

- CULIK, B.M., WILSON, R.P., AND BANNASCH, R. 1993. Flipper-bands on penguins: what is the cost of a life-long commitment? *Marine Ecology Progress Series* 98:209-214.
- DUTTON, P., AND McDONALD, D. 1994. Use of PIT tags to identify adult leatherbacks. *Marine Turtle Newsletter* 67:13-14.
- ECKERT, K.L., AND ECKERT, S.A. 1989. The application of plastic tags to leatherback sea turtles, *Dermochelys coriacea*. *Herpetol. Rev.* 20:90-91.
- FONTAINE, C.T., WILLIAMS, T.D., AND CAMPER, J.D. 1987. Ridleys tagged with passive integrated transponder (PIT). *Marine Turtle Newsletter* 41:6-7.
- HENWOOD, T.A. 1986. Losses of monel flipper tags from loggerhead sea turtles, *Caretta caretta*. *J. Herpetol.* 20:276-279.
- LIMPUS, C.J. 1992. Estimation of tag loss in marine turtle research. *Aust. Wildl. Res.* 19:457-469.
- McDONALD, D.L., AND DUTTON, P.H. 1996. Use of PIT tags and photoidentification to revise remigration estimates of leatherback turtles (*Dermochelys coriacea*) nesting in St. Croix, U.S. Virgin Islands, 1979-1995. *Chelonian Conservation and Biology* 2:148-152.
- NICHOLS, W.J., AND SEMINOFF, J.A. 1998. Plastic "rototags" may be linked to sea turtle bycatch. *Marine Turtle Newsletter* 79:20-21.
- PARMENTER, C.J. 1993. A preliminary evaluation of the performance of passive integrated transponders and metal tags in a population study of the flatback sea turtle (*Natator depressus*). *Wildlife Res.* 20:375-381.

Received: 19 February 1998

Reviewed: 20 September 1998

Revised and Accepted: 23 December 1998

Chelonian Conservation and Biology, 1999, 3(3):479-486
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On the Turtles of Hainan Island, Southern China

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Hainan Island in the South China Sea is the southernmost province of China. It has an area of 32,000 km² and a subtropical climate, with winter temperatures averaging 21°C. In the mountains, however, temperatures may become significantly lower. Smith (1923a) reported that frost is not uncommon at high altitudes, and in January he experienced freezing fog in the morning at an altitude of 1200 m. From March through October the weather becomes hot and humid; typhoons may strike and most rain falls in this period. We measured average day temperatures of 35°C in May.

As part of the "one country, two systems" policy, Hainan was designated a special economic zone by China in early 1988. At that time the human population of the island consisted mainly of the original inhabitants, the Li and Miao minority groups. Today, as a result of being a special economic zone, Hainan has a population of more than 7 million, the majority of them being Han Chinese coming from Indonesia, Malaysia, and mainland China. The Li and Miao are the people profiting the least from the economic

developments; they inhabit remote mountainous areas and subsist through agriculture and hunting.

The northern and western coastal plains of the island are intensively exploited: rice fields, rubber plantations, eucalypt species, *Casuarina* sp., and sisal plantations dominate the landscape. On the northeastern plain there is much industrial development on the outskirts of Haikou. On the eastern plains there is agriculture and rapidly developing Chinese tourism.

Central Hainan comprises a series of mountains, the Limu Ling Shan and Wuzhi Shan, the highest peak being Wuzhi Shan (Five Finger Mountain), reaching 1890 m. Many mountains are still covered with primary rainforest, but there is considerable cultivation and deforestation in the valleys and on many slopes.

Hainan has 13 Nature Reserves (Li and Zhao, 1989), most of them set up to protect large mammals like the Hainan deer (*Cervus eldi hainana*) and Hainan black headed gibbon (*Hylobates concolor hainanus*), or to protect whole ecosystems. The level of protection maintained in these reserves is difficult to determine. We have only been on the border of Jianfengling Nature Reserve in the southwest. Our interpreter told us it was prohibited to enter the reserve, and that it was impossible to visit it. However, Pack-Blumenau (1997) visited Bawangling Nature Reserve (close to Jianfengling, and also created to protect the mountain rainforest ecosystem) recently, and found that local people still poach in the reserve. Li people are forced to hunt for subsistence, and little is done to prevent this.

One of the first accounts on chelonians of Hainan was that of Siebenrock (1906). At that time only *Clemmys schmackeri* (= *Mauremys mutica*) was known to occur there. Based on material from Hainan provided by Steindachner, Siebenrock extended the distribution of *Ocadia sinensis* and *Pelodiscus sinensis* to Hainan. In addition, he described a new softshell: *Trionyx steindachneri* (now *Palea steindachneri*). Smith (1923a) published an elaborate account of his travel to Hainan in 1923, but he had little success collecting chelonians — he was only able to obtain one *O. sinensis* from the market in Haikou. Schmidt (1927) examined material collected by Pope during an 8-month stay on Hainan in 1922-23. Based on Pope's material, Schmidt extended the ranges for *Platysternon megacephalum*, *Sacalia bealei*, *Cuora trifasciata*, *Pyxidea mouhotii*, and *Pelochelys cantorii* to Hainan. Pope (1935) reported nine turtle species on Hainan Island. Li (1958) described *Clemmys bealeii quadriocellata* and *Cyclemys flavomarginatus hainanensis* from southeastern Hainan. Hu et al. (1975) elevated the latter to species level and included it in the genus *Cuora* as *C. hainanensis*. However, most authors now consider it synonymous with *C. galbinifrons* (see Iverson and McCord, 1992a).

Both Iverson (1992) and Zhao and Adler (1993) reported 15 non-marine species of turtle to occur on Hainan: Iverson included *Chinemys nigricans* as possibly occurring on Hainan, whereas Zhao and Adler reported *Geoemyda spengleri* to occur there. Recently, two new species of

batagurid turtles, *Ocadia philippeni* (McCord and Iverson, 1992) and *Sacalia pseudocellata* (Iverson and McCord, 1992b), and one newly recognized subspecies, *Cuora galbinifrons serrata* (Iverson and McCord, 1992a), have been reported also. The taxon *serrata* was recently elevated to full species status by Fritz and Obst (1997).

The number of documented localities for turtles on Hainan is sparse (see Iverson, 1992). Most species are known from only one locality, or are reported to have been collected on "Hainan," or "to have been brought in by native boys or hunters" from localities within a considerable radius of Nodao (= Zhan Xian, 19°31'N, 109°33'E, the base from where Pope made his collections [Schmidt, 1927]), or "to have been collected by local people" (e.g., McCord and Iverson, 1992).

In an attempt to further study these matters, we undertook an expedition to Hainan in May 1997. Our main goals were to delimit the distribution of *O. philippeni* and *S. pseudocellata*, to identify and locate the different forms of *C. galbinifrons* said to occur on the island (Li, 1953; Hu et al., 1975; Iverson and McCord, 1992a), and to obtain a better understanding of all turtles on the island, including amplification of available locality data.

Methods. — With the help of an English-speaking interpreter we explored the western coastal plain, the southwest region, and central Hainan from 17 to 26 May 1997. In every village we passed, we showed the villagers a set of illustrations of Chinese turtles. As "controls" we also included some non-Chinese species. Because very few Europeans visit Hainan, we always attracted a large crowd, and hence, were able to show the turtle pictures to hundreds of people. We always asked the people if they knew any of the turtles shown, if they knew whether they occurred around their village, if they ate turtles, and if they knew anyone who possessed turtles. When, through these enquiries, we found a turtle collector we asked him where he had caught the animals, and in which habitat the animals occur. Most of the collectors were very reluctant to share information with us,

apparently because they were concerned we would go to the localities ourselves to catch "their" turtles.

When no technical obstacles were present (i.e., heavy cloud cover and/or mountains), the coordinates of localities were recorded using GPS (Garmin GPS 40, Lenexa, KS). Coordinates of cities were taken from the Tactical Pilotage Chart of Hainan (TCP J-11c, St. Louis, MO). All localities are recorded in Table 1, and mapped on Fig. 1. We report our findings on a species-by-species basis, with a separate section for the Dongmen Market in Haikou where significant trade in mainland southeast Asian turtles takes place.

Dongmen Market. — This is the largest food market in Haikou (Fig. 2). We visited this market on the morning and afternoon of 16 May and in the morning of 26 May. Here we saw hundreds of *Cuora amboinensis kamaroma* (Fig. 3), *Siebenrockiella crassicollis*, *Orlitia borneensis*, and *Heosemys grandis*. Smaller numbers of *Hieremys annandalei*, *Cyclemys* sp., *Melanochelys trijuga indopeninsularis*, and *Notochelys platynota* were present. We saw many *Amyda cartilaginea*, *Pelodiscus sinensis*, and several forms of softshell turtle which we could not identify to species level. It was remarkable that batagurid turtles were only represented by very large adults. Some *Ocadia sinensis*, *Mauremys annamensis*, *Morenia petersi*, *Indotestudo elongata*, *Manouria emys*, *Manouria impressa*, and *Pyxidea mouhotii* were also seen. Many turtles were packed in wooden air freight boxes with labels from Garuda Indonesia and South China Airlines.

Although *Ocadia sinensis* occurs on Hainan (our observations), and *Manouria impressa* and *Pelodiscus sinensis* have been reported from this island also (Iverson, 1992; Zhao and Adler, 1993) we believe that none of the turtles seen at Dongmen Market came from Hainan, but rather, were imported from Indonesia, Bangladesh, Myanmar (Burma), Laos, and Vietnam. The only exception might be *Pyxidea mouhotii*, of which we saw 3 animals that resembled the form we found all over central Hainan.

Because of the brevity of our visit we were not able to estimate the turnover of turtles at this market. Nevertheless, the numbers of large, adult turtles that are traded for food seemed enormous. Together with the large numbers of southeast Asian turtles sold in other mainland Chinese food markets, such as the Qingping Market in Guangzhou, this trade almost certainly poses a serious threat to the survival

Table 1. Place names, synonyms, and coordinates for Hainan towns and villages mentioned in text and mapped on Fig. 1. Coordinates marked with an asterisk were measured by the authors using GPS. Other coordinates were taken from the Tactical Pilotage Chart of Hainan Island. Names in the first column are in Pinyin; names in the second column are either Pinyin or other transliteration systems. These names are not necessarily used by the Chinese today, but can still be found on maps or in the literature.

Place	Synonym	Coordinates
Dongfang	Basuo, Tungfang	19°07'N, 108°38'E
Jiu Dongfang*	Chiu Dongfang	19°03'N, 108°57'E
Gancheng	Kancheng	18°51'N, 108°38'E
Haikou		20°02'N, 110°20'E
Jianfeng*		18°41'N, 108°48'E
Ledong*	Baoyou	18°44'N, 109°10'E
Lingtou		18°41'N, 108°42'E
Maoyang		18°56'N, 109°30'E
Qiongzhang	Yinggen	19°02'N, 109°51'E
Sanya	Yaxian	18°14'N, 109°30'E
Tuozha cun	To cha ts'un, TuoLiCun	18°51'N, 108°45'E
Tongzha	Tongshi, Tongshen	18°46'N, 109°32'E
Xinlong*		18°57'N, 108°41'E
Xinzheng*		18°32'N, 109°38'E



Figure 1. Map of Hainan Island. See Table 1 for coordinates.



Figure 2. Turtle dealer at Dongmen Market in Haikou.



Figure 3. *Cuora amboinensis kama-roma* at Dongmen Market, Haikou.



Figure 4. Tongzha, situated in the central mountains of Hainan.

Figure 5. *Pyxidea mouhotii* male from near Jiu Dongfang.



of these species in the long term (Jenkins, 1995). Moreover, the fact that no turtles from mainland China were found (e.g., *Chinemys nigricans*, *Chinemys reevesii*, *Cuora flavomarginata*) may imply that these animals may have already reached commercial extinction.

Bataguridae

Pyxidea mouhotii. — The species most often encountered on Hainan were *P. mouhotii* and *Cuora galbinifrons*. We examined approximately 150 *P. mouhotii* that had been caught in the central mountains of Hainan. We found this

species in the market in Dongfang, where they had been bought from Li people living at the foot of the central mountains in Jiu Dongfang, approximately 20 km east of Dongfang. We also found this species in Jianfeng, Sanya, Xinzhen, Tongzha (Fig. 4), and Qiongzong (Table 2). Many specimens that were shown to us were gravid females (diagnosed via palpation), probably caught when they were in search of a nesting site. Many animals were near or beyond the known maximum length of the species. Ernst and Barbour (1989) cited the maximum straight line carapace length (CL) as 180 mm. We measured 3 males with a CL of more than 190 mm. Also, the head coloration appeared significantly

Table 2. Localities recorded for Hainan turtles. ¹Animals were purchased in Jiu Dongfang where they were caught in the mountains. ²Animals offered to us in Sanya were said to have been collected in the central mountains. ³Actually a small village close to Gancheng at 18°40'N, 108°43'E. ⁴One animal kept in captivity in Tongzha and caught in the Changhua Jiang River near Maoyang.

	Dongfang	Gancheng	Jianfeng	Ledong	Qiongzong	Sanya ²	Tongzha	Xinzhen
<i>P. mouhotii</i>	+		+		+	+	+	+
<i>C. galbinifrons</i>			+	+	+	+	+	+
<i>C. trifasciata</i>				+	+			
<i>M. mutica</i>		+			+			
<i>O. sinensis</i>					+		+	
<i>S. quadriocellata</i>					+		+	+
<i>P. megacephalum</i>					+		+	+
<i>P. cantorii</i>							+	



Figure 6. a (top): Variation in carapace color and pattern in *Cuora galbinifrons* collected in the hills around Xinzheng. **b (bottom):** Plastral variation in the same animals.

brighter than in mainland *P. mouhotii*. The animals we observed all had a yellow or orange head with fine black reticulations (Fig. 5). It was recently shown however that Hainan *P. mouhotii* do not differ from mainland China animals (Fritz et al., 1998).

Cuora galbinifrons. — Three subspecies of *C. galbinifrons* are said to occur on Hainan: *C. g. galbinifrons*, *C. g. hainanensis*, and *C. g. serrata* (Iverson and McCord, 1992a). We observed approximately 150 *C. galbinifrons* at the following locations: Jianfeng, near Jianfengling Nature Reserve, Sanya, Xinzheng, Tongzha, Ledong, and Qiongzong, all collected by Li people living in the mountains of central Hainan. The variation in pigmentation of plastron, carapace, head, and extremities at a single location was remarkable. The ground color of the costal scutes was either orange-reddish or cream-yellow (Fig. 6a), the plastron was either black, with or without varying degrees of yellow pigment, or yellow with black blotches (Fig. 6b). The dorsum of the head was either yellow, brown with black reticulations, or black. Most, but not all specimens had a bright yellow head and a red neck (Fig. 6c). The scales on the forelegs were yellow, red, or black, the color being independent of the head coloration or ground color of the carapace. In all localities we tried to establish if different color forms (e.g., yellow vs. reddish carapace) lived on separate mountains, in separate habitats, or occurred sympatrically. In all instances the collectors assured us that all forms we saw



Figure 6c. Head of *Cuora galbinifrons* (female, carapace length 170 mm) collected near Xinzheng.

occurred sympatrically and that there were no distinctive forms living in separate areas or habitats. The animals fitted the descriptions reported for *C. g. galbinifrons* (Ernst and Barbour, 1989) and *C. g. hainanensis* (Hu et al. 1975), the latter being poorly differentiated and showing considerable overlap with the description of the nominate form.

Cuora g. serrata is reported to have been collected "100 km east of Tungfang at Tainhien in central Hainan Island" (Iverson and McCord, 1992a). Unfortunately, Tainhien (coordinates not given in original description) was not on any of the maps we could obtain, not even on Chinese maps bought locally. However, on the TPC map (scale 1:500,000) the area 100 km east of Dongfang was easy to locate. This appeared to be an area north of the central valley running through the central mountains. We spent one day in the vicinity of Qiongzong, close to this locality, to see if people were familiar with this turtle, and if we could obtain some specimens. Most people we asked were familiar with *C. galbinifrons* and *P. mouhotii*, but no one recognized the serrated form. Collectors in Qiongzong offered us many *C. galbinifrons* of the *C. g. galbinifrons* and *C. g. hainanensis* types, but no *C. g. serrata*.

Since all animals were collected in the mountains, and none were offered to us on the coastal plains, we cannot confirm previous reports stating the occurrence of *C. galbinifrons* there (Weiss, 1989). On Hainan, this species appears at this time to be confined to mountainous areas.

On our return trip we visited Oscar Shiu in Hong Kong, the individual who found *C. g. serrata* on Hainan and brought it to the attention of the describers. He had some animals in stock that definitely resembled the serrated form but surprisingly, these animals were from northern Vietnam and not from Hainan (O. Shiu, *pers. comm.*). We conclude that much more research needs to be done before anything definite can be said about the validity of any subspecies of *C. galbinifrons* occurring on Hainan. The situation of *C. galbinifrons* as a whole reminds us of the well-documented extensive variation of North American *Terrapene carolina* even within a single locality.

Cuora trifasciata. — This species was offered to us at two locations: Ledong and Qiongzong. Hainan "golden



Figure 7. *Cuora trifasciata* male from Ledong.

turtles," as they are called by the locals, are brightly marked with yellow (Fig. 7). All animals were shown to us in a very clandestine manner, with the asking price ranging from US\$ 300 to 500 each. According to some turtle collectors, *C. trifasciata* may be found in almost any habitat (hill streams, rice fields, ponds, rivers, etc.). According to the same sources, many are kept in captivity since they are believed to be an efficacious drug against cancer. For this reason, they are widely used in Chinese medicine and as food. Their price inflates as they become scarcer.

Mauremys mutica. — We were offered only 9 specimens of this turtle, four adult males, one female, and four juveniles. Eight of these were from Qiongzhong in the central region, and one animal we found in a small village between Dongfang and Gancheng (name unknown, location: 18°40'N, 108°43'E). The villagers told us this was the first turtle found in the rice fields in years. Thus, *M. mutica* may be considered scarce on the western coastal plains of Hainan.

Ocadia sinensis. — We saw approximately 30 *O. sinensis* in the Dongmen Market in Haikou, but since none of the other turtles seen there were of mainland Chinese origin, it is unlikely that these *Ocadia* were. They may have originated from Vietnam, in that one dealer offered them together with a *Mauremys annamensis*. Both in Tongzha and Qiongzhong we were offered an adult male *O. sinensis* (Fig. 8). The seller in Tongzha was a Li turtle collector who assured us that they were caught around Tongzha (probably in swamps or rice fields, since local Li people call them "grass turtle"), and that they were very rare. Contrary to the



Figure 8. *Ocadia sinensis* male from near Tongzha.

animals in the Dongmen Market, which were nearly all females in a poor condition and with extensive shell abrasions, the two males offered to us were in very good condition, suggesting that they were indeed of local origin. The animals have no obvious external features that distinguish them from mainland *O. sinensis*.

Ocadia philippeni. — This recently described species was "reported to have been collected near Kancheng = 48 km from Tungfang, western Hainan Island" in the spring of 1988 or 1989 (McCord and Iverson, 1992). We intensively explored the 38 km road between Dongfang (Tungfang) and Gancheng (Kancheng) (Fig. 9), and also a stretch of road ca. 15 km south of Gancheng, including Lingtou, and three small villages (Jiu Dongfang, Tuozha Cun, and Jianfeng) on the western coastal plain bordering the central mountains and forming a rectangle with Dongfang and Lingtou (Fig. 1). The only turtle we saw on this trip was a single *M. mutica*. Even at the market in Gancheng, situated at a river, people were unfamiliar with turtles.

Sacalia quadriocellata. — At many of the locations where *C. galbinifrons* and *P. mouhotii* were offered to us, people also had *S. quadriocellata*, locally known as "stone turtles." These animals were also caught in remote mountain areas, where they were said to occur in hill streams and to have nocturnal habits. We saw about 80 *S. quadriocellata* at Xinzhen, Tongzha, and Qiongzhong. The animals differed from the ones we know from the pet trade (which probably came from mainland China or northern Vietnam) in being

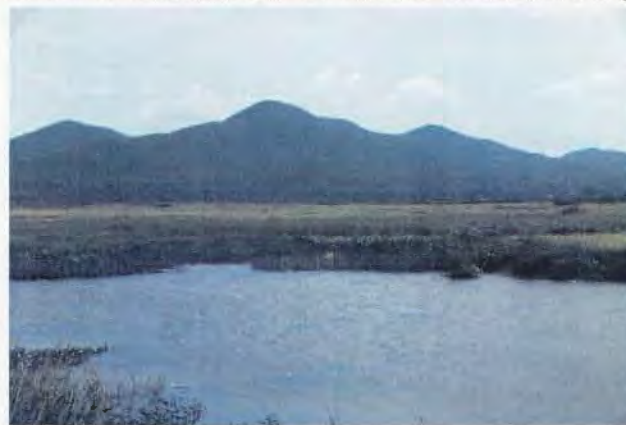


Figure 9. Western coastal plain of Hainan between Dongfang and Gancheng, facing the central mountains.



Figure 10. *Sacalia quadriocellata* male from near Tongzha.

slightly smaller. The largest specimens from Hainan we measured were a female with a straight line CL of 132 mm, and a male of 122 mm (Fig. 10). The largest mainland specimens known to us, however, are a female of 152 mm and a male of 134 mm. Moreover, Hainan males have faint black reticulations on their carapace. Morphometric and pigmentation analysis will be carried out to determine their possible subspecific status (Artner and de Bruin, in prep.). If this taxon is indeed to be separated from the mainland Chinese one, Adler (1962) has already proposed *insulensis* as a subspecific name.

Other Species. — *Sacalia pseudocellata* is reported to have been found at the same western Hainan locality as *O. philippeni* in the spring of 1988 (Iverson and McCord, 1992). As with *O. philippeni*, we found no specimens of this species.



Figure 11a. Portrait of a juvenile *Platysternon megacephalum* from near Xinzheng.



Figure 11b. Juvenile *Platysternon megacephalum* from near Xinzheng (same animal as Fig. 11a).

We also found no specimens of *Geoemyda spengleri*, *Sacalia bealei*, or *Chinemys nigricans* on the island, nor did we find anybody familiar with them. We seriously doubt their presence on Hainan Island. Records of *S. bealei* probably are erroneous and refer to *S. quadriocellata*. These two taxa have frequently been confused. Schmidt (1927) and Fang (1930) depicted *S. quadriocellata* in their descriptions of *S. bealei*. Sachsse (1975) attributed the difference between these forms to sexual dimorphism, with the *quadriocellata* form representing the female and the *bealei* form being the male. Rödel and Prædicow (1988) did not recognize the validity of *S. quadriocellata* as a separate taxon because of the lack of information regarding distribution. There are no known locality records for *G. spengleri* or *C. nigricans* on Hainan (Iverson, 1992).

Platysternidae

***Platysternon megacephalum*.** — We saw approximately 50 specimens in restaurants and at collectors' homes at the following locations: Xinzheng, Tongzha, and Qiongzong. This species was often offered in conjunction with *S. quadriocellata*.

Two juvenile specimens (plastron length 95 and 102 mm) caught on a fishing line by a Li individual living in the vicinity of Xinzheng resembled *P. megacephalum peguense* (Figs. 11a, 11b) in having a yellow, black-bordered postorbital stripe, a symmetrical dark plastral figure, and a slightly



Figure 11c. Adult *Platysternon megacephalum* from Qiongzong.

serrated carapacial rim. Some of the subadult *P. m. peguense* we saw still showed the characteristic head and plastral markings of the young, although less distinct.

Adults offered to us in Qiongzong resembled *P. megacephalum shiui* (Ernst and McCord, 1987) in having many pinkish and yellow spots on the head, tail, and limbs (Fig. 11c). However, they reached a CL of at least 180 mm whereas *P. m. shiui* has a reported maximum CL of 151 mm (Ernst and McCord, 1987). Apart from their larger adult size, Hainan *Platysternon* were virtually indistinguishable from *P. m. shiui*. At one site in Qiongzong where we saw over 20 specimens of Hainan *Platysternon* it was noted that juvenile and subadult animals showed features of *P. m. peguense*, and all adults resembled *P. m. shiui*. In Tongzha we found an intermediate specimen with a CL of 155 mm; it still had a pale plastral figure and was developing the colored spots and flecks seen in adult animals.

Two Li turtle collectors we interviewed informed us that *Platysternon* are caught during the night, since this is a nocturnal species, but may also be found occasionally at dawn. They live in slow to fast-moving mountain streams. Both collectors took us to streams where they frequently caught *Platysternon*. These were both slow-moving, had depths of approximately 30–50 cm, and water temperatures (at an altitude of approximately 300 m) of 24 and 28°C, significantly higher than the previously reported preference for *P. megacephalum* (Ernst and Barbour, 1989).

These findings indicate that *P. m. peguense*, not the nominate subspecies, occurs on Hainan. This was already suggested by Pritchard (1979) based on drawings of *Platysternon* from Hainan provided by Pope (1935). The typical markings attributed to *P. m. peguense* are present only in juvenile animals and are lost in adulthood, being replaced by a pattern of colored spots and flecks over the whole body. These remarkable age-related changes may cast a different light on the subspecies as currently recognized. Ontogenetic and regional variation of *Platysternon*, based on material from the entire range of the genus, needs further study.

Trionychidae

Pelodiscus sinensis. — Hundreds of these turtles were sold at the food markets in Haikou and Sanya. Just south of Dongfang, near Xinlong (18°58'N, 108°43'E) we visited a large newly developed breeding farm for these animals. This farm has 4 large artificial ponds, each measuring approximately 500 m². According to the manager, each pond contained about 2000 *P. sinensis*. Eight new ponds were under construction. The manager told us the farm was owned by a Hunan businessman, and that all *P. sinensis* in the ponds were wild-caught in Hunan Province, China. He also told us that the eggs were deposited at night in artificially created sandbanks, and that they were left to incubate at those sites. Immediately after hatching, the hatchlings were sold to businessmen in Hunan. We were unable to obtain any information on wild *P. sinensis* on Hainan.



Figure 12. Changhua Jiang River near Maoyang.

Palea steindachneri. — We have neither seen this animal at local food markets, nor in the wild. According to O. Shiu of Hong Kong (*pers. comm.*), this species has not been available for years in the pet trade either.

Pelochelys cantorii. — A specimen of this species with a total body length (neck extended) of 1.48 m and a pale brown color was caught in November 1996 in the Changhua Jiang River near the village of Maoyang (Fig. 12), and kept in a large tank in the Museum of Ethnic Minorities in Tongzha. It was said to have been released into the wild only a couple of weeks before our visit. We were able to identify the species from photographs the museum staff showed us. Local scientists had erroneously given the age of the turtle as five hundred years.

Testudinidae

Manouria impressa. — We saw two specimens at Dongmen Market in Haikou. As already argued for *O. sinensis*, they were probably not from Hainan. We could not find anybody on the island who was familiar with this remarkable tortoise. The only published Hainan locality for this species is Haikou (Zhao and Adler, 1993), based upon specimens probably purchased in a market. There are only anecdotal indications of its presence on Hainan. For example, Jenyns (1930) wrote: "an ancient work of Chinese National History speaks of a 'hill tortoise' from Hainan so big that it could walk with a man on his back and which bellowed like a cow," which might have referred to *M. impressa*. Based only on this, we question its occurrence on Hainan.

General Remarks

This is the first report of a Western expedition to study the turtles of Hainan since the visit of Pope in 1922 and its resulting publications (Schmidt, 1927; Pope, 1935). One of our goals was to obtain more knowledge of Hainan turtles in general. We have considerably increased the number of localities for 8 species. Unfortunately, we were unable to find turtles in the wild by ourselves, but in all cases we could

confirm that animals were caught within a small radius of the place where they were shown to us.

Our findings indicate that turtles in the coastal plains are extremely rare. The only specimen we saw there was a *Mauremys mutica*. The extreme scarcity is unlikely to be attributable to the season of our visit. In May it is spring on Hainan, and daily temperatures are already high. Temperature during the day averaged 35°C, whereas the water temperature in the rice fields was 31°C. Moreover, in the mountains many turtles that were offered to us were gravid females which indicates that in May turtles are active on Hainan.

The absence of *O. philippeni* underscores its rareness. Since it was first encountered in 1988-89, a total of ca. 20 specimens have been collected (O. Shiu, pers. comm.). The chances of finding this turtle on a short expedition were clearly against us. The same holds true for the even rarer *S. pseudocellata*.

In the mountains, turtles are still present in numbers that allow catching them relatively frequently. Li and Miao people, who catch turtles in the mountains, do not seem to eat them. Turtle is considered a delicacy by the Han Chinese and hence is relatively expensive. Prices asked in central Hainan were approximately US\$ 10-20 for a turtle of 0.7-0.9 kg. Turtles caught by native people in the mountains and by peasants working on the coastal plains are sold to restaurants, or to collectors who sell them in markets and to restaurants. The fact that we saw no Hainanese turtles at Dongmen Market in Haikou, whereas we saw many in the mountains, is puzzling. A possible explanation might be that the animals caught in the central mountains are consumed locally and hence no animals are sold to markets on the coast. Another possibility is that the prices in Haikou are so high that it is more convenient and still profitable for Haikou turtle-dealers to import large (and perhaps better-selling?) turtles from southeast Asia than to obtain animals from the central mountains.

Acknowledgments. — The authors wish to thank Christian Steinböck and Andreas Hofer for their friendship and help during the expedition, Pan Jia Bao from Haikou for his invaluable help and friendship, Oscar Shiu from Hong Kong for his hospitality and for sharing his knowledge on Chinese turtles, Uwe Fritz from the Zoological Museum in Dresden, Germany, for his support and continuing interest, K. Yang-de Witte from Leiden University, Dept. of Sinology, Leiden, Netherlands, for her help with Chinese place names and their synonyms, Hans-Dieter Philippen for providing much of the literature cited, and Peter Paul van Dijk for his valuable comments on an early draft of this paper.

Literature Cited

- ADLER, K. 1962. A new name for a Chinese turtle, genus *Clemmys*. Nat. Hist. Bull. Siam Soc. 20:135.
- ERNST, C.H., AND BARBOUR, R.W. 1989. Turtles of the World. Washington, DC: Smithsonian Inst. Press. 313 pp.
- ERNST, C.H., AND McCORD, W.P. 1987. Two new turtles from southeast Asia. Proc. Biol. Soc. Wash. 100:624-628.
- FANG, P.W. 1930. Notes on chelonians of Kwangsi, China. Sinensia 1(8):95-135.
- FRITZ, U., AND OBST, F.J. 1997. Zum taxonomischen Status von *Cuora galbinifrons serrata* Iverson & McCord, 1992 und *Pyxidea mouhotii* (Gray, 1862) (Reptilia: Testudines: Bataguridae). Zool. Abh. Staatl. Mus. Tierk. Dresden 49(14):261-279.
- FRITZ, U., ANDREAS, B., AND LEHR, E. 1998. Eine neue Unterart der Dreikiel-Schamierschildkröte, *Pyxidea mouhotii* (Gray, 1862) (Reptilia: Testudines: Bataguridae). Zool. Abh. Staatl. Mus. Tierk. Dresden 50(3):33-43.
- HU, S., ZHAO, E., AND HUANG, C. 1975. Three new species of reptiles from Hainan Island, Guangdong Province. Acta Zool. Sinica 24:379-384. (Translation by A. Koshikawa, 1982, Smithsonian. Herp. Inf. Serv. 53:1-9.)
- IVERSON, J.B. 1992. A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, IN: Privately printed, 363 pp.
- IVERSON, J.B., AND McCORD, W.P. 1992a. A new subspecies of *Cuora galbinifrons* (Testudines: Batagurinae) from Hainan Island, China. Proc. Biol. Soc. Wash. 105:433-439.
- IVERSON, J.B., AND McCORD, W.P. 1992b. A new Chinese eyed turtle of the genus *Sacalia* (Batagurinae: Testudines). Proc. Biol. Soc. Wash. 105:426-432.
- JENKINS, M.D. 1995. Tortoises and Freshwater Turtles: The Trade in Southeast Asia. Cambridge: TRAFFIC International, 48 pp.
- JENYNS, S. 1930. The tortoise and the turtle in Kwongtong. Hong Kong Naturalist (November):161-163.
- LI, W., AND ZHAO, X. 1989. China's Nature Reserves. Beijing, China: Foreign Languages Press.
- LI, Z.Y. 1958. Report on the investigation of reptiles of Hainan Island. Chinese J. Zool. 2(4):234-239.
- McCORD, W.P., AND IVERSON, J.B. 1992. A new species of *Ocadia* (Testudines: Bataguridae) from Hainan Island, China. Proc. Biol. Soc. Wash. 105:13-18.
- PACK-BLUMENAU, A. 1997. Zum Status endemischer Huhnervögel, des Schopgibbons und des Leierhirsches auf der Insel Hainan. Mitteil. Zool. Gesellsch. Art. Popul. 13:10-12.
- POPE, C.H. 1935. The Reptiles of China. New York: American Museum of Natural History, Natural History of Central Asia, Vol. X. 604 pp.
- PRITCHARD, P.C.H. 1979. Encyclopedia of Turtles. Neptune, NJ: TFH Publ., 895 pp.
- RÖDEL, M.-O., AND PRAEDICOW, G. 1988. Die Chinesische Vieraugenschildkröte, *Sacalia bealei* (Gray 1831). Sauria 10(4):3-8.
- SACHSSE, W. 1975. *Chinemys reevesii* var. *unicolor* und *Clemmys bealei* var. *quadriocellata* - Ausprägungen von Sexualdimorphismus der beiden "Nominatformen". Salamandra 11:20-26.
- SCHMIDT, K.P. 1927. The reptiles of Hainan. Bull. Amer. Mus. Nat. Hist. 53:395-465.
- SIEBENROCK, F. 1906. Zur Kenntnis der Schildkrötenfauna der Insel Hainan. Zool. Anz. Leipzig 30:578-586.
- SMITH, M.A. 1923a. Narrative of a journey to the interior of Hainan. J. Nat. Soc. Siam 6:185-193.
- SMITH, M.A. 1923b. On a collection of reptiles and batrachians from the island of Hainan. J. Nat. Soc. Siam 6:195-212.
- WEISS, M. 1989. A chelonian puzzle: the Indo-Chinese box turtle in captivity. Plastron Papers 18(5):20-24.
- ZHAO, E., AND ADLER, K. 1993. Herpetology of China. Soc. Study Amphib. Reptiles, Contr. Herpetol. No. 10, 522 pp.

Received: 20 February 1998

Reviewed: 20 September 1998

Revised and Accepted: 18 February 1999