional WCS training workshops for Indonesian biologists.
2. Involve government conservation staff in WCS training workshops, particularly those individuals tasked with stewardship of protected areas in Sulawesi. Training should emphasize the essential role played by protected areas in chelonian conservation. Furthermore, once trained, protected area staff will form a network of first tier investigators able to collect on-site data regarding the population status, distribution, and natural history of these poorly known endemic chelonians. A similar approach has proven useful in turtle conservation efforts in Myanmar (Platt, 2001).
3. Support Indonesian graduate students conducting field projects on chelonians in Sulawesi. John Tasirin can identify suitable candidates at local universities and make recommendations regarding support.

II. Field surveys, and *in situ* and *ex situ* conservation

1. The distribution of both *L. yuwonoi* and *I. forstenii* in northern Sulawesi must be resolved before effective conservation measures can be implemented. To this end, we recommend a vigorous follow-up of the initial survey efforts described in this report. Particular emphasis should be placed on verifying anecdotal reports concerning the occurrence of *L. yuwonoi* and *I. forstenii* in Dumoga-Bone National Park and Panua Nature Reserve with voucher photographs or actual specimens. WCS field staff working with the Maleo conservation program are based in the communities surrounding Dumoga-Bone National Park and as such, are in an excellent position to verify these reports. Moreover, efforts should be made to determine if local reports of the “white turtle” refer to *L. yuwonoi* or a hitherto undescribed taxon.
2. Investigate the possibilities of establishing local community-based turtle conservation projects on Pundtu Daa Island near Wanggarasi Timur Village, and Toluan Village. The latter site is especially promising as the village administration has already established a marine turtle conservation program and expressed a desire to expand this project to include freshwater turtles and tortoises.
3. Establish a WCS turtle rescue center and assurance colonies of *L. yuwonoi* and *I. forstenii*. This facility should be located on the outskirts of Manado

where land can still be obtained relatively cheaply. Technical expertise for training Indonesian staff is available through the Bronx Zoo. The possibility of signing a memorandum of understanding between WCS, Gibbon Foundation, and Balai Konservasi Sumbar Danga Alam to supply confiscated turtles for stocking the assurance colonies should be explored. Finally, public education programs must be a major emphasis of the rescue center.

III. Trade, exploitation, and education

1. Institute village-level monitoring of harvest and trade. An effective small-scale program could be implemented using WCS field staff already working with Maleo conservation project in villages on eastern and western periphery of Dumoga-Bone National Park.
2. Collaborate with Wildlife Crimes Unit to monitor regional trade. If large numbers of turtles are being transported to urban centers for export, these will undoubtedly be intercepted at WCU checkpoints.
3. Collaborate with TRAFFIC on monitoring export trade from northern Sulawesi.
4. Develop local educational programs that stress the uniqueness and legal status of Sulawesi chelonians in addition to fostering a greater awareness of the islands natural heritage. Lee et al. (2005) suggest that a similar public education program was partly responsible for a decline in the trade of protected mammals in Sulawesi.

ACKNOWLEDGEMENTS

This project would not have been possible without the generous support of Bradley Trevor Greive. Colin Poole, Nick Brickle, and John Tasirin were instrumental in facilitating fieldwork and insuring the success of our venture. I am especially indebted to those who accompanied me into the field: Iwan Hunowu, Stephan Siwu, Usman, David Kosegeran, Toar, Franky Wongkar, Linelejan, and Livemy Pajan. We are all most grateful for the assistance and accommodation provided by the many villagers we met during our expedition. I am indebted to Iwan Hunowu for taking the photographs in this report. Ian Ives and Cris Hagen are thanked for sharing their knowledge of Sulawesi turtles. Chris Shepherd generously provided information concerning regional wildlife trade, and Mike Robinson and the interlibrary loan staff at Sul Ross State University were very helpful in securing historical and difficult to locate references. Finally I would like to thank my wife, Kalyar for invaluable assistance with preparing the final draft of this report.

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Appendix 1: Itinerary for Steven G. Platt.

- 30 June Travel from New York to Manado, Sulawesi. Arrive in Manado ca. 1330. Meet with John Tasirin at WCS Office.
- 1 July WCS Office in Mando. Preparation for training and field survey.
- 2 July WCS Office in Manado. Preparation for training and field survey.
- 3 July WCS Office in Manado. Review results of preliminary survey, conduct training session with WCS Staff and local university students. Topics covered include field methodology and collection of biological data.
- 4 July WCS Office in Manado. Continue training session. Topics covered include use of hand-held GPS Units, GIS applications, topographical maps, and orienteering. Attend sea turtle conservation meeting sponsored by LESTARI in afternoon. Present brief overview of project to local governmental and NGO conservation community.
- 5 July WCS Office in Manado. Continue training. Present seminar on preparation and writing scientific manuscripts and technical reports. Logistical planning for upcoming field work.
- 6 July WCS Office in Manado. Continue training. Present seminar on preparation of technical reports and manuscripts.
- 7 July Travel from Manado to northern-most Minahasa Peninsula. Visit Batu and Werot Villages. Examine captive turtles and interview residents. Attempt to reach Likopoung, but road blocked. Returned to Manado.
- 8 July Travel to Tomohon. Visit market to search for wildlife, particularly turtles. Climb to crater of Mount Mahawu. Return to base of mountain and visit Rurukan, a village where Alfred Russell Wallace (1869) lived briefly. Inspect nearby geothermal area described by Wallace and return to Manado.
- 9 July WCS Office in Manado. Prepare for upcoming expedition.
- 10 July Travel from Manado to Toluan Village. Conduct field survey of nearby *Nippa* Swamp known locally as “Tabuu”. Drive to another site known as “Woau” (=Place where turtles are found) and conduct field survey. Return to Toluan Village and bivouac for the night. Conduct nocturnal survey of Tabuu Swamp.

- 11 July Inspect another *Nippa* swamp adjacent to Toluan Village. Return to Waou, stopping enroute at Laumpay Village to interview residents and measure turtles. Conduct field survey of Woau. Return to Manado in late evening.
- 12 July Travel from Manado to Gorontalo.
- 13 July Travel from Gorontalo to Suwawa Village. Hike from Suwawa Village to Tulabolo Village. Establish basecamp and conduct interviews of residents and field surveys of Bulabo Creek and Tanggi River.
- 14 July Hike to Maleo nesting area inside Dumoga-Bone National Park. Interview villagers and forest workers along the route. Conduct nocturnal survey of Bulabos Daa Creek.
- 15 July Depart Tulabolo Village and travel to Gorontalo for resupply. Visit Pareteis Lake along the way and interview residents. Travel from Gorontalo to Lemito Village. Stopped enroute to interview villagers regarding occurrence of crocodiles in nearby mangrove swamps. Establish basecamp in Wonggarasi Timur Village.
- 16 July Conduct field survey in hills above Wonggarasi Village.
- 17 July Conduct field survey in hills above Wonggarasi Village; climb to site where *Indotestudo forstenii* was recently captured. Visit palm swamp near village in late afternoon where *Leucocephalon yuwonoi* was reportedly captured last year.
- 18 July Visit Maleo nesting site near Wonggarasi Village at daybreak. Conduct field survey of Pundtu Island. Visit Sukadamae Village and interview residents. Conduct nocturnal survey of Wonggarasi Timur Creek.
- 19 July Travel from Wonggarasi Village to Balayo Village. Interview residents and obtain shell fragments. Conduct field survey of extensive grass swamp approximately 5 km west of village.
- 20 July Examine red junglefowl in Balayo Village. Depart Balayo Village and travel to Marisa for resupply. Continue to Panua and interview residents. Conduct field survey of forest near village.
- 21 July Accompany bird trappers into Panua Nature Reserve to examine capture site of *Indotestudo forstenii* and conduct field survey. Fieldwork hampered by intense rainfall. Travel to Gorontalo in late afternoon.
- 22 July Travel from Gorontalo to Bolontio Village. Interview residents and conduct nocturnal survey of nearby creek and small swamp.

- 23 July Accompany rattan collectors to site where turtles (probably *Leucocephalon yuwonoi*) in hills above Bolontio Village. Conduct nocturnal survey of nearby swamp, but thwarted by swarms of nocturnal bees.
- 24 July Travel from Bolontio Village to WCS Field Station at Tambun. Visit Fort Orange along the way.
- 25 July Visit Maleo nesting area near Tambun Station at daybreak. Interview residents and examine captive turtles in Kembang, Merta, Doloduo, and Mopugad Salantan Villages. Conduct nocturnal survey of Tabun Creek.
- 26 July Field operations temporarily suspended due to vehicle malfunctions. Vehicle taken to Kotamobagu for repairs. Remainder of team climbed mountain above Tambun Field Station. Conduct nocturnal survey of fish farm near field station.
- 27 July Travel from Tambun Field Station to Kombat. Examine captive crocodiles, visit crocodile habitat, interview residents, and conduct nocturnal survey (for turtles) of Tonop River.
- 28 July Conduct survey of swamp in Kombat Village. Travel from Kombat Village to Tambun Field Station. Conduct nocturnal survey of fish ponds and rice fields in Tambun Village.
- 29 July Visit Maleo nesting area at Tambun Field Station and observe birds. Visit Oboy Village along Pusian River and interview residents. Also visit crocodile nesting area along Pusian River. Conduct nocturnal survey of ricefields and wet grasslands surrounding Tambun Village.
- 30 July Depart Tambun Field Station and return to Manado. Visit wildlife rehabilitation center near Bitung in afternoon.
- 31 July Depart Manado. Fly to Singapore and overnight.
- 1 August Depart Singapore and fly to New York.
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Appendix 2: List of training and survey participants.

Name	Institutional affiliation
Hunowu, Iwan	Wildlife Conservation Society, Indonesia Program, Manado.
Kosegeran, David	Wildlife Conservation Society, Indonesia Program, Tambun Field Station.
Linelejan, Verra	Department of Agriculture, Sam Ratulangi University, Manado.
Pajan, Livemy	Department of Agriculture, Sam Ratulangi University, Manado.
Siwu, Stephan	Wildlife Conservation Society, Indonesia Program, Manado.
Usman	Wildlife Conservation Society, Indonesia Program, Gorontalo.
Wongkar, Franky R.	Department of Agriculture, Sam Ratulangi University, Manado.

Appendix 3: Summary of training course, recommendations, and syllabus.

A training course in turtle biology and research methodology was conducted at the WCS Office in Manado from 3-5 July 2006. Participants included three WCS field staff and three local graduate students (Appendix 2). A syllabus listing the topics covered is presented below. Participants were given the syllabus to use as an outline during the course, which greatly facilitated language comprehension and note-taking. While most of the participants were not fluent English speakers, simultaneous translation did not prove necessary. It has been my experience that when simultaneous translation is required, the amount of material that can be delivered and the technical scope of the presentation becomes limited (meaningful translation of technical jargon is extremely difficult). Concepts and methods covered during the training were later integrated into the field surveys and emphasized throughout my time in Sulawesi. Perhaps the single greatest impediment to capacity building that I identified during the training course is the difficulty that local WCS staff and students have in accessing international peer-reviewed scientific literature (see recommendations below).

Recommendations

1. Provide means for local WCS staff and students to access electronic journals held by WCS library in New York.
2. Conduct future training courses using native Bhasa speakers from WCS Indonesia Program.
3. Involve government conservation staff in training, particularly those tasked with stewardship of protected areas in Sulawesi.

Training syllabus.

I. Introduction

- A. Overview of Sulawesi turtles (diversity and species identification).
 1. *Cuora amboinensis*
 2. *Indotestudo forstenii*
 3. *Leucocephalon yuwonoi*
- B. Threats to populations (habitat destruction, over-harvesting).
- C. Conservation.
- D. Objectives of this project.

II. Field methodology

- A. Interview surveys of local inhabitants – target hunters, farmers and others who spend time in turtle habitat. These individuals can provide a wealth of information concerning the local turtle fauna.
 1. Questionnaires and photo arrays.
 2. Informal interview techniques.
 3. Exercise caution when interpreting local “folk taxonomy” (i.e., local names).

4. Examine captive turtles; salvage shells and other remains from villagers for voucher specimens.

B. Methods for collecting turtles – local hunters and villagers can be especially helpful.

1. Aquatic turtles – traps, nets, snorkeling, etc.
2. *Indotestudo forstenii* – time constrained searches using people and dogs.
3. *Leucocephalon yuwonoi* – time constrained nocturnal searches with headlights.
4. Time constrained searches quantify search effort as the number of turtles found per man- or dog-hour of searching. One person or one dog searching for one hour constitutes one man- or dog-hour of search effort. To determine the total number of man- or dog hours expended during a survey, multiply the number of people and dogs participating in a survey by the number of hours (to the nearest 15 minutes) spent searching. For example, if three people and two dogs searched for turtles from 1600 to 1800 hours, then six man-hours and four dog hours were spent looking for turtles.
5. Hunting dogs – generally much more efficient at finding terrestrial turtles and tortoises than people. Their use is highly recommended if dogs are available.

C. Collection of biological data

1. Field notes and maintaining a field notebook.
2. Explanation of data sheets (see attached).
3. Morphometric data – carapace length and width, plastron length and width, shell depth, mass. Measured with tree calipers (or dial calipers for smaller turtles). Mass readily determined with hanging scales.
4. Scute nomenclature – presence or absence of nuchal scute in *Indotestudo forstenii*.
5. Techniques for sexing turtles (males typically have larger tails than females; males may also exhibit a pronounced plastral concavity.). Adult *Indotestudo* and *Leucocephalon* are easily sexed. Immature turtles can prove difficult to sex.
6. Methods of marking turtles and numbering system (see attached sheet). Marks should be permanent, but not harm or interfere with the turtle. Notching marginal scutes is a permanent, inexpensive, and easily applied method to use in the field.
7. Mark-recapture studies and long-term population monitoring.
8. Size class distribution and use in population assessment.
9. Natural history observations (e.g., fecal collection for determination of diet).

10. Photographing turtles and the importance of photographic vouchers.

D. Habitat descriptions

1. Physical characteristics (e.g., topography, altitude, etc.).
2. Environmental characteristics (e.g., air and water temperature, water chemistry, soils, etc.).
3. Vegetation
 - a. General description (e.g., primary forest, second-growth forest, grassland, etc.).
 - b. List dominant plant species.
4. Anthropogenic modifications (e.g., shifting cultivation, ricefields, livestock grazing, etc.).
5. Photograph habitat (“One picture is worth a thousand words”).

E. Application of GPS and GIS technologies to field studies and surveys.

1. Operation of hand-held GPS units.
2. Topographical maps and orienteering.
3. ARC View, Google Earth, etc.
4. *****It is extremely important to record accurate locality data during field surveys.

III. Preparation of scientific manuscripts and technical reports.

- A. The need for presenting results of scientific investigations.
- B. Explanation of the peer review process.
- C. Audience for technical reports.
- D. Preliminary library research (including accessing literature), citing literature, and plagiarism.
- E. A word on internet sources.
- F. Components of the scientific report.
 1. Abstract
 2. Introduction
 3. Study site and methods
 4. Results
 5. Discussion
 6. Acknowledgments
 7. Literature cited
- G. Components of the technical report
 1. Title page
 2. Executive summary
 3. Acknowledgments
 4. Introduction and background material
 5. Study site and methods
 6. Results
 7. Discussion
 8. Literature cited
 9. Appendices

Appendix 4: Summary of a visit to the Gibbon Foundation wildlife rehabilitation center and recommendations for establishing a WCS turtle rescue center and assurance colonies of endemic Sulawesi chelonians.

On 30 July 2006 we visited a wildlife rehabilitation center near the port city of Bitung about 60 km northeast of Manado. The purpose of our visit was to assess the possibility of collaborating with the center in establishing a turtle rescue program and captive assurance colonies for endemic Sulawesi chelonians. The latter are urgently needed given the difficulties of legally obtaining sufficient numbers of Sulawesi endemics to establish assurance colonies outside of Indonesia. Additionally, commercially obtained *Leucocephalon yuwonoi* are often in poor health and extremely difficult to maintain in captivity, and with one exception, captive breeding has proven unsuccessful (Innis, 2003). This is thought to be due in part to physical stress and exposure to pathogens engendered by the unsanitary conditions the turtles are subjected to while being held by reptile dealers (Innis et al., 2002). Establishing assurance colonies in Sulawesi would avoid many of the problems associated with previous efforts to propagate *L. yuwonoi* in captivity.

The center is situated on a 52 ha site and operated jointly by the Balai Konservasi Sumbar Danga Alam (BKSDA) and the Gibbon Foundation (GF), with most funding provided by the latter. The mission of the center is to rehabilitate animals (primarily birds and mammals, but also reptiles) confiscated by government conservation authorities with the eventual goal of repatriation to the wild. The facility is not engaged in the captive propagation of any species in accordance with stipulations of their permit. Because Bitung is a major port with links to other islands in Indonesia as well as the Philippines and Irian Jaya, a variety of species end up at the facility, including many that do not occur in Sulawesi.

The facility is normally closed to public visitation, but an exception was made for our team. Unfortunately we were not allowed to take photographs during our visit, but other than a quarantine area, were permitted to inspect the entire facility. The state-of-the-art facility is well maintained with clean, spacious enclosures, a modern kitchen, and fully equipped veterinary clinic. Furthermore, the staff seems knowledgeable, dedicated, and highly competent. Most importantly, the animals we observed appeared to be well treated and in excellent physical condition.

The facility has a battery of 20 well-designed tortoise enclosures, each measuring 3 × 4 m and equipped with a shallow pool and small shelter. Ten adult *Indotestudo forstenii* were present in these pens during our visit. Reportedly these animals were destined for the pet trade and confiscated at an airport in southern Sulawesi. According to the staff these tortoises were slated for repatriation, although a suitable release site had yet to be identified.

Although the GF may be interested in collaborating with WCS to establish a turtle rescue center and assurance colonies, several potential drawbacks to such an arrangement must be considered. Foremost are stipulations of their government license prohibiting the

GF from engaging in the captive propagation of any species. Amending the license is possible, although this would likely prove to be a lengthy process involving a maze of government bureaucracy with no guarantee of success. Furthermore, the GF facility is located at a rather remote site and closed to the public; consequently opportunities to develop conservation education and community outreach programs are extremely limited.

Based on the results of our visit to the GF facility, John Tasirin (WCS Indonesia Program Coordinator for Sulawesi) and I concur that the most feasible plan is for WCS to obtain several hectares of land on the outskirts of Manado and independently develop a turtle rescue center and assurance colonies. A sufficiently large parcel of land can be obtained relatively cheaply and the technical expertise for training Indonesian staff is available through the Reptile Department at the Bronx Zoo. The possibility of signing a memorandum of understanding between WCS, GF, and BKSD to supply confiscated turtles for stocking the assurance colonies should be explored. Finally, public education programs must be a major focus of the WCS rescue center.

Appendix 5: Translated questionnaire designed and used by WCS staff during preliminary interview survey conducted in June 2006.

Interviewer: _____ Date: _____

Respondent: _____.

Name of location and GPS coordinates: _____.

Occupation (check one):

Farmer: _____. Fisherman: _____. Government employee: _____. Retired: _____.

Self-employed: _____. Village leader: _____. Other: _____.

1. Have you seen turtles? _____. (If yes, present photo array).
2. What species? *Cuora*: _____. *Leucocephalon*: _____. *Indotestudo*: _____.
3. Where? River: _____. Marsh: _____. Roadside: _____. Irrigation canal: _____. Forest: _____. Other: _____.
4. When did you last see turtles:
<1 yr: _____. <2 yr: _____. <3 yr: _____. <4 yr: _____. <5 yr: _____.
5. Have you seen turtles in the market? (If yes, go to question #6. If no, go to question #7.).
6. When did you see turtles in the market?
<1 yr: _____. <2 yr: _____. <3 yr: _____. <4 yr: _____. <5 yr: _____.
How many turtles were in the market: _____. What was the price: _____.
7. Has anyone asked you to sell them turtles? Yes: _____. No: _____.
When were you asked to sell turtles?
<1 yr: _____. <2 yr: _____. <3 yr: _____. <4 yr: _____. <5 yr: _____.
8. Do you ever catch turtles? Yes: _____. No: _____.
If yes, how many do you catch: _____.
Why do you catch them: _____.
How do you catch them: _____.
When did you last catch turtles?
<1 yr: _____. <2 yr: _____. <3 yr: _____. <4 yr: _____. <5 yr: _____.

9. How often do you go to the river, marsh, or other turtle habitat?
Everyday: ____ . Twice each week: ____ . Once each week: ____ .
Twice each month: ____ . Once each month: ____ .
Less than once each month: ____ .

10. Have you found any other species of turtles? If so, please describe them:
_____.

Additional notes, comments, etc.

Appendix 6: Summary of fieldwork conducted from 7 to 30 July 2006 in Gorontalo and Northern Provinces of Sulawesi. Surveys are summarized chronologically by location. GPS coordinates for these locations can be found in Appendix 7. Morphometric data for all specimens examined are included in copies of field notes archived in the Campbell Museum, Clemson University, Clemson, South Carolina, USA.

7 July

Our initial surveys were conducted in the northernmost region of the Minahasa Peninsula, north of Manado. Wallace (1869) described this area as heavily forested, although even at that time clearing and establishment of plantations was underway. Little natural forest now remains and the region is largely given over to extensive coconut and clove plantations with lesser areas of paddy rice. The dense understory of open canopied coconut plantations may provide habitat for some wildlife, including turtles.

I. Batu Village

We interviewed 15 to 20 villagers at the residence of the Chief. Villagers maintain that three species of chelonians are present in the area: *Cuora amboinensis* is said to be common, while *I. forstenii* and *L. yuwonoi* are considered very rare. Although local identifications must be interpreted cautiously until verified by actual specimens, one woman who brought the team six *C. amboinensis*, maintained that a species other than *Cuora* occurred along the river. This species purportedly has serrated marginal scutes, a description that is consistent with juvenile *L. yuwonoi*. *Indotestudo forstenii* is likewise reputed to inhabit the area, although we saw nothing that appeared to be suitable tortoise habitat. However, one villager described capturing a large turtle that deposited a small clutch of eggs, and the size, shape, and texture of the latter were consistent with *Indotestudo* eggs.

Cuora amboinensis appears to be very common in the surrounding area, and villagers report that *Cuora* frequently wander into the village. Large numbers of *C. amboinensis* are often found when villagers clear swamps to plant rice. We visited two of these swamps where *C. amboinensis* is regularly encountered. These habitats are low-lying swales between hills, spring-fed with standing water, and dominated by dense herbaceous vegetation and grasses with scattered palms (*Metroxylon* spp.). We examined eight *C. amboinensis* that were collected in nearby fishponds and kept as pets by the villagers.

II. Werot Village

According to a small group (ca. 10) of villagers that we interviewed, *C. amboinensis* is common in swamps near the village (see habitat description above). One individual described a turtle that may have been *L. yuwonoi*, but added that this species had not been encountered in recent years. One villager had a living *Eretmochelys*

imbricata (CL = 46.9 cm) recently captured at a nearby beach. The villagers planned to butcher and eat the turtle at an upcoming party.

III. Exploitation

There appears to be little if any, harvest of turtles for commercial or subsistence reasons in this area. A few people eat turtles (marine turtles excepted), but this practice is not widespread and apparently somewhat opportunistic. A number of villagers indicated that turtles are frequently kept for pets or curiosities and then released after a short time. Indeed, all of the turtles we examined at Batu Village were pets of village children.

10 to 11 July

We visited two sites on the eastern coast of the northern Minahasa Peninsula: Toluan Village and Woau. The latter is an agricultural area, rather than a village, and the name roughly translates to “the place where turtles live”. Little if any pristine habitat remains. The region is best described as steep, rugged terrain with coconut and clove plantations throughout. Anthropogenic grassland is present on low hills along the coast. Several small *Nippa* sp. swamps occur in depressions to the rear of coastal beaches.

I. Toluan Village

This village located on a beach regularly used for nesting by *Chelonia mydas*. Villagers initiated a community-based marine turtle conservation project to protect the nesting turtles and the potential exists to include other species under the umbrella of this project. According to the villagers, *Cuora amboinensis* and at least one other species of turtle occur in the region. The identity of the latter is problematic. Villagers refer to this species as the “white turtle” (=kuru kuru putih) and it is said to inhabit swamps and rocky streams. This description probably refers to *L. yuwonoi*, but when presented with a photo array the villager’s selected *I. forstenii*.

We conducted two surveys of Tabuu Swamp, a wetland near the village said to be inhabited by turtles. This small (ca. 2 ha) freshwater swamp is located on the leeward side of a beach ridge within 100 m of the high-tide mark. The vegetation is characterized by an overstory of *Nippa*, coconut, and *Pandanus* sp. Villagers assert that the swamp is inhabited by the “white turtle” and *C. amboinensis*. We collected three of the latter; one in the afternoon and two during a nocturnal spotlight survey. Two of these turtles were found submerged in shallow water concealed beneath palm debris. The third was actively foraging in shallow water when found. These turtles were marked and released the following day. We also measured and marked three additional *C. amboinensis* captured by villagers in a low area immediately adjacent to the village. Interestingly, there is a widespread belief among those we interviewed that *C. amboinensis* produces nocturnal vocalizations that are audible to the human ear.

II. Woau

This site is located in the midst of an extensive coconut and clove plantation in the rugged hills surrounding the village of Lalumpay. An intermittent stream in the bottom of a deep ravine is said to be inhabited by turtles, including *C. amboinensis* and the enigmatic “white turtle”. Because turtles are commonly encountered in the ravine and on the adjacent hillsides, the area has been dubbed Woau (=the place where turtles live) by the local populace. Large clumps of bamboo and dense herbaceous vegetation grow along the streambank making access difficult. There was little flowing water in the stream during our visit, but frequent isolated pools were present in the rocky streambed. We conducted a survey of the streambed in the early evening of 10 July and found an adult *C. amboinensis* concealed in a shallow pool beneath woody debris. We returned on the morning of 11 July and with the assistance of two area farmers, followed the streambed for 1-2 kilometers. During this survey, a juvenile *C. amboinensis* was found under a rock in a shallow, sunlit pool. Additionally, we examined an adult *C. amboinensis* being kept as a pet in Lalumpay Village that was reportedly collected in Woau.

III. Exploitation

Similar to other areas of the northern Minahasa Peninsula, we found nothing to suggest that commercial or subsistence harvesting of turtles is occurring. The villagers occasionally capture turtles that are opportunistically encountered in their plantations or along streams, but these animals are generally kept only a short while before being released.

IV. Conclusion

Based on our field surveys of Tabuu Swamp and Woau, it appears that *C. amboinensis* is common in this region and under little if any threat from subsistence or commercial exploitation. Likewise, because *C. amboinensis* is frequently encountered in highly modified agricultural areas, it is likely that habitat destruction poses a minimal threat to *C. amboinensis* populations at this time.

13 to 14 July

Tulabolo Village

Two days were spent at this small village on the western boundary of Dumoga-Bone National Park. The village is located on the southern bank of the Bone River and only accessible by a dilapidated suspension bridge. The habitat surrounding the village is largely secondary forest with high gradient streams flowing from the surrounding hills. During our stay at Tulabolo Village we conducted nocturnal surveys of Bulaboo Creek, Bulaboo Daa Creek, and the Tanggi River. Bulaboo Creek is a small, shallow, high gradient stream flowing from a hillside spring through a deep, narrow channel. Bulaboo Daa Creek is similar, and both creeks flow through secondary forest. The Tanggi River

is a large boulder-strewn creek flowing through secondary forest and farmland. Our nocturnal surveys netted a single adult *Cuora amboinensis* from both Bulaboo Creek and the Tanggi River; no turtles were found on Bulaboo Daa Creek. The *C. amboinensis* captured in the Tanggi River was found swimming upstream in a swift flowing section. Numerous frogs, freshwater crabs, and small snakes were encountered on these creeks during nocturnal surveys.

Although we failed to locate *Leucocephalon yuwonoi* during nocturnal surveys of this area, a villager claimed to have captured a specimen about three years ago in a cacao and coconut plantation along Bulaboo Creek. Additionally, during a preliminary survey Usman interviewed several rattan collectors from Pinogu Village, a populated enclave deep within Dumoga-Bone National Park. These individuals reportedly observed a group of four *L. yuwonoi* feeding on a *Colocassia* tuber after first excavating a hole to expose the root. The interview data garnered in Tulaboo and Pinogu Villages suggest that *L. yuwonoi* occurs within Dumoga-Bone National Park.

We found little evidence of an on-going commercial harvest of any species of chelonian in Tulaboo Village. However, according to villagers an agent visited the area twice weekly during 2002 to purchase turtles. The villagers sold a large quantity of *C. amboinensis* to the agent, but after about 12 months of collecting turtles became difficult to find in quantities sufficient and visits by the trader ceased.

15 July

Pareteis Lake

This is a large (ca. 3 km long), heavily vegetated lake surrounded by agricultural plantations in Suwawo, an outlying hamlet near Gorontalo. We interviewed several residents who stated that *Cuora amboinensis* remains common along the lake margin. One individual selected *Indotestudo forstenii* from our photo array and indicated that a single specimen was found near the lake in 2002. Although the habitat appeared unsuitable for *I. forstenii*, a nearby tract of forest was being cleared at the time and this record might represent a displaced tortoise.

During 2002 villagers collected more than 100 *C. amboinensis* each month to sell to an agent that visited on a regular basis. Collecting continued for about one year, but ceased when the agent stopped visiting the village. This was probably the same buyer who visited Tulaboo Village during 2002. The villagers are no longer collect turtles for to sell commercially.

16 to 18 July

We established a base of operations in Wanggarasi Timur Village, conducted surveys of the surrounding hills and creeks, and interviewed inhabitants of nearby villages. Wanggarasi Timur Village is located in the coastal lowlands along the main highway linking Manado and Palu. Hills rising to > 200 m are within easy walking

distance of the village. Agricultural lands extend into the hills with even steep slopes under cultivation, and selective logging is carried out by villagers in remaining hillside forests. Large mangrove swamps that reputedly harbor estuarine crocodiles (*Crocodylus porosus*) occur along the coast within several kilometers of Wanggarasi Timur Village. We observed a captive adult *C. porosus* (total length ca. 250 cm) recently captured in these swamps and villagers maintain crocodiles remain common.

I. Wanggarasi Timur Village

We accompanied a party of villagers with two hunting dogs into the forested hills north of the village to search for turtles on 16 and 17 July. The terrain is rugged, very steep (60-70°), and covered in dense second growth forest that became established after the primary forest was logged in 1990. The villagers reportedly capture turtles on these hillsides, although it was unclear which species is taken. From the description they provided, *Indotestudo forstenii* was the most likely candidate, but several villagers selected *Leucocephalon yuwonoi* from the photo array. It is possible that both species occur on these slopes. We accompanied villagers to dense thickets of bamboo (*Schizostachyum* sp.) at an altitude of 255 m where turtles are occasionally found under leaf litter and concealed in forms at the base of bamboo clumps. We searched for turtles using village dogs but found nothing.

According to villagers, *I. forstenii* are occasionally caught by the forelimbs in snares set for small mammals and birds on the forest floor. We visited the site of one such snare where a tortoise was reportedly taken approximately one month ago. The tortoise died while in the snare and was left in the forest. We searched unsuccessfully among the dense undergrowth for the shell. Hunters claimed to have observed *I. forstenii* in this area consuming monkey feces and also “white worms” (probably beetle grubs) that inhabit rotting logs. The former undoubtedly contains undigested vegetation and fruit pulp that can be utilized by the tortoises.

A single adult male *Indotestudo forstenii*, captured in April 2006 in the hills nearby, was being held by a villager pending sale to a dealer in Marisa. The carapace measured 26.3 cm and lacked a nuchal scute. On 17 July we accompanied two villagers to the site where the tortoise was captured in the hills above Wanggarasi Timur Village. The capture site (XXXXXXGPSXXXXXX) was located on a steep slope at an altitude of 130 m. Villagers found the tortoise in secondary forest on the edge of an agricultural field while felling timber, after being alerted by their dog. The forest surrounding the capture site is characterized by a dense understory beneath a relatively open canopy.

Two adult *Leucocephalon yuwonoi* were reportedly found in a palm swamp on the edge of the village during the previous four years. We visited the site on 17 July, but the swamp was dry. We also conducted a nocturnal survey of Wanggarasi Timur Creek on the night of 18 July. This creek appears to be suitable habitat for *L. yuwonoi* and flows through a patchwork of agricultural land and secondary forest. We assembled into two teams at a bridge on the outskirts of the village; one team then proceeded upstream and the other went downstream, but neither encountered any turtles.

II. Pundtu Daa Island

This large (~5 km²) island, located about 200 m offshore from Wanggarasi Timur Village, is afforded village-level protection and has never been logged. Other than limited fuelwood cutting and extraction of non-timber forest products, the island appears little-visited and largely undisturbed. Local legends regarding large snakes that reputedly inhabit the island may be partly responsible for the relatively pristine conditions. The vegetation covering the island is best described as dense, low-growing forest with an almost impenetrable understory of thorny creepers and vines. A large hill mass rising to about 100 m dominates much of the island.

Several villagers in Wanggarasi Timur told us that they have encountered *L. yuwonoi* while gathering firewood and other forest products on the island. One villager indicated that he recently came upon several intact turtle shells in dense scrub near the beach. We accompanied this individual to the island on 18 July, but our guide was unable to relocate the shells. The xerophytic nature of the vegetation appeared more typical of *Indotestudo* than *Leucocephalon* habitat calling into doubt the identifications of our informants.

III. Sukadamae Village

This village is located several kilometers from Wanggarasi Timur Village on the Manado to Palu Highway. We visited the village on 18 July and interviewed a crowd of residents. These individuals stated that “yellow turtles” (probably *L. yuwonoi* based on selections in the photo array) were common in adjacent secondary forest and most easily found during wet periods in September and October. One villager kept a “yellow turtle” as a pet for about a week before releasing it on the day prior to our visit. Another villager kept an adult *Cuora amboinensis* as a pet; we examined and measured this turtle. We also recovered the remains of an adult *C. amboinensis* from a small creek behind the village. According to our hosts, his turtle died when villagers poisoned fish in the creek using a mixture of expired pharmaceuticals.

IV. The “White Turtle”

Several persons in Wanggarasi Timur and Sukadamae Villages mentioned the local occurrence of the “white turtle”. Initially we assumed this was a reference to *Leucocephalon yuwonoi*, but after viewing our photo array these individuals stated they were familiar with the three species shown, and that the white turtle was definitely not among those pictured. At this time we are unable to ascertain whether the “white turtle” is the local designation for *L. yuwonoi* or a reference to a hitherto undescribed taxon.

V. Exploitation

Some evidence of commercial trade was noted in Wanggarasi Timur Village. Several people reportedly harvest turtles in the area, which are sold to a trader in Marisa. This activity seems limited in scope; one villagers caught 8 turtles several weeks prior to our visit, and another caught “about 20” approximately six months previously. It was unknown which species of turtles were being collected. This catch appears to be largely opportunistic; i.e., villagers collect turtles during chance encounters while engaged in other pursuits. People collect turtles to generate extra income and we were unable to locate any professional turtle hunters in this area. In contrast, we found no evidence of even opportunistic harvesting of turtles in nearby Sukadamae Village.

19 July

Balayo Village

We received numerous reports of *Indotestudo forstenii* from inhabitants of this village, who repeatedly selected tortoises from photo arrays during independent interview sessions. According to the villagers, tortoises occur in second-growth forests and nearby agricultural fields and plantations. While tortoises are occasionally kept for brief periods as pets, we found no evidence of commercial harvesting.

On the morning of 19 July we visited a homestead on the edge of the village (XXXXXGPSXXXXXX; altitude = 25 m) that overlooks a large grass (*Saccharum* sp.) swamp. The farmer indicated that *Cuora amboinensis* and *Leucocephalon yuwonoi* occur in the swamp, while *I. forstenii* is found in the adjacent forested hills. We obtained the partially burned carapace of a *C. amboinensis* that perished during a recent land-clearing fire. Later in the afternoon we returned, and using machetes cut our way through the swamp while searching for turtles. These efforts yielded an adult *C. amboinensis* that was found among dense grass. The swamp was almost dry at the time of our survey, but floods at the onset of the wet season.

20 to 21 July

Panua (Maleo) Village

We interviewed two former professional bird trappers in the village. These individuals trapped red junglefowl and doves in the nearby Panua Nature Reserve, which were sold in local markets for food. The birds are trapped using snares of monofilament fishing line placed in long lines (up to 60 snares/trapline) on the forest floor; brush fences partially obstruct game trails and channel the birds into snares. These “twitch-up” snares are set at ground level and designed to catch the bird by its feet, jerking it into the air when a rather complicated triggering device is tripped. During two years of bird snaring the trappers caught 10 to 20 *I. forstenii* and *L. yuwonoi*. The turtles were generally caught by a foreleg while following the same trails as the birds. Because bird snares are checked once or twice daily, the turtles suffered no mortality, and having little if any commercial value, were released by the trappers. On 21 July the trappers guided us to their former trapping area and demonstrated methods of snare construction and

deployment. The site (XXXXXGPSXXXXXX; altitude = 2 m) was in second growth forest with a dense understory of vines, creepers, and saplings on flat coastal plain within 1.0 km of the beach. The trappers also reportedly observed *I. forstenii* grazing on grass or sedges in the forest understory.

We found no evidence of commercial exploitation of turtles in Panua Village. Several people told us that about one year ago an agent from Marisa visited the village and made arrangements to purchase turtles. However, the agent failed to return and the turtles were later released.

22 to 23 July

Bolontio Village

Most people that we interviewed were unfamiliar with turtles other than *C. amboinensis*, which appears common in the coastal lowlands surrounding the village. One farmer claimed to have captured and released a large (ca. 5 kg) *I. forstenii* about five months previously. None of the individuals we spoke with were aware of any commercial turtle collecting in the area. We also interviewed rattan collectors in the hills above the village. These individuals occasionally encounter *I. forstenii*, *L. yuwonoi*, and the enigmatic “white turtle”. Rattan collectors were adamant that the latter was not one of the three species pictured in our photo array. We accompanied two rattan collectors into the nearby hills to sites where they independently encountered two “white turtles” within the previous 6 months. Both sites were shallow, mesic ravines with small springheads at elevations of about 400 m. The first site (XXXXXGPSXXXXXX; altitude = 397 m) was a springhead with water trickling into small pools among rocks, surrounded by dense succulent vegetation under a relatively open forest canopy. We were unable to obtain a GPS reading at the second site, located approximately 300 m east of site #1. Site #2 was similar to the first except that understory vegetation at the springhead was minimal. These sites were above a small-scale gold mine where mercury is used to remove gold from dirt and then flushed directly into streams.

We conducted a nocturnal search for *L. yuwonoi* on Tonalá Creek, a high gradient stream that crosses a road about 1 km from Bolontio Village. The stream consists of a series of pools linked by swift flowing sections that cascade over small waterfalls. Our upstream progress was eventually halted by a series of high waterfalls (>20 m) that could not be safely climbed at night. We returned to the road crossing and then followed the creek downstream into farmland near the village until further progress was impeded by deep water. We found no turtles either up- or downstream from the road crossing.

25 to 26 and 28 to 30 July

Dumoga River Valley

This region was settled as part of a large transmigration project during the 1960's and 1970's when large numbers of Javanese were encouraged to settle in the river valley with offers of cheap farmland (Davis, 1988). As a result of large scale settlement, the lowland tropical forests in the valley were largely replaced with paddy rice agriculture. The adjacent Dumoga-Bone National Park was later established to protect the watershed of this rice growing region which is heavily dependant on surface runoff for irrigation (Goodland, 1988). We established a base camp at Tambun Field Station on the boundary of the national park and then visited a number of villages in the Dumoga Valley, including Kembang Marta, Doloduo, Mopugad, and Tanbun. Each is discussed below.

I. Doloduo Village

According to residents, three species of turtles are present near the village. Children are said to occasionally find *I. forstenii* in riparian forest along the river and *C. amboinensis* are often taken in fish traps and in wetlands and vegetated fishponds surrounding the village. The latter are regarded as especially common. We visited a site on the edge of the village where a *L. yuwonoi* was found about two years ago while grazing on aquatic *Ipomea* sp. among sedges and dense grass along the margin of a large lake.

II. Kembang Marta Village

This village was established in about 1963 by trans-migrants from Bali. Most of the inhabitants are Hindu and many households maintain small, walled shrines where turtles are sometimes kept for religious reasons. We examined a single *C. amboinensis* in one shrine. According to the owners, these turtles are often found in grass swamps and natural wetlands in the Dumoga River floodplain.

III. Mopugad Selatan Village

Like Kembang Marta, the inhabitants of this village are largely Hindu's originating from Bali. We examined 5 *C. amboinensis* kept by the villagers in a shrine. One of these turtles was captured from a small, swift-flowing creek that runs through the village, while the others originated from herbaceous wetlands adjacent to rice-fields. The inhabitants were unfamiliar with any species of turtle other than *C. amboinensis*.

IV. Tambun Village

We visited a fish farmer near the Tambun Field Station who reported that *C. amboinensis* are common in his ponds, ditches, and vegetated reservoirs. We conducted a nocturnal survey of the fish farm, but found no turtles. The following day, one of the field station personnel captured an adult *C. amboinensis* in a small (4 × 4 m) pond in the midst of the village. We measured the turtle and then returned to the village to release it. A number of children who accompanied us to the capture site indicated they were

familiar with *Cuora* as well as a second species inhabiting the fish ponds. When presented with the photo array, some children identified the second species as *L. yuwonoi* while others selected *I. forstenii*. Regardless, the youngsters were adamant that a second species other than *C. amboinensis* was to be found in the immediate environs of the village. We conducted two nocturnal surveys in the village (28 and 30 July), but found no turtles; however, we did obtain five *C. amboinensis* from villagers, all reportedly captured in nearby wetlands. On the day of our return to Manado we visited the home of a village youngster who had released a “yellow turtle” only two days previously. This individual selected *I. forstenii* from the photo array. During the interview other villagers maintained that all three species are present in the area, with *I. forstenii* being found in hillside forests and *L. yuwonoi* occasionally encountered in the same wetlands that harbor *C. amboinensis*. These reports are consistent with what is known regarding the respective habitat preferences of each species.

V. Tabun Creek

We conducted a nocturnal survey of this small, swift-flowing creek emanating from hills within the national park, but found no turtles. The presence of stick weirs and a number of dead eels indicated the stream had recently been poisoned by villagers. This method of harvesting fish is apparently widespread in the area. We were unable to ascertain the chemical used or what effect it has on aquatic turtles.

VI. Exploitation

We found evidence of a limited subsistence harvest of turtles in the Dumoga River Valley. Five *C. amboinensis* that we examined in Tambun Village were allegedly collected for personal consumption. Likewise in Kembang Marta Village a few individuals purportedly eat turtles. These were the only instances of subsistence harvest we noted during the expedition. Except among the Chinese community, consumption of turtles appears extremely rare in Sulawesi. Muslims are forbidden by the Koran to consume turtles and among Christians (the predominant group in Minahasa), eating turtles is socially unacceptable, although the reasons for this are unclear.

27 July

Kombot Village

According to villagers, *C. amboinensis*, *I. forstenii*, and *L. yuwonoi* are known to occur in the forests and wetlands surrounding the village. *Cuora amboinensis* is said to be particularly common, and both *C. amboinensis* and *L. yuwonoi* have been found in weedy areas of the village. With the assistance of an enthusiastic group of local youngsters, we conducted a nocturnal survey of the Tonop River. This small river originates from a large spring on the edge of the village and flows about 1 km to the ocean. Unfortunately the village lacks sewerage facilities and the riverbanks serve as a community defecation site. The large quantity of fresh human feces presented serious health concerns during our investigation. The habitat along the riverbank is largely

coconut plantation and coastal scrub. We captured two adult *C. amboinensis* in the river during our nocturnal survey; one was found under an over-hanging bank and another buried in mud beneath a submerged palm frond. The following morning we collected a juvenile *C. amboinensis* from a small swamp in the village. We also obtained a fourth *C. amboinensis* that was found in a nearby field.

Like most places in northern Sulawesi, we found no evidence of subsistence or commercial exploitation of turtles. The villagers told us that about 2 years ago a Chinese businessman from Kotamobagu regularly visited Kombot to purchase turtles. However, the visits have since ceased and turtles are no longer being collected. Villagers estimated that about 100 turtles, mostly *C. amboinensis* were collected and sold to the buyer. Villagers formerly employed an interesting pitfall trap to capture turtles along the Tonop River. An inverse cone-shaped pitfall (widest at the bottom) was excavated in soft soil along the river and baited with banana, papaya, or coconut meat. The sloping walls of the pitfall prevented captured turtles from climbing out. Normally 10 to 20 traps were constructed, baited in the late evening, and checked the following morning. On occasion the traps proved quite successful, catching as many as 0.5 turtles/trap. Both *C. amboinensis* and *L. yuwonoi* were taken by this means.

29 July

Obuy Pusian Village

We interviewed several groups of farmers living along the Pusian River. After viewing our photo array, these individuals stated that *C. amboinensis*, *I. forstenii*, and *L. yuwonoi* occur in the nearby banana and coconut plantations on a natural levee of the river. *Cuora amboinensis* has been observed feeding on ripe bananas. One of the farmers unearthed a bloated *C. amboinensis* carcass from the perimeter of his plantation. The ethnic Mongondow inhabiting this area believe that *C. amboinensis* are endowed with the ability to ward off floodwaters. To protect their homes and property, they chop off the legs of a living *C. amboinensis* to prevent it from fleeing. The turtle is then buried with its plastron facing the anticipated path of the floodwaters. According to the local belief, the plastron will deflect the approaching floodwaters, which pass around the turtle and the farmers' property rather than over it.

Appendix 7: Gazetteer. Place names in agreement with Nelles[®] map of northern Sulawesi, except for Bolontio and Kombot Villages (incorrectly shown on Nelles map as “Bolonito” and “Kompot”, respectively). Local names (spelled phonetically) used for places not shown on map. Coordinates determined with a Garmin[®] 12 GPS unit.

ATCN Note: Villages and coordinates removed.