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STATUS AND DISTRIBUTION OF THE GREY-HEADED FISH-EAGLE (*ICHTHYOPHAGA ICHTHYAETUS*) IN THE PREK TOAL CORE AREA OF TONLE SAP LAKE, CAMBODIA

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ABSTRACT.—The regional population of the Grey-headed Fish-Eagle (*Ichthyophaga ichthyaetus*) in Southeast Asia is thought to be in recent decline and its conservation status under threat. We undertook a systematic survey in a flooded swamp forest at the Tonle Sap Lake in Cambodia and recorded 32 pairs of eagles in an area of approximately 80 km². Three species of water snakes were identified as eagle prey items, previously unrecorded for this species. We suggest that this eagle population has significant regional importance and discuss potential anthropogenic threats to population stability, such as water snake harvesting and construction of upstream hydropower dams.

KEY WORDS: *Grey-headed Fish-Eagle*; Ichthyophaga ichthyaetus; *Cambodia*; *conservation*; *prey*; *water snake*.

ESTADO Y DISTRIBUCIÓN DE *ICHTHYOPHAGA ICHTHYAETUS* EN EL ÁREA NÚCLEO DE PREK TOAL, LAGO TONLE SAP, CAMBOYA

RESUMEN.—Se cree que la población regional de *Ichthyophaga ichthyaetus* en el sureste de Asia ha disminuido recientemente, y que se encuentra bajo amenaza en términos de conservación. Realizamos un muestreo sistemático en un bosque pantanoso inundado en el lago Tonle Sap, Camboya, y registramos 32 parejas de águilas en un área de aproximadamente 80 km². Se identificaron a tres especies de serpientes de agua como ítems presa, las cuales no habían sido registradas como presas para esta especie de águila anteriormente. Sugerimos que esta población de águilas tiene una importancia regional significativa y discutimos algunas posibles amenazas antropogénicas para su estabilidad poblacional, tales como la caza de serpientes de agua y la construcción de represas hidroeléctricas río arriba.

[Traducción del equipo editorial]

The genus of Asiatic-Oriental fish-eagles, *Ichthyophaga*, contains two species: the Grey-headed Fish-Eagle *I. ichthyaetus* and the Lesser Fish-Eagle *I. humilis* (Brown and Amadon 1968, Brown 1976, Collar et al. 1994, del Hoyo et al. 1994). While both species are broadly sympatric, ranging from northeast India (down the Thai-Malay Peninsula) to Indonesia, virtually nothing is known of their specific ecological requirements in any part of their range (Ferguson-Lees and Christie 2001). Generalized reports suggest the Grey-headed Fish-Eagle is distributed in forests along rivers and lakes, on reservoirs and coastal swamp habitat on the Thai-Malay Peninsula (Wells 1999), and in Sri Lanka it is thought to hunt in water storage tanks and is thus known locally as the ''tank eagle'' (Henry 1998). As its scientific and common name suggests, the Grey-headed Fish-Eagle is considered a specialist piscivore (del Hoyo et al. 1994, Ferguson-Lees and Christie 2001), thought to favor foraging from perches overhanging rivers and lakes (Baker 1928, Brown and Amadon 1968, Wells 1999). Amadon (1983) suggests it is more spe-

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cialized for fish-catching than the sea eagles, because its talons are curved like the Osprey's (Poole 1989). Other than this, nothing has been published on the species' foraging ecology.

The Grey-headed Fish-Eagle is currently classified as globally near-threatened (BirdLife International 2001), exhibiting range contraction and apparent population decline, for unknown reasons (Ferguson-Lees and Christie 2001, BirdLife International 2004), although potential threats are thought to include deforestation, pesticides, and anthropogenic disturbance (BirdLife International 2001, Baral and Inskipp 2004). The remaining stronghold of the Grey-headed Fish-Eagle has been reported as northeast India and Nepal (Ferguson-Lees and Christie 2001). The species is considered rare in most of mainland Southeast Asia (Ferguson-Lees and Christie 2001, Poole 2001) but there are conflicting reports of its status in Cambodia. BirdLife International (2000) records it as scarce in Cambodia, whereas Robson (2005) suggests it is widespread. This confusion is likely a result of poor survey coverage due to the country's long political instability, as comprehensive ornithological fieldwork was not possible until the late 1990s (Poole 2001). Since then, incidental observations have suggested the presence of a scattered breeding population in lowland Cambodia (Timmins and Men 1998, Goes and Davidson 2001, van Zalinge et al. 2002), and multiple anecdotal sightings of individuals have also led to speculation on the existence of a small breeding population in the Prek Toal Core Area of the Tonle Sap Lake (Parr et al. 1996, Goes et al. 1998, Gum 1998, Ear-Dupuy et al. 1998, Goes 2001, Goes and Hong 2002, Goes 2005).

We report the findings of the first systematic survey of the Grey-headed Fish-Eagle population in the Prek Toal Core Area on the Tonle Sap Lake in Cambodia and discuss the regional status of this population and potential threats to its long-term stability.

METHODS

Study Area. The Tonle Sap (12°25′–13°25′N; 103°25′–104°40′E; Fig. 1) is Southeast Asia's largest freshwater lake, covering 2500 km² in the dry season (January–May) and expanding to 12 000 km² during the wet season (June–October; Rundel 2000). The Tonle Sap River connects the lake to the Mekong River, which it joins at the Chaktomuk junction near Phnom Penh. The lake has an extraordinary hydrological feature: during the wet season, the Tonle Sap River changes its direction and flows into, instead of away from the lake, due to the flooding of the Mekong River. This pulsing system makes the Tonle Sap a highly productive wetland ecosystem, because the influx of sediment creates a nutrient-rich environment that supports one of the largest freshwater fisheries in the world (Kummu et al. 2005). The dominant floodplain habitat is described as freshwater swamp forest and is characterized by the seasonality of the flooding, as opposed to the permanent flooding of the classic swamp forest of Southeast Asia (Rundel 2000). This unique ecosystem forms a large vegetation belt 7–40 km wide surrounding the open water surface and is estimated to cover approximately 3600 km² (Rundel 2000). It is adapted to withstand seasonal water level variation of up to 10 m and is of relatively simple floristic composition, including three main vegetation types: short-tree scrublands, gallery forest, and aquatic herbaceous vegetation. The short-tree scrublands, consisting of fairly homogenous stands of short trees and scrub 2–4 m high, cover approximately 80% of the floodplain. Typical species include *Vitex holadenon*, *Acacia spiralis* and *Corbretum trifoliatum*. The gallery forest covers approximately 10% of the floodplain, is mainly found close to the shoreline and riverways, and consists of 7–15-m-tall trees dominated by freshwater mangrove (*Barringtonia acutangula*) and *Diospyros cambodiana*. The aquatic herbaceous vegetation comprises floating or emergent herbs which colonize the open areas and include *Sesbania javanica* and the introduced water hyacinth *Eichhornia crassipes* (McDonald et al. 1997).

The Tonle Sap was designated a UNESCO World Biosphere Reserve in 1997 (Poole 2005), with three designated core areas: Prek Toal (21 342 ha), Boeng Chhma (14 560 ha) and Stung Sen (6355 ha; Fig. 1). The Prek Toal Core Area (13° 07′N, 103° 39′E) is considered one of the most intact areas of freshwater swamp forest around the lake (Chan et al. 2004). The Prek Toal Core Area consists of gallery forests and short-tree scrublands with scattered trees and small ponds. The site has been designated as an internationally Important Bird Area (Chan et al. 2004) because it supports the most significant large waterbird colonies of Southeast Asia, including breeding populations of the globally threatened Spot-billed Pelican *Pelecanus philippensis*, Milky Stork *Mycteria cinerea*, Lesser Adjutant *Leptoptilos javanicus* and Greater Adjutant *Leptoptilos dubius* (Goes 2005).

Survey Techniques. We conducted a systematic survey for Grey-headed Fish-Eagles in an area of approximately 80 km² at the northern end of the Prek Toal Core Area (Fig. 2) from 6–13 December 2005. This area (approximately 20% of the total Core Area) was selected on the basis of time constraints and to avoid disturbance of the principal waterbird breeding colonies at the southern end of the Core Area. The survey was conducted by motorboat, using a series of 12 north-south transect lines 1 km apart. Start and end transect points were determined using a handheld global positioning system (Garmin GPS 12) and a 1:50 000 map of Prek Toal (Defense Mapping Agency Topographic Center, Washington DC, Sheet 5735 III). Two transects were conducted each day between 0700–1600 H, starting with an outward southerly transect followed by a northerly return. Transect length ranged from 4.5–8 km and took between 1.5–3.5 hr to complete. A minimum of two observers conducted each transect, each observer surveying either to the west or east of the transect line. Each observer continuously scanned for Grey-headed Fish-Eagles and/or nests through a 180° arc using 8 × 32

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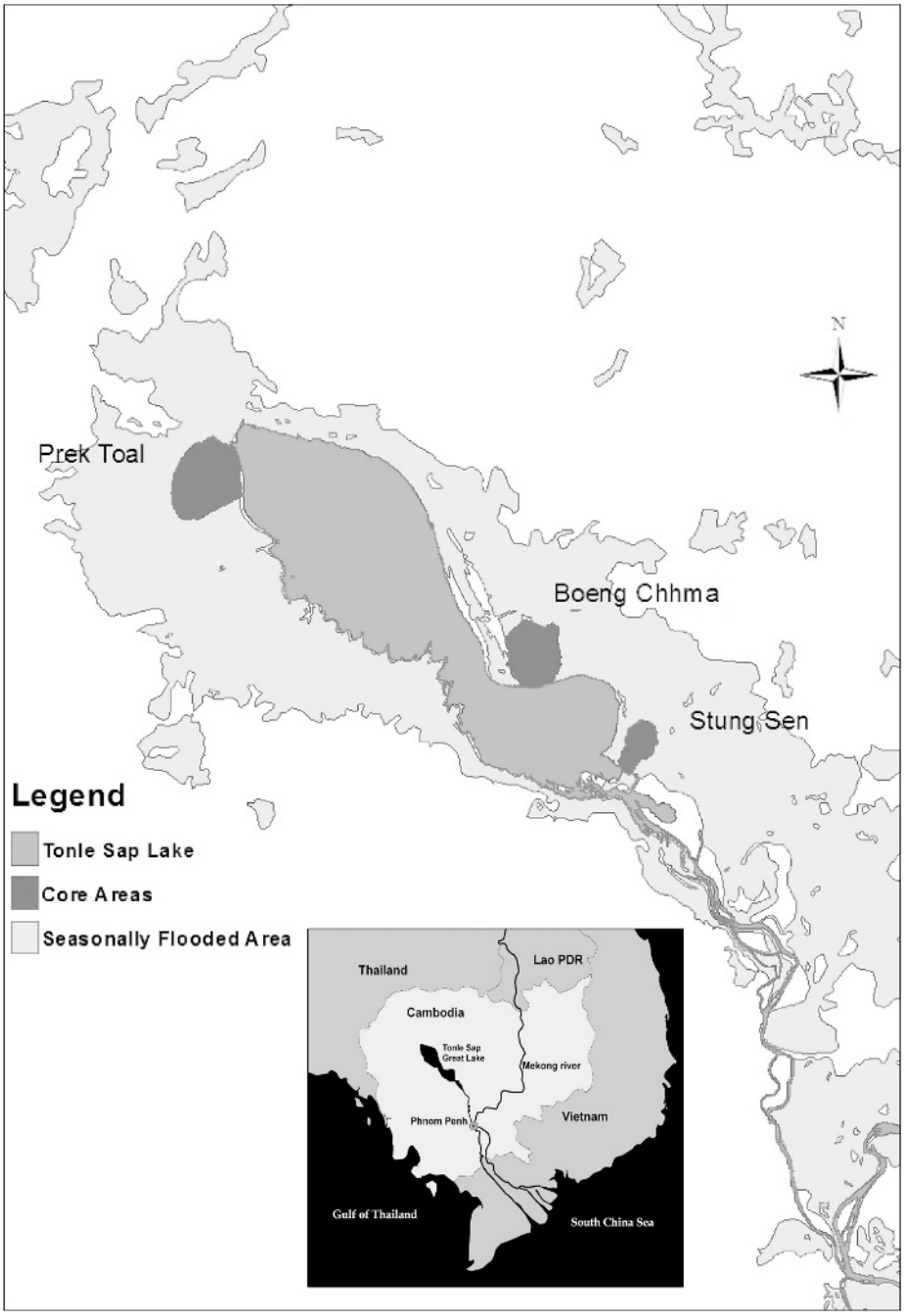


Figure 1. Location of the three Core Areas on Tonle Sap Lake and extent of the floodwater.

and 7 × 50 binoculars while up to three additional people made casual observations while navigating at the front of the boat. A 20–60 × zoom telescope was used occasionally to verify initial sightings at distances of over 800 m. Our observations were categorized according to the criteria used by Rabarisoa et al. (1997): (a) active nest (i.e., an eagle on nest or within 400 m of nest or chick(s) on nest or green leaves on nest); (b) unused nest (i.e., none of

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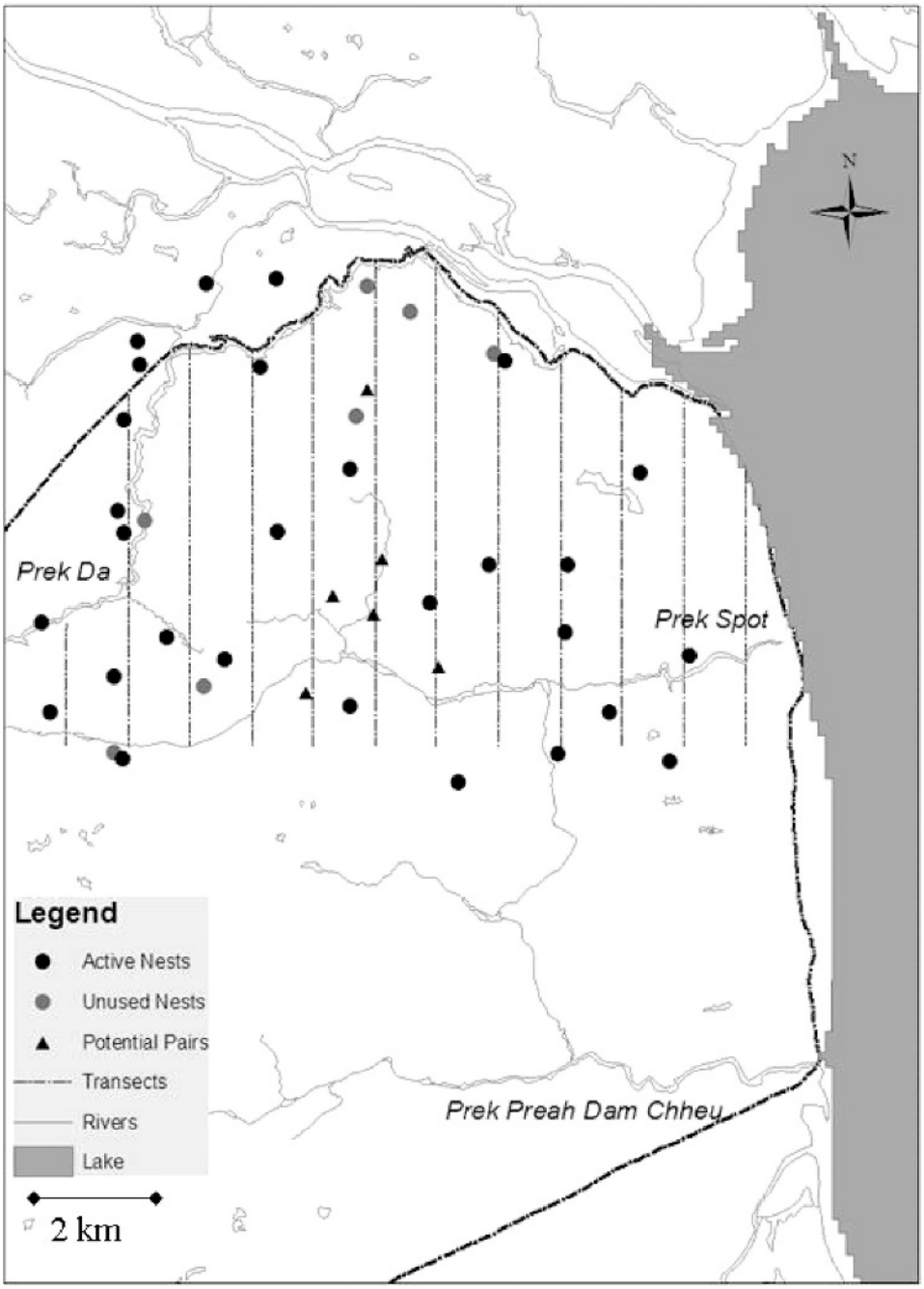


Figure 2. Distribution of the Grey-headed Fish-Eagle nest sites and potential breeding pairs within the Prek Toal Core Area.

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previous, or partial/full collapse of nest); (c) breeding pair (i.e., pair at nest or nest building); (d) potential pair (i.e., pair observed together but no nest found in vicinity); or (e) single bird (i.e., an eagle observed alone with no nest found in vicinity).

RESULTS

Survey. Thirty-two pairs of Grey-headed Fish-Eagles were recorded during the survey and two further pairs were found to the north of the surveyed area (Fig. 2). Of these 34 pairs, 28 were considered as breeding pairs and six as potential breeding pairs. Twenty-eight active nests were found. Observed breeding stages included nest-building, incubation, and nestling. The age of nestlings ranged from approximately two d (white downy chicks) to 6–7 wk (almost fully-feathered chicks). Fledglings were not observed. Single adults were observed in 12 locations and a single juvenile (immature plumage) was observed once (locations not shown). Seven old/unused nests were located (Fig. 2). Grey-headed Fish-Eagles were regularly observed perched on the tops and sides of trees and bushes. We observed caught prey on four occasions and identified the prey each time as a water snake (Tonle Sap water snake (*Enhydris longicauda*), Bocourt's water snake (*E. bocourti*), tentacled snake (*Erpeton tentaculatum*), and unknown water snake.

DISCUSSION

This study provides the first systematic survey and confirmation of a breeding population of Grey-headed Fish-Eagles in the Prek Toal Core Area of Tonle Sap Lake, Cambodia. Previous reports have suggested the possibility of a small breeding population at this site (Goes 2005) but there were no recorded observations of active nests at Prek Toal prior to this study. An additional six breeding pairs were located outside the survey area in the south-central region of the Prek Toal Core Area (Tingay and Nicoll 2006), and individual eagles have been reported anecdotally in the two other Core Areas (Boeng Chhma and Stung Sen) on the eastern side of the lake (Mundkur et al. 1995, Goes et al. 1998, Hong 1999, Goes and Hong 2002). The area surveyed during this study (80 km^2) represents only 2.2% of the total estimated swamp forest (3600 km^2) surrounding the Tonle Sap Lake. Thus, assuming the remaining swamp forest has a similar ecological structure, it is likely that the Grey-headed Fish-Eagle breeding population extends well beyond the boundaries of the Prek Toal Core Area. This conclusion is supported by anecdotal reports, including the observation of one nest north of the Boeng Chhma Core Area in 2000 (Goes and Hong 2002), and individual eagles reported from other areas on the eastern side of the lake (Parr et al. 1996, Goes and Hong 2002). Although the Prek Toal population has previously been recorded as globally (Goes 2005) and regionally (Poole 2001) significant, neither study provided quantitative data to support these claims. Based on our results, we suggest that the Tonle Sap Lake supports a regionally significant population of Grey-headed Fish-Eagles, as populations in neighboring Thailand, Laos and Vietnam have apparently suffered rapid declines in recent years (Poole 2001), with only small numbers reported from a few areas (Lekagul and Round 1991, Thewlis et al. 1998, Round 2000). Global population data are currently lacking for the species (Ferguson-Lees and Christie 2001) so the global significance of this population cannot be ascertained.

Our study was the first to document water snakes in the Grey-headed Fish-Eagle diet. The Prek Toal Core Area is known to support a high density of at least seven homalopsine water snake species (Poole 2005) and we have identified three of these, including the endemic Tonle Sap water snake (Saint-Girons 1972), as prey items of the eagle. Little is known about the ecology of homalopsine water snakes because of their aquatic nature and secretive behavior (Stuart et al. 2000), although they are thought to occur at naturally high densities (Murphy et al. 1999). It is not yet known whether water snakes are a seasonal or year-round prey item for the eagles, because unstudied water snake life history traits such as potential migration and hibernation in response to water level recession may influence water snake activity and seasonal abundance in the lake, and, consequently, in the eagle diet. However, the Tonle Sap water snake is clearly a common prey item in this area; it is known by the local fishermen and snake hunters as the ''fish-eagle water snake'' (L. Carek pers. comm.). The endemic Tonle Sap water snake is the object of considerable conservation concern, because it and at least five other species of water snake at the Tonle Sap are intensively harvested as a food source for local people and for commercially reared captive crocodiles, as well as for skin and live exports to Thailand and Vietnam (Stuart et al. 2000). An estimated 8500 snakes/d have been harvested during the peak of the wet season, which was thought to represent the greatest exploitation of any single snake assemblage in the

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world (Stuart et al. 2000). The sustainability of this harvest and its possible effect on the Grey-headed Fish-Eagle population remains unknown.

The stability of the Grey-headed Fish-Eagle population on the Tonle Sap also may be affected by the Chinese development of large hydropower dams in the upstream reaches of the Mekong River. A cascade of eight dams is planned for the Chinese Mekong (Poole 2005) with two (the Manwan and Dachaoshan) already in operation. The downstream impact of these projects is not fully understood, although studies have shown that the two operational dams have trapped significant amounts of sediments and nutrients (Kummu et al. 2005), which, combined with significant changes to the flood regime, may influence the productivity of the Tonle Sap ecosystem and the stability of the Grey-headed Fish-Eagle population.

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