Turtles on the Brink in Madagascar: Proceedings of Two Workshops on the Status, Conservation, and Biology of Malagasy Tortoises and Freshwater Turtles
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Conservation of the Angonoka (Ploughshare Tortoise), *Astrochelys yniphora*

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Abstract. – We describe the conservation history of the Angonoka, or Ploughshare Tortoise (*Astrochelys yniphora*), that has led to its current status as the world's rarest tortoise. Because of the scale of poaching that threatens this tortoise and the fact that individuals are illegally sold around the world, conservation of this species is a truly global problem. The 2011–2013 wild population size is estimated to be 600 individuals (carapace length > 200 mm) down 33% from the 2006–2008 estimate of 900. We conclude that at least a similar number are being held illegally. We believe that significantly marking all animals by engraving will help to reduce this international trade. We review our current anti-poaching efforts and new *ex-situ* colonies composed of animals already confiscated from the illegal trade. This species requires extraordinary measures and a coherent global strategy to prevent its further decline.

Key Words. – Reptilia, Testudines, Testudinidae, *Astrochelys yniphora*, Ploughshare Tortoise, Plowshare Tortoise, Madagascar, illegal wildlife trade, captive breeding, reintroduction

The Angonoka, or Ploughshare Tortoise (*Astrochelys yniphora*), is arguably the most difficult problem in tortoise conservation and one of the most difficult problems in all of conservation. It occupies one of the smallest natural ranges of any extant tortoise species, being endemic to a tiny area around Baly Bay in northwestern Madagascar and it is one of the world's rarest tortoises, with perhaps 400–600 adults remaining in the wild. Although this species was exported for food in large numbers in the 19th Century and has long-been threatened by bush fires in its native habitat, it is illegal collection for the international animal trade, due to its extraordinary value, that has caused it to become ranked as Critically Endangered under IUCN Red List criteria and listed in Appendix I of CITES (Leuteritz and Pedrono 2008).

It is quite possible that the majority of individuals now occur in illegal captive collections outside of the natural range and habitat of this species. Because of this and the fact that the remaining wild population of Ploughshares is so depleted, conservation of the species has become a truly global problem. Conservation planning must consider how to best utilize all extant individuals. Further, we know from the experience of the Asian Turtle Crisis that we must use all possible tools for the conservation of this species. We must adopt an ecumenical approach in which the effective use of one particular conservation tool must not prevent the effective use of any other tool. In this paper we will review the conservation status and possible actions that can be taken to save this species from extinction.

History and Background. — Pedrono (2008) gives a comprehensive review of the biology and conservation of this species and a complete bibliography. Here we give a brief review of the history of the Angonoka. It begins in the late 19th Century when a resident of Anjouan in the Comoros Islands in the Mozambique Channel between Madagascar and East Africa received a strange tortoise from Arab sailors who made vague reference to the animal's origin from small islands to the north near Aldabra. Forwarded to the Paris Museum, the herpetologist Leon Vaillant described the specimen as a new species, *Testudo yniphora*, in 1885. Fifteen years later the true natural range of the tortoise was discovered by the German biologist Alfred Voeltzkow, who secured a few specimens from the wild at Cape Sada (Baly Bay) on the coast of northwestern Madagascar. Over the next half-century fewer than a half dozen Angonoka specimens found their way into international museum collections, although it is apparent that many were collected for food by sailors from the Comoros Islands. The French zoologist Raymond Decary (1950) described the species as possibly on the verge of extinction.

Encouraged by southern California tortoise aficionado Ronald Beltz in the 1960s, James Juvik teamed up with French Zoologist Charles Blanc in April 1971 to visit the Baly Bay area to resolve the status of this elusive species (Juvik and Blanc 1974; Juvik et al. 1981). They encountered a few Angonoka at Cape Sada on Baly Bay. However, cattle grazing, dry season burning, and probable predation by the introduced African bush pig were seen as severe threats to

the small remaining population. These observations led to the development of a draft species Recovery Plan for the IUCN Tortoise and Freshwater Turtle Specialist Group (Juvik et al. 1982). Major recommendations were to establish a protected area on Cape Sada, begin an education program to halt the incidental collection of wild animals, and establish a captive breeding program.

Soon thereafter the Jersey Wildlife Preservation Trust (now renamed the Durrell Wildlife Conservation Trust [DWCT]) began to implement many elements of the Recovery Plan. In 1986 they initiated a captive breeding and headstart program at Ampijoroa in Ankarafantsika National Park. This represented collaboration between Durrell and the then Malagasy Department of Water and Forests (since 2009, called the Direction des Forêts). Breeding occurred from year one of the project (Reid 1996). In 1996, the project was compromised by the theft of 73 juveniles and two adult females from Ampijoroa. Only half of these animals have ever been found and they are now in the hands of a private individual in Madagascar. This breeding program was, until 2011, the only legal breeding program anywhere in the world. The captive breeding program at Ampijoroa led to a trial release of five animals in Baly Baly in 1998 (Pedrono and Sarovy 2000) and further releases of 40 juveniles in 2005–07.

The human population living around the natural range of the tortoise is extremely poor, with many of the communities subsisting on less than $2/person/day. In the mid-1990s DWCT began working with these local communities to increase public awareness and initiate conservation actions that supported both the local people and the Angonoka, including education and local development initiatives (Durbin et al. 1996). By raising the awareness of local communities, the area and the tortoise gained a new importance for them and they proposed that its habitat become protected. In 1997 the area became Baly Bay National Park (BBNP) and since 2001 has been managed by Madagascar National Parks (MNP).

A continuing threat to the animal's habitat comes from bush fires that are still being set within the boundaries of BBNP to promote grazing for zebu cattle. In collaboration with the Direction des Forêts, the DWCT community-based program has led, in part, to the establishment of a complete set of firebreaks around the Park and, as a result, there has been a year-to-year decrease in fires impacting the Park's boundaries. Unfortunately, fires within the Park have not been fully curtailed with the existing firebreak network, which is only on the perimeter.

Currently, the greatest threat to the Park's tortoises is from poaching for the international pet trade. We know that hundreds of animals exist illegally in private collections around the world (see below). This population may even be approaching the size of the remaining wild population. Individual adult Ploughshares on the international market can change hands for $5,000-$50,000 and more and can effectively be stolen on order from BBNP. The Park lies on the coast, so access from the sea is easy and the coastal waters need to be patrolled. The lack of capacity of the local authorities, the difficulties of patrolling the habitat, and the socio-economic situation for most of the local population create ideal conditions for exploitation by poachers and traffickers. Once animals are smuggled out of Madagascar, they appear all over the world. This means that the conservation of this species is a global issue requiring the collaboration and support of non-governmental, inter-governmental, and state organizations to apprehend smugglers and bring illegal animals out into registered collections or back to Madagascar.

2008 Meeting and Action Plan. — In January 2008, a workshop for the conservation of Malagasy chelonians "Turtles on the Brink" was convened in Antananarivo by the IUCN Tortoise and Freshwater Turtle Specialist Group in order to develop specific conservation actions for implementation. This was held, in part, due to a growing realization between the government of Madagascar, IUCN, and the conservation community, that the Ploughshare Tortoise was facing a crisis situation. The workshop resulted in a draft Action Plan (Lewis et al. 2009) that set out the conservation priorities for the species, and it has formed the basis for our review. The main objectives of the Action Plan are to stop poaching and illegal traffic and to reinforce in-country captive breeding and re-introductions. The establishment of further legal *ex-situ* captive assurance populations was also discussed at the workshop.

Unfortunately, in 2009, just as the Action Plan was being completed, the existing government of Madagascar was ousted, and the new regime has struggled to be internationally recognized and to govern effectively. It has not yet been able to achieve political consensus on the Action Plan and has had trouble preventing the illegal exploitation of the country's natural resources. This lack of effectiveness has put the Ploughshare Tortoise in a more precarious position than ever before, and reinforces the necessity of a global approach to its conservation.

A Global Strategy: *in-situ*, *ex-situ*, and *non-situ*

Figure 1 diagrams how the different possible places an individual tortoise can exist are connected, and how different conservation actions can impede or enhance flow between these places. We believe the standard classification of *in-situ* and *ex-situ* is too simplistic and we therefore introduce the term "*non-situ*" for those animals that are in captivity, but not part of a long-term program to maintain the evolutionary potential of the species. We restrict the use of the term "*ex-situ*" to captive animals that are included in such programs. In this view, a global conservation strategy will seek to prevent the movement of animals from *in-situ* to *non-situ*, while facilitating movement of animals from *non-situ* to *ex-situ* and eventually back to *in-situ*. Reintroduction of animals maintained or born *ex-situ* to the native range then closes the loop of this global strategy. A theoretical possibility is that currently clandestine private breeders may eventually produce enough animals to almost qualify the

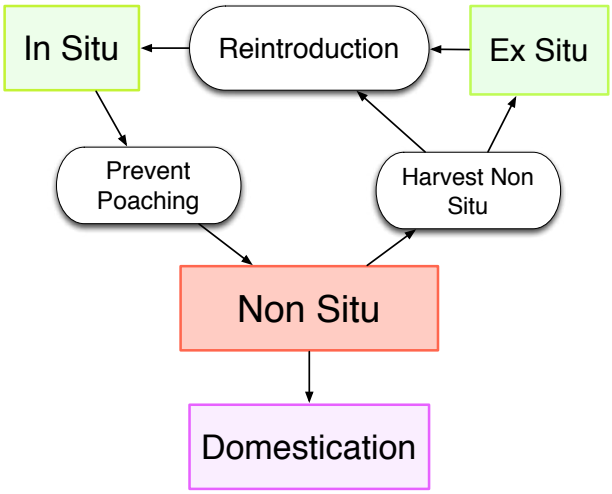

Figure 1. Global pattern of flow of individual Ploughshare Tortoises and the conservation strategies used to manage that flow.

species as domesticated. This has partially happened with other tortoises (e.g., *Centrochelys sulcata*), but certainly not with the Angonoka.

In-Situ

Astrochelys yniphora typically inhabits bamboo scrub forest, though it is not confined to this habitat, and can at times be found in more open habitat (Juvik et al. 1997). The current range of the species is believed to be entirely within the limits of the BBNP, created specifically to conserve *A. yniphora*. In 2000, the total area of suitable habitat was estimated at approximately 7975 ha, of which 6670 ha contained tortoises (Andrianandrasana 2000). Recent estimates by DWCT personnel using satellite images, estimate that as much as 16,000 ha of potentially suitable habitat may exist, although this work has yet to be fully validated through ground surveys. It is important to note that suitable habitat does not necessarily mean the presence of tortoises. Most of this range is close to the coast and its altitudinal range is only 0–90 m above sea level (Andrianandrasana 2000).

Populations. — *Astrochelys yniphora* habitats are fragmented and isolated. There are six known populations of *A. yniphora*, with Baly Bay dividing them into eastern and western subpopulations (Mandimbihasina 2004). The eastern populations at Cape Sada, Maroabolay, and Beheta are all smaller than the western populations of Ambatomainty-Andrafiafaly, Betainalika, and Beabolay (Mandimbihasina 2004). Figure 2 gives the distribution of these populations and the outline of Baly Bay National Park. Five of the six habitats, covering a total area of 14,528 ha, support original wild populations. The sixth habitat, Beabolay in the west, previously supported *A. yniphora*, but the area was destroyed by fire in the late 1960s, and it now contains a reintroduced population.

An intensive program of line transect sampling (Burnham et al. 1980) was undertaken by DWCT from 2006 to 2009 (Mandimbihasina and Young, in prep.). Preliminary results suggested a population estimate of 900 individuals > 200 mm in carapace length, with a 95% confidence interval of 560 to 1400 animals. A resurvey during 2001–2013 estimated only 600 animals, a decline of 33%. There is uncertainty associated with this estimate, but it is clear that the species is declining precipitously.

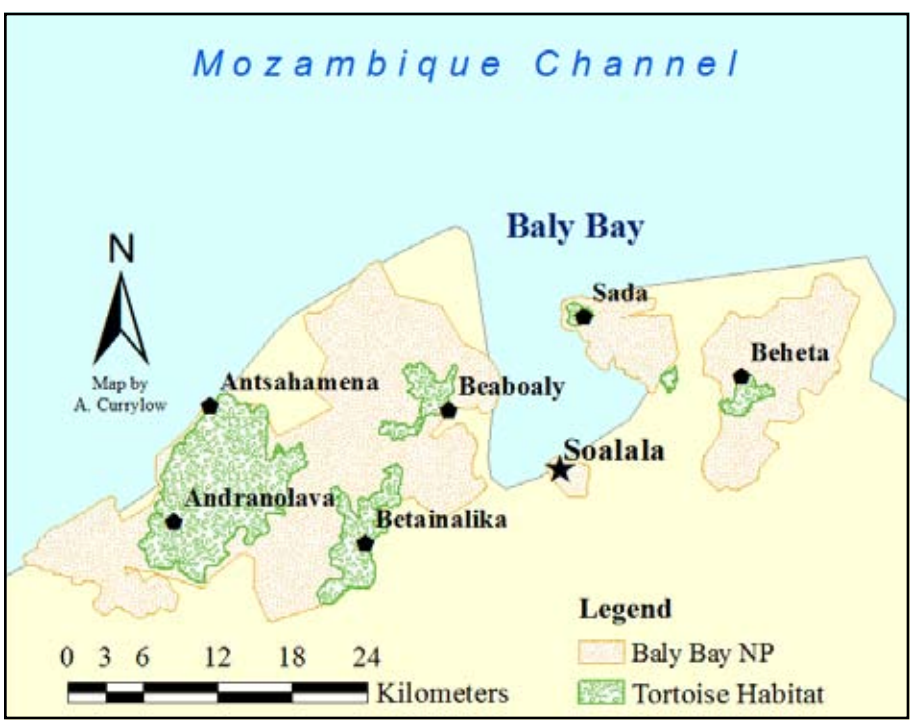

Figure 2. Map of Baly Bay, Madagascar, showing the boundaries of Baly Bay National Park and the six habitat fragments historically occupied by Ploughshare Tortoises.

Habitat Management. — The bamboo scrub forest that forms the habitat of the Angonoka is a relatively tolerant and fast-growing ecosystem that is an advantage in managing this species. Nonetheless, we need to develop long-term strategies to protect tortoise habitat. Funding development programs that use monetary incentives to encourage local villages to avoid burning and grazing key areas and to actively create and maintain firebreaks is one option. African bush pigs are a threat to both eggs and younger tortoises and generally an annoyance to the local villagers, so a program to curtail their populations also may be worth pursuing.

Marking and Branding. — All captive tortoises in Madagascar have been marked by notching their shells, as have those tortoises in the wild encountered through surveys by researchers. These traditional marks are useful for research and management, but it is now apparent that a redundant system of marking should be undertaken using notching, PIT tags, and photographs. This redundancy is necessary because poached animals must be identified in a way that will stand up in courts around the world if poachers and smugglers are to be prosecuted.

A newer approach is to significantly deface animals by engraving the shells with a Dremel® tool. This method was originally used by John Behler in 1999 (Love 2000; Smith 2011) and provoked controversy at the time. The idea now is to undertake similar branding to reduce or eliminate the value of the tortoises for the pet market. Trials with animals at Ampijoroa have demonstrated that it is easy to do and does not appear to have any long-term ill effects on the animals (Fig. 3). Anecdotal information from interviews with smugglers indicated that few pet fanciers would pay for such animals, and that dealers and smugglers would be reluctant to handle them. Marking of wild animal began in January 2012 and appears not to bother the animals, as their scutes are much thicker than those of other tortoise species. We believe that this strategy will provide some real protection for this species.

Anti-Poaching Program at Baly Bay. — Although MNP manages Baly Bay National Park, it does not have enforcement rights to stop and search or to arrest poachers. These rights remain the responsibility of the Direction des Forêts, gendarmes, and police. There are eight Park Rangers operating in the field. This separation of detection and enforcement, coupled with the small number of Park Rangers, means that poachers can often find a way to poach inside the Park and avoid arrest. As a consequence, DWCT and the Turtle Conservancy (TC) recently teamed up to strengthen the anti-poaching program in Baly Bay. Given the large surface area (57,142 ha) of BBNP, the existing ranger staff is not enough to protect the remaining wild Angonoka. The four permanent (on site) employees of DWCT are also insufficient to cover the Park. More feet are needed on the ground. But there must also be a way of directly engaging the local communities in the goals of the Park and further legitimizing the existence of the Park.

Figure 3. Adult Ploughshare Tortoise engraved to prevent sale on the illegal market. Ampijoroa, Madagascar. Photo by A.R. Mandimbihasina.

The reality is that Park Rangers cannot live at all times in the park. They go home on weekends, take holidays, and are called on for other Park duties. Only the local communities are based permanently around the Park. They are logically the first line of protection for the park. DWCT has worked for many years with these communities and most of the time they are sympathetic to the needs of the Park and the plight of the tortoise. They take pride in the fact that the tortoise belongs to them and that the animal exists nowhere else in the wild. Although they do not use the tortoise, they do use other resources in the park on a regular basis, such as raphia, fuel wood, and wood for house building. They also graze zebu cattle there, although this is now not legal. The Park managers do recognize their logistic limitations as well as the need to bring all stakeholders together. So the Park Manager and DWCT agreed to work together, and the principle of creation of "Para-Rangers", using local villagers to systematically patrol Angonoka habitat, was born. Park personnel and DWCT then worked with the village elders to create a system of selecting patrol members and villages to participate, and developed the infrastructure and protocols that the Para-Rangers use.

Because some local villagers have been involved in poaching tortoises, choosing the villages and Para-Rangers was complex. Among the 15 groups of villages originally proposed for conservation patrols, four villages were not involved at this stage due to lack of habitat or known involvement in smuggling. To prevent the employment of people who participate in trafficking of this species, meetings were held with the whole community, the "Fokonolona",

Table 1. Criteria for choosing Para-Rangers to protect Ploughshare Tortoises.

Criterion	Score
Physical condition	+3
Literate	+2
Knowing how to use a mobile phone	+2
Has already worked for either the village and/or State	+5
Able to work with partners; ability to understand ideas	+3
Knowledge of the area	+10
Rumored to be involved in smuggling	-10
Confirmed to be involved in smuggling	-20

from each village. They would offer us four representatives from their village, and MNP and DWCT then chose among those people, using a set of criteria with positive and negative scores to select those who were both trustworthy and capable of doing the work; these criteria are summarized in Table 1.

The persons thus selected then attended a meeting and training workshop on conservation of biodiversity, and how the patrols would act in the field. The workshop emphasized the importance of calling for backup, rather than trying to capture poachers who might well be armed, and of not getting caught in moving fires. Clearly the safety of the patrol members was the most important consideration. These patrols are based permanently at five field sites where huts and sheds have been constructed and equipped. A regular routine for patrolling each area is maintained. Patrols began in June 2010 and these efforts have had some positive results:

• Fast action against fires in Beheta in August 2010.

• Arrest of two poachers in November 2010 in Ambatomainty (Fig. 4).

• Obtaining reports on the observation of footprints of people in many sites (Sada, Ambatomainty, Andranolava, and Beheta).

It has become clear that this anti-poaching effort is complex and difficult. However, at this time we feel that it shows the following strengths:

• Good cooperation and assumption of responsibility by all partners.

• Much greater presence on the ground near and in Angonoka habitats.

• A better understanding of the patterns of human activity in tortoise habitat, both legal and illegal.

• During their patrols, the Para-Rangers record animals they see and their data can be useful to assess relative abundance of these species.

• The cost is less than hiring police or regular park guards.

Despite these strengths, we also recognized some shortcomings of the program:

• Insufficient follow-up for various reasons: time constraints, fuel not available, delayed arrival of salaries, overland routes impassable during the rainy season.

• Some reports are inconsistent or difficult to read as Para-Rangers are often illiterate.

• A few of the guards are suspected of poaching, but together with the Fokonolona and authorities, they are being watched closely.

• The large block to the west of Baly Bay is divided into two sites, but we do not yet have enough personnel to patrol both areas at once. When the guards go to one site, the traffickers who are watching may enter the other site. Thus we need to create at least one additional guard station and patrol team.

The anti-poaching program is too new to evaluate its overall success. However, there are three ways in which we plan to build on the Para-Ranger patrol efforts. First, we must develop a system of incentives for the Para-Rangers and their communities, so that doing a measurably good job of protecting the Angonoka will result in tangible benefits. Developing a measure of success is not easy. One idea is to radiotrack as many animals as possible so that the population can be censused periodically by finding known animals. Rewards would then be based on animals remaining within the Park.

Figure 4. Arrest of two poachers in Baly Bay National Park in November, 2010. Photo by A.R. Mandimbihasina.

Second, we propose to further legitimize the community role by developing a regional Dina, the Malagasy traditional law. Local authorities can accept and legalize these traditional laws as long as they do not conflict with the constitution and other existing codified laws. The different communities around the park have already proposed that a regional Dina could be established to protect the park against arson and animal theft. If a Dina were established, this would allow the communities to directly fine people rather than having the guilty parties punished by the State.

Dina is a Malagasy concept; Rakotoson and Tanner (2006) described the Dina and its use in natural resources management as follows:

"On account of the "legal transplant" of French civil law into traditional customary law in Madagascar, the traditional social code generally known as "Dina" has coexisted with the modern law since the pre-colonial era and has conditioned the implementation of such law. The concept and use of Dina has been influenced by that process. This paper illustrates the role of Dina as a mechanism for reconciling modern decentralized and traditional governance of marine resources and the coastal zones in Madagascar. Democratic participation is important for enforcing the regulations governing marine resources and coastal zones. As law should be the will of people themselves, it is therefore necessary to develop legislation in community forums such as through Dina. It is especially critical that regulations be imbued with community aspiration and culture so that the population can respect laws freely."

We will work with the local communities to establish a Dina for the Ploughshare Tortoise. The lessons from Rakotoson and Tanner (2006) and Andriamalala and Gardner (2010) are important to our effort. A crucial aspect of the Dina must be that the local people see some tangible benefit from the Dina. The income provided to the Para-Rangers is of benefit to the community and is a start.

Third, we must undertake more lobbying and advocacy. During 2010 there were successful identifications of poachers by the Para-Rangers both in the field and in the nearby town of Soalala. We have seen that people are willing and are capable of supporting confiscations. However, our results have been hindered by the fact that several clear cases of smuggling (poachers caught in the act) were dismissed when brought to court. We have not been able to track down why cases have been dismissed, as typically the courts do not encourage visits by the general public and typically trial dates and court decisions are not published. Since the beginning of the political crisis in 2009, two environmental advocacy groups have sprung up to defend the public's interest in the face of the apparent inability of the State to control smuggling of natural resources such as rosewood and tortoises. At the national level, Alliance Voahary Gasy (www.alliancevoaharygasy.mg) is working to publicize acts of smuggling, and at the regional level, Komanga is lobbying for "environmental justice". Both are Associations made up of members from civil society. DWCT is a member of Komanga and an associate of Alliance Voahary Gasy. We propose to support Komanga by undertaking four activities:

1. Follow the smuggling cases that are brought to the courts in Mahajanga.
2. Lobby the police and the courts to enforce the laws protecting wildlife.
3. Maximize publicity of all arrests and court decisions.
4. Undertake a public awareness campaign for school children and their parents in Mahajanga to raise the plight of the tortoise and to raise the local pride in their unique wildlife.

Table 2. *Non-situ* Ploughshare Tortoise confiscations from 2008–11.

Country	Entity	Confiscated	Died or Disappeared
Madagascar	DWCT Antananarivo	44	0
	Olaf Pronk Antananarivo	18	12
	Croc Farm	8	0
	Direction de Forêts	4	0
Taiwan	Taipei Zoo	2	2
	Ping Tung Rescue Center	2	0
Thailand	Government	20	18
Hong Kong	Kadoorie Farm	30	1
China	Kunming	3	3
Malaysia	Government	2	2
Singapore	Singapore Zoo	3	1
United States	Fish & Wildlife Service	1	0
Germany	Frankfurt Zoo	4	0

Ex-Situ

Ampijoroa Captive Breeding Facility. — As mentioned above, DWCT's captive breeding program at Ampijoroa has been very successful. It has now recovered from the thefts of 1996 and has a population of 225 offspring. At this time planning is underway to both expand the facility at Ampijoroa and to look to creating a second breeding center within Madagascar, possibly at Soalala on Baly Bay, next to the native range and BBNP.

Reintroduction Program at Baly Bay. — Reintroduction of Ploughshare Tortoises into BBNP currently takes place in Beabolay, an area once inhabited by tortoises where it is thought that they no longer exist naturally. Many of the tortoises previously released initially carried radio transmitters. By and large this program has been success-

Table 3. *Non-situ* Ploughshare Tortoises illegally held or offered for sale from 2008–11.

Country	Number	Source
Singapore	10	private communication
Thailand	80	Nantarika Chansue, internet and market surveys
China	112	internet and market surveys
Indonesia	6	internet and market surveys
Philippines	6	internet and market surveys
Italy	2	private communication
Germany	2	private communication

Figure 5. Illegally held Ploughshare Tortoises in Thailand. Photo courtesy of the Turtle Conservancy.

ful, although the released tortoises have some years to go before they reach reproductive age. Unfortunately, four of the released tortoises appear to have been poached from this site. Future releases of tortoises are planned and are currently awaiting evaluation of the success of the anti-poaching program.

TC/Behler Chelonian Center (BCC) Program. — In 2010 the TC/BCC program received a U.S. CITES import permit for 10 Ploughshare Tortoises to be obtained from confiscated animals in Asia. In October 2010, a juvenile and a nearly adult female were sent to the BCC from the Pingtung Rescue Center in Taiwan. In June 2011, seven juveniles and one adult female were sent from Hong Kong by Kadoorie Farm and Botanic Garden. In October 2011, the Center received an adult male owned by the San Antonio Zoo and kept for nearly 40 years by William Zovickian. Together, these three adults will become the first legal breeding colony outside of Madagascar, but as of February 2012 there has not yet been any successful breeding.

Non-Situ

Although it is extremely difficult to determine *non-situ* numbers with any precision because the trade is illegal, we do have data on many animals. We know from studies of other global illegal markets that only a small fraction (ca. 10% or so) is caught by enforcement and interdiction. Even if these numbers are off by an order of magnitude, they are operational in the sense that they guide activities. They show that a significant percentage of the total number of the species is *non-situ*. We can divide *non-situ* animals into those that government authorities have confiscated and those that are estimated to be illegally held. Table 2 gives the numbers of confiscated tortoises held around the world. We estimate a total of 141 animals have been confiscated in recent years, of which 39 have died or disappeared. Table 3 shows our estimates of the number of animals held illegally. Many animals were counted because they were offered for sale on the Internet. These numbers add up to 218 individuals. Figure 5 shows animals illegally held in Thailand and Fig. 6 is an Internet advertisement for Ploughshare Tortoises in the Philippines. Most, but by no means all, of the animals held illegally are juveniles, as shown in these figures.

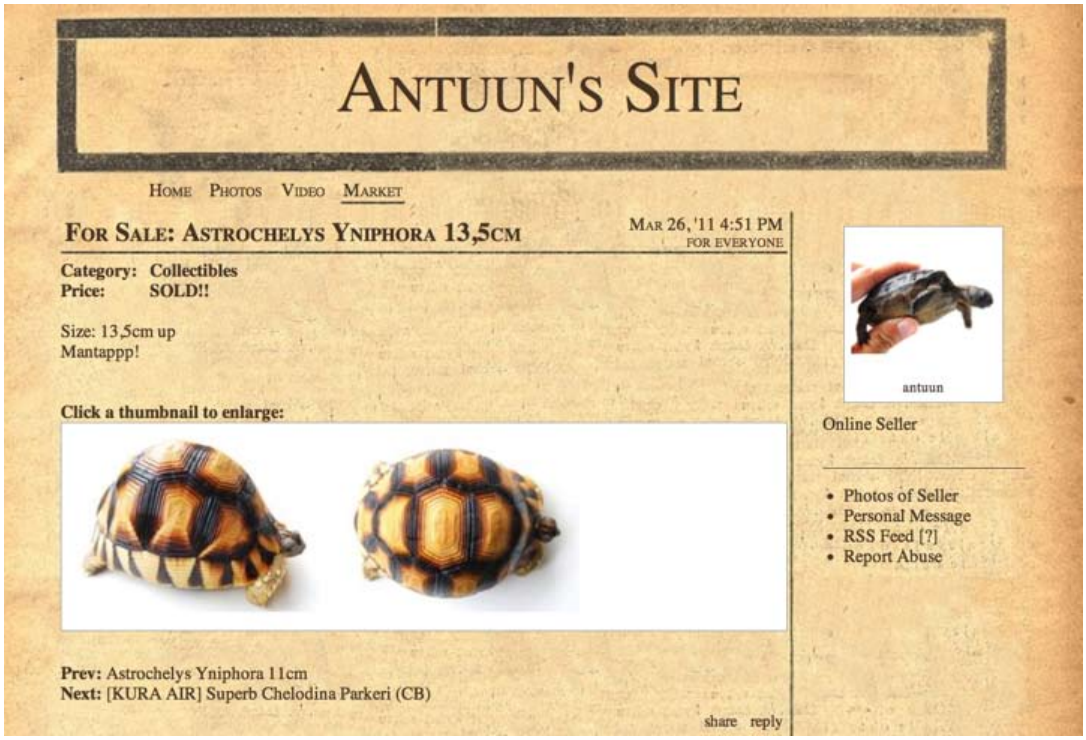

Figure 6. Internet advertisement from 2011 for Ploughshare Tortoises. Photo courtesy of the Turtle Conservancy.

Not recorded in Table 2 are 54 animals confiscated in Bangkok in March 2013, of which only 28 were still held by the government in June 2013, and two animals known to have been confiscated in Japan in 2004 and 2005 (TRAFFIC Data, K. Foley, pers. comm.). Because a large number of *A. radiata* have been confiscated in Japan in recent years, we suspect that *A. yniphora* are also being smuggled into Japan. In September 2011, we found Angonoka openly for sale in Mahajanga, Madagascar, and were able to clandestinely purchase two specimens for $200 USD each. We turned these animals over to the Malagasy Government and they are now in the care of DWCT. The smugglers who offered these animals for sale also informed us that they could easily move animals to Bangkok via a flight from Mahajanga to Mayotte in the Comoros Islands, then on to Reunion Island and from there to Bangkok. There are no baggage scanners at the Mahajanga Airport, so this route appears to be favorable to the smugglers. They also said that small animals are much easier to smuggle. We also learned from them how they work with the villagers in Baly Bay and how little they pay for the animals there. In October 2010, the government of Malaysia sent four confiscated Ploughshare Tortoises back to Madagascar. This return was facilitated by DWCT and TRAFFIC Southeast Asia. One of the returned animals had, in fact, been stolen from DWCT's reintroduction program. This was the first case of repatriation in recent times and represents an important new step in global Ploughshare management.

To summarize, we believe that the number of *non-situ* Angonoka is on the order of hundreds, which is the same order of magnitude as the estimated size of the wild population of adults. Most of the animals known outside of Madagascar are juveniles, but there are many adults as well. Clearly the population of *non-situ* animals is potentially a major conservation resource.

Discussion

Currently (as of early 2013) the wild *in-situ* population of Ploughshare Tortoises is estimated to be around 600 individuals and is declining rapidly. Our estimates of both *ex-situ* and *non-situ* numbers are very rough. However, it is clear that we do not require accurate estimates of any of these numbers to know that this species is in great trouble. Without doubt, the incredible demand for this species on the international market is the primary cause of its decline in the wild. We acknowledge that this demand will continue to put extreme pressure on the Ploughshare Tortoise until ways are found to meet or decrease this demand without otherwise imperiling its survival.

Formation of the International Angonoka Working Group (IAWG). — Recognizing that the conservation of the Ploughshare Tortoise is a genuinely global problem and that all possible conservation approaches need to be synthesized for this species, DWCT, the TC, Conservation International, and the Turtle Survival Alliance have begun the process of creating an international institution to provide coordination for the many actions aimed at saving this tortoise. The initial goals of the IAWG are:

1. Support efforts to protect and restore wild populations of Ploughshare Tortoises around Baly Bay.
2. Reduce the trade in illegally harvested or bred Ploughshare Tortoises on the international market.
3. Build capacity within Madagascar to tackle wildlife trade issues and to work better with the authorities in countries confiscating tortoises to facilitate repatriation.
4. Expand and enhance the captive breeding program within Madagascar and increase capacity to manage confiscated animals.
5. Establish and manage an international breeding program for Ploughshare Tortoises based on animals already outside Madagascar that acts as a safety-net population.
6. Build capacity in Southeast Asia to manage confiscated tortoises.
7. Develop a sustained media campaign to raise funds and awareness for Ploughshare Tortoise conservation.

However, each of these goals must be further refined to lead development of an integrated strategy. The IAWG would like to see this working group take on a public face and be able to highlight cases of illegal animals coming to international market as well as the positive actions taken to save the species. It would also function as a fundraising group to support the delivery of its core objectives. The group will need representation from the government of Madagascar, TRAFFIC, and CITES, and will be open to all parties interested in conserving this tortoise. None of the goals of the IAWG are surprising: they represent conservation strategies that have been discussed, and in many cases, at least partially implemented before.

The plight of the Ploughshare Tortoise is at such a critical point that we must find new ideas and methods to add to these well-known ones. For example, the numbers of *non-situ* animals may cause the consideration of an amnesty for some illegally held animals. They simply represent too important a resource to be ignored. But figuring out how to do this in a way that works for the many government agencies involved, as well as CITES, is a challenge we believe the conservation community should take on. Another idea is having the government of Madagascar lease animals using a model similar to that of China and the Giant Panda. Again there are challenges to be met. The reasons that this is the rarest tortoise in the world are daunting indeed, but we must struggle to overcome them.

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Résumé

Nous décrivons l'histoire de la conservation de l'Angonoka, ou Tortue à Soc (*Astrochelys yniphora*), qui l'a conduit vers son statut actuel de tortue la plus rare du monde. A cause du niveau de braconnage qui menace cette espèce et du fait que ses individus sont vendus dans le monde entier, la conservation de cette espèce est un véritable problème planétaire. La population sauvage de 2011 à 2013 est estimée à 600 individus (longueur de carapace > 200 mm), un déclin de 33% de l'estimation de 900 individus pour les années 2006 à 2008. Nous concluons qu'au moins un nombre similaire est détenu illégalement en captivité. Nous croyons que marquer les animaux de façon significative avec une gravure aidera à diminuer ce commerce international. Nous faisons le bilan de nos efforts contre le braconnage de même que sur les nouvelles colonies *ex-situ* constituées d'animaux confisqués du commerce illicite. Cette espèce nécessite des mesures extraordinaires et une stratégie mondiale cohérente pour empêcher l'avancement de son déclin.

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