Chapter 1

Introduction

Conservation biology is a topic of increasing interest and concern as the world approaches the 21st century. Advantages of wildlife conservation include preservation of biodiversity, beneficial aspects on ecosystem balance and economic advantages from wise utilization of natural resources. Conservation management can take many forms, including habitat preservation and enhancement, translocation of individual animals to more suitable habitats, maintenance and breeding of animals in captivity and direct hormonal stimulation of breeding. Reproductive biology is believed to be one of the requirements bases for a successful conservation program (Wildt et al.., 1992; Edgar, 1993; Cockrem, 1997).

Thailand is one of a few countries world-wide with more than 25 species of turtles. A total of 28 species representing 26 genera in 6 families occur in Thailand. Some of these turtles could be developed to be of economic importance, such as softshell turtles of the family Trionychidae. But with ever-increasing habitat destruction, hunting and human settlement, Thailand is listed among 15 countries with the largest number of threatened species of reptiles (IUCN, 1996). Many species of turtles are disappearing and may become extinct before we have the chance to study and conserve them. These include the Impressed tortoise *Manouria impressa*, the Painted terrapin *Callagur borneoensis*, the Striped giant softshell turtle *Chitra chitra* and the Asian giant softshell turtle *Pelochelys cantorii* (Kumthorn Thirakhupt and van Dijk, 1994; Saowanee Sematong and Kumthorn Thirakhupt, 1994). Even the widely distributed species, the common Asiatic softshell turtle *Amyda cartilaginea*, is listed as a vulnerable species according to the IUCN red list of threatened animals (IUCN, 1996). Conservation efforts should include both habitat conservation and captive breeding programs which are based on an understanding of reproductive biology. At present this knowledge is still scarce for turtles in tropical regions including Thailand, leading to unsuccessful recovery programs.

There have been efforts to farm *Amyda cartilaginea* on a commercial basis in order to supply local demand for its meat. But economic profit is still low compared to farming an introduced species, *Pelodiscus sinensis*, which is mainly

cultured for export to Taiwan and Hong Kong. There were also attempts to develop a breeding program of *Amyda cartilaginea* by the National Inland Fisheries Institute, but the results were only moderately encouraging due to lack of a reproductive biology basis (Sujin Nukwan, Panu Tavarutmaneegul and Anusin Inkuan, 1995). Data concerning the reproductive biology of *Amyda cartilaginea* at present was mainly obtained by observation from natural populations (Wirot Nutaphand, 1979; van Dijk, 1992; Wirot Nutaphand, 1990; Meylan, Moll and van Dijk, 1995). The data is still scarce in most aspects, especially sexual dimorphism and the annual reproductive cycle.

Sexual dimorphism, one aspect of reproductive biology, is a condition in which the males and females in a species are different in morphological traits such as coloration, size or other features. Presumably the dimorphism in some species reflects factors important in social interactions, survival, or reproduction (Bury, 1979). Three major hypotheses have been proposed to explain sexual differences in organisms: 1) the female fecundity hypothesis: females are larger because larger body size is associated with increased number or size of eggs, 2) the competition avoidance hypothesis: differences in head and mouth size and differences in microhabitat usage result in decreased intersexual competition for resources, and 3) the sexual selection hypothesis: males are larger because large male size is favored in male-male disputes over breeding territories (Darwin, 1889; Slatkins, 1984; Shine, 1989, 1990). In *Amyda cartilaginea* males show longer and heavier tails which are important in mating performance. There was also a proposed difference in plastron color by Smith in 1931. While other sexually dimorphic characters have not been recorded (Wirot Nutaphand, 1979; van Dijk, 1992; Meylan, Moll and van Dijk, 1995).

The annual reproductive cycle is another important feature of reproductive biology contributing to the mode of reproduction and temporal changes in fertility of organisms. With the advent of sensitive methods for hormone measurement, investigations of hormonal profiles have become powerful tools for the study of reproductive cycles. In chelonian species, reproductive cycle in term of hormonal profiles have been studied in some freshwater species, including *Chelydra serpentina*, *Chrysemys picta* and *Sternotherus odoratus* (Callard et al., 1978; Lewis, Mahmoud and Klicka, 1979; Licht, 1982; Licht, Breitenbach and Congdon, 1985, Mahmoud and Licht, 1997), some tortoises including *Geochelone* spp, *Gopherus agassizii* and *Testudo* spp (Rostal et al., 1993; Casares et al., 1994), and some

marine turtles including *Caretta caretta*, *Chelonia mydas*, *Dermochelys coriacea*, *Lepidochelys kempi* and *Lepidochelys olivacea* (Licht et al., 1979; Licht, Rainey and Cliffton, 1980; Licht et al., 1982; Licht, Wood and Wood, 1985; Wibbels et al., 1990; Guilette et al., 1991; Wibbels et al., 1992; Rostal et al., 1996, 1997; Whittier, Corrie and Limpus, 1997; Rostal et al., 1998). In the temperate zone, turtles show a distinct seasonal reproductive cycle. Males show typical spring mating behavior and autumn spermatogenesis; both are under major control of testosterone. Females show autumn vitellogenesis and oocyte maturation, spring mating, followed by nesting behavior. In females, testosterone plays a role as a precursor for estradiol synthesis, while estrogen levels correlate with vitellogenesis and progesterone has an important role in the ovulatory process. In general only a few studies concern the reproductive cycle of softshell turtles, while most of the aforementioned studies of turtle hormonal profiles were performed in temperate zone and thus are unlikely to be applicable to tropical turtles due to climatic differences.

A study of *Amyda cartilaginea* for sexual dimorphism, in order to properly identify sex from secondary sex features and other morphological traits, and annual reproductive cycle, in order to monitor changes in fertility year-round by detecting plasma sex steroids profile, could form a useful basis for both endangered turtle recovery programs and economic animal development programs in the future.

Objectives

1. To study sexual dimorphism, in order to properly identify sex from secondary sex features and other morphological traits.

2. To study the annual reproductive cycle of mature male and female *Amyda cartilaginea* by detecting changes in plasma sex steroids profile year-round.

Anticipated benefit

To obtain basic knowledge about sexual dimorphism and the annual reproductive cycle of mature male and female *Amyda cartilaginea* in a tropical region. This could be used for endangered turtle recovery programs and economic animals development programs in the future.