FAUNISTISCHE ABHANDLUNGEN
Staatliches Museum für Tierkunde Dresden

Band 20 Ausgegeben: 10. Dezember 1996 Nr. 17

Distribution and status of the Fishing Cat (*Prionailurus viverrinus rhizophoreus* SODY, 1936) in West Java, Indonesia (Mammalia: Carnivora: Felidae)

With 1 Map and 1 Table

ROLAND MELISCH, PRIYO BUDI ASMORO,
IRWANSYAH REZA LUBIS & LISTYA KUSUMAWARDHANI

Abstract. Results of a wetland survey carried out in West Java, Indonesia, during the years of 1993 and 1994 are presented. Findings of this survey and other recent information revealed five extant, but fragmented subpopulations of Fishing Cats in West Java. Footprint measurement results are shown on a table, and present and historical records are displayed on a map. The conservation status of this cat subspecies is considered by the authors to be IUCN Critically Endangered.

Kurzfassung. **Verbreitung und Status der Fischkatze (*Prionailurus viverrinus rhizophoreus* SODY, 1936) in Westjava, Indonesien (Mammalia: Carnivora: Felidae).** - Ergebnisse einer Felderhebung in den Feuchtgebieten Westjavas, Indonesiens, aus den Jahren 1993 bis 1994 werden vorgestellt. Aus den Resultaten der Feldstudie und anderen neueren Informationen lassen sich fünf rezente, aber fragmentierte Subpopulationen der Fischkatze in Westjava ableiten. Trittsiegelmaße wurden tabelliert, und rezente und historische Nachweise auf einer Karte dargestellt. Der Naturschutz-Status dieser Fischkatzen-Unterart wird von den Autoren als IUCN-'kritisch vom Aussterben bedroht' eingestuft.

Introduction

Despite its beauty, the Fishing Cat has long been neglected in recent research and its elusive life has rarely been documented by photographic material (NEUMANN-DENZAU & NEUMANN-DENZAU, 1986; A. COMPOST, pers. comm. 1994).

The range of the Fishing Cat patchily covers South and Southeast Asian wetlands. On its western distributional fringe, isolated populations of the Fishing Cat live in the lower Indus Valley of Pakistan (ROBERTS, 1977), South West India (BHATTACHARYYA, 1992) and Sri Lanka (ALWIS, 1973). Its major distribution ranges from Nepal and Assam (POCOCK, 1939) to Myanmar (U TUN YIN, 1967), Thailand (LEKAGUL & MCNEELY, 1977) and Indochina (DELACOUR, 1940). BREE & KHAN (1992) recently recorded the Fishing Cat from Peninsular Malaysia but see also MELISCH's note

Author's addresses:
Roland Melisch, WWF Germany, Hedderichstraße 110, D-60591 Frankfurt/M., Germany
Priyo Budi Asmoro, Wetlands International – Indonesia Programme, P.O.Box 254/BOO, Bogor 16002, Indonesia
Irwansyah Reza Lubis, Wetlands International – Indonesia Programme, P.O.Box 254/BOO, Bogor 16002, Indonesia
Listya Kusumawardhani, Direktorat Bina Program, Direktorat Jenderal PHPA, Jl.Ir.H. Juanda No. 15, Bogor 16002, Indonesia

from 1995. In Indonesia *Prionailurus viverrinus* occurs isolated on Java (MELISCH, 1992), where it constitutes the eastern limit of its range. Doubtful records from Bali and Borneo have been discussed by BREE & KHAN (1992). Records from Sumatra have been controversially discussed in the past (DELSMAN, 1932a; SODY, 1931 & 1936a; JACOBSON, 1936; ZON, 1979). In 1985, NASH & NASH found footprints of a Fishing Cat in South Sumatra, but did not secure plastercasts. In 1992, a HIMBIO team secured a dead Fishing Cat in Berbak, Jambi Province. However, there is not much known about the species' occurrence on Sumatra and no museum specimens are yet known for the island (BREE & KHAN, 1992). CORBET & HILL (1992) indicate East Java as distributional range of *P. viverrinus* but there is, however, no recent evidence available (PFEFFER, 1965; HOOGERWERF, 1974; M. GRIFFITHS, M. INDRAWAN & S. HEDGES, pers. comm. 1994). The easternmost records of Fishing Cats come from the north coast of Central Java and date back to the 1930's (BRONGERSMA, 1935; JACOBSON, 1933).

Conclusively, West Javan populations of *P. viverrinus* remain the only known living examples in Indonesia. Fishing Cats share the island of Java with two other felids, the Leopard Cat *Prionailurus bengalensis* and the Javan Leopard *Panthera pardus* melas. The Javan Tiger is most probably extinct (SANTIAPILLAI & RAMONO, 1992; M. GRIFFITHS & A. RAFIASTANTO, pers.comm. 1994). SODY (1936b) proposed the name *P. viverrinus rhizophoreus* for the West Javan race of the Fishing Cat. The Fishing Cat, *P. viverrinus*, is protected by Indonesian law (ANONYMOUS, 1979), and is listed as IUCN 'insufficiently known' (GROOMBRIDGE, 1993). The recent IUCN/SSC Cat Action Plan (NOWELL & JACKSON, 1996) considers this cat at species level in the second highest category of vulnerability.

This paper analyses the current situation of the cat on Java, with suggestions for its conservation.

Methods

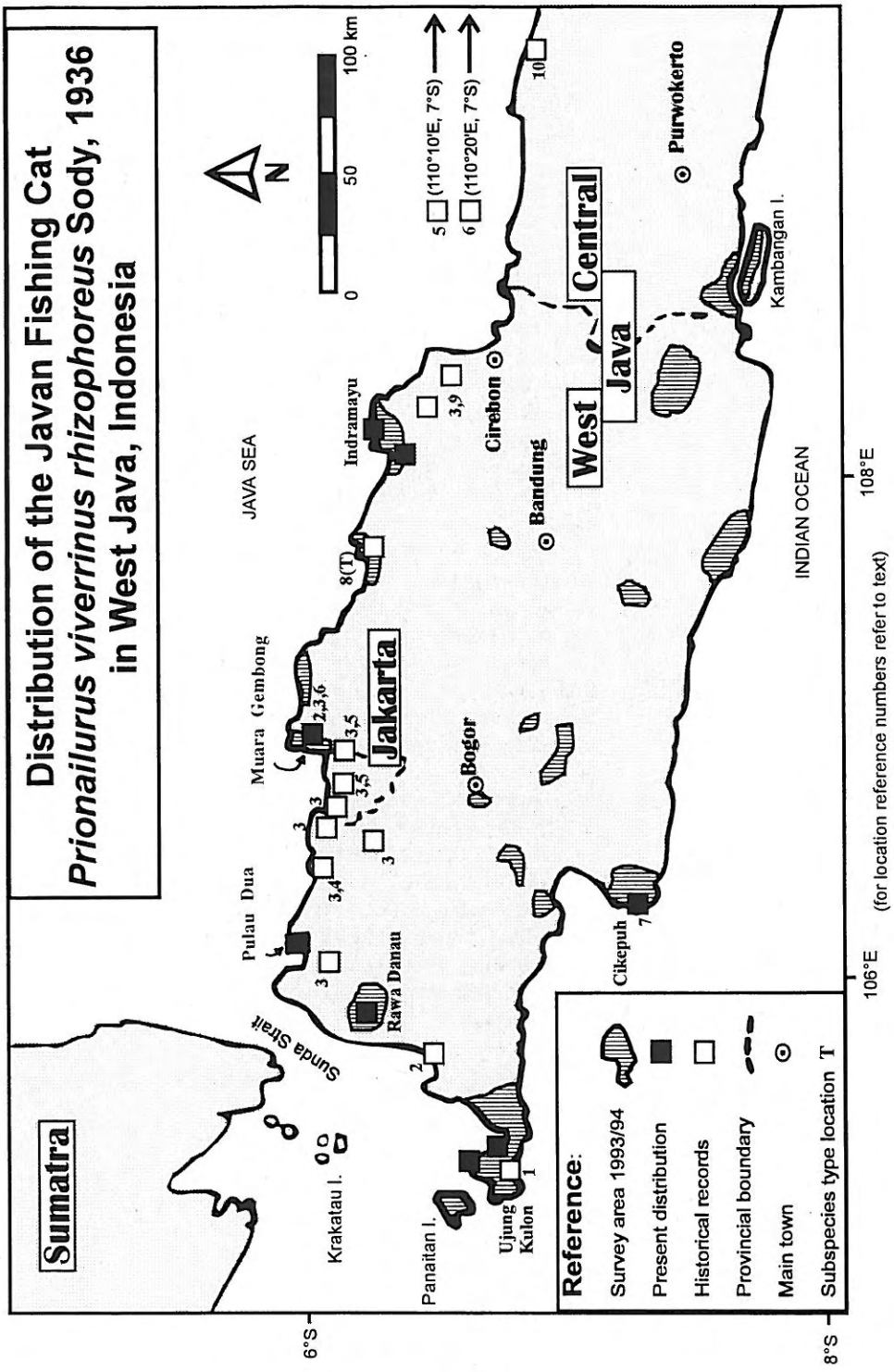
For our survey work, which was carried out between July 1993 and May 1994, we chose nineteen representative wetland areas of West Java, covering most of the national parks, nature reserves and remaining mangrove areas. A total of 591 survey sites, each one consisting of 400-600 m stretches of shorelines or of transects were subsequently selected. Sites were positively identified for the presence of Fishing Cats if footprints or faeces were found. On Java, faeces of the Fishing Cat are considerably larger than the ones of the feral domestic cat *Felis catus* and Leopard Cat *Prionailurus bengalensis*, but smaller than Javan Leopard *Panthera pardus melas*, Dhole *Cuon alpinus* and feral dogs (personal observations, 1992-1994). The faeces of the cat family differ in shape and size from viverrids and mustelids. Footprints of cats are easy distinguishable from other carnivores, in having the typical four-toe imprint and not showing any claw marks. Footprints of Fishing Cats also differ in size from other cats (SODY, 1936c; STRIEN, 1983). The footprints were cast using dentist's plaster (STRIEN, 1983) and deposited in the plastercast reference collection of Wetlands International – Indonesia Programme in Bogor. Additionally, available literature has been reviewed for historical and modern records of Fishing Cats from West Java.

Results

A distance of 286 survey kilometres, divided into 581 survey sites, resulted in 41 sites positively identified for the Fishing Cat. The inhabited sites were all in the area of Indramayu and mainland Ujung Kulon National Park (25 sites and 16, respectively, please see map).

In both areas, *P. viverrinus* inhabited tidal forests with sandy or muddy shores. In Ujung Kulon, forests were in the natural state, having an understorey consisting of seedlings or smaller bushes. At Indramayu, positive records of the Fishing Cat were correlated to habitats consisting of older mangrove stands or abandoned mangrove plantation areas, interspersed with fishponds. No Fishing

Map 1: Distribution of the Javan Fishing Cat *Prionailurus viverrinus rhizophoreus* in West Java, Indonesia [Verbreitung der Javafischkatze *Prionailurus viverrinus rhizophoreus* in Westjava, Indonesien]. ▶


Distribution of the Javan Fishing Cat
Prionailurus viverrinus rhizophoreus Sody, 1936
in West Java, Indonesia
Sumatra
Sunda Strait
Krakatau I.
Panaitan I.
Ujung Kulon
Pulau Dua
Rawa Danau
Muara Gembong
JAVA SEA
Indramayu
Jakarta
Bogor
Cirebon
Bandung
West Java
Central
Purwokerto
Cikepuh
Kambangan I.
INDIAN OCEAN
N
0
50
100 km
(110°10'E, 7°S)
(110°20'E, 7°S)
Reference:
Survey area 1993/94
Present distribution
Historical records
Provincial boundary
Main town
Subspecies type location T
6°S
8°S
106°E
108°E
(for location reference numbers refer to text)

Cats were found in habitat without vegetation cover at Indramayu, e.g. intensive Milkfish *Chanos chanos* fishponds or prawnponds with bare dams. The closest distance to human settlements at which footprints of Fishing Cats were found was one kilometre in Indramayu mangroves, and 20 kilometres in Ujung Kulon.

At Indramayu, all faeces (n=13) were found on bare ground on the top of fishpond-dams, but vegetation cover was never further away than two or three metres. In Fishing Cats' faeces of the Indramayu mangroves we found hair, bones and skull parts of rats, scales of Tilapia *Oreochromis mossambicus* and crab remnants. Surveys in Ujung Kulon revealed only a single faecal deposit at an advanced disintegrated state, which did not enable us to determine its prey contents. A more detailed faeces analyses will be presented later (LUBIS, in prep.).

Mammalian prey availability was much higher in Ujung Kulon as compared to Indramayu mangroves. Only while surveying Ujung Kulon did we find evidence of *Macaca fascicularis, Sus* spec., *Bos javanicus, Muntiacus muntiac, Cervus timorensis, Tragulus javanicus* and *Rhinoceros sondaicus*, whereas the only larger mammals present at Indramayu were feral dogs and domestic goats. Among the small mammal community, we found no squirrels or tree-shrews in Indramayu. Rats and aquatic prey such as fish, water snakes and invertebrates were abundant in both Ujung Kulon and Indramayu. Habitat overlap between Fishing Cat and other carnivores was highest in Ujung Kulon (*Panthera pardus* occurred in 39 % of all sites positive for Fishing Cat, *Paradoxurus hermaphroditus* 39 %, *Herpestes javanicus* 29.3 %, *Prionailurus bengalensis* 22 %, *Viverricula indica* 7.3 %, *Lutrogale perspicillata* 2.4 %) compared to Indramayu mangroves (*Herpestes javanicus* 46.3 %, *Viverricula indica* 34.1 %, feral dogs 34.1 %, *Prionailurus bengalensis* 12.2 %, *Aonyx cinerea* 4.8 %, *Prionodon linsang* 2.4 % and *Lutrogale perspicillata* 2.4 %). Infrared triggered camera-trapping showed good results for Asian Small-clawed Otter and Leopard Cat, but was unsuccessful in obtaining any Fishing Cat photographs.

According to A. COMPOST (pers. comm. 1993 & 1994), *P. viverrinus* was also present on Pulau Dua, a small strict nature reserve of eight hectares in Banten Bay, on the North coast of Java. This former island is now connected to the mainland at low tide. Just during submission of this article, information on recent rediscovery of a Fishing Cat population in Muara Gembong has reached one of us (IRL).

In February 1992, a fresh footprint of *P. viverrinus* was recorded in Rawa Danau Nature Reserve (6°11'S, 105°59'E), which was the first inland record of the species in over fifty years, the first documentation of a Fishing Cat from a Javan freshwater swamp-forest and the first for the reserve (MELISCH et al., 1993). A living individual has since been spotted in October 1994 by R. BERGHAIER (ROMPAEY, in litt. 1995). In West Java, the following vernacular local names are in use for *P. viverrinus:* meong congkok, kucing akar, kucing leuweung (ZON, 1979); gogor, macan batu, ucing memeng, blacan, kucing bakau (SODY, 1931 & 1938). The name most commonly used by Indonesian scientists is kucing bakau. For present and historical records from West Java please refer to the map.

Reference table for historical records of *P. viverrinus* on West Java:

1	HOOGERWERF,	1970
2	DELSMAN,	1932a
3	SODY,	1949
4	DELSMAN,	1931
5	BRONGERSMA,	1935
6	SODY,	1931
7	UNAS,	1989
8	SODY,	1936b
9	Staatl. Museum f. Tierkunde, Dresden, Germany: two skins (coll. MENDEN: MTD 11849 u. 13930, Cheribon, 24.06.1931 u. 19.10.1929)	
10	JACOBSON, 1933	

	Average total length (max/min)	Average total width (max/min)
Front paw imprint (FF)	-	74(90,65), n=3
Hind paw imprint (HF)	-	66(71,60), n=2
undetermined (HF & FF)	40(54,33), n=4	47(80,22), n=9
solepad width (undeterminable whether HF or FF)	-	26(37,15), n=6

Table 1: Footprint measurements of the Javan Fishing Cat *Prionailurus viverrinus rhizophoreus* from West Java, Indonesia [Trittsiegelmaße der Javafischkatze *Prionailurus viverrinus rhizophoreus* von West-Java, Indonesien].

Material from collections in the Netherlands and Indonesia was reviewed by BRONGERSMA (1935) and SODY (1949). Apart from the two skins deposited at the Staatliches Museum für Tierkunde, Dresden, no records of Javan Fishing Cats were found in German museums.

Discussion

Distribution

Taking into account present survey results and historical records, we consider Fishing Cats on Java to be restricted to coastal wetlands. No record has been reported further inland than 15 km from the sea, and no single record has been found above 20 m a.s.l., albeit records of Fishing Cats dwelling at 1500 m a.s.l. in the Himalayas (GUGGISBERG, 1975) exist.

From Myanmar observations, the Fishing Cat's distribution seems highly correlated with vegetation cover (U TUN YIN, 1967). SUNQUIST & SUNQUIST (1989) emphasized the importance of hunting cover for most felids, as they need to get as close as possible to prey before making the final attack. Our findings from Java correspond to the previous two authors, as *P. viverrinus* was never detected in habitat without vegetation cover (e.g. intensivly managed fishponds), despite a high abundance of prey. In West Java, preference for coastal aquatic habitats (mangroves, rivers, estuarines, ponds) seems obvious from our survey results and compiled data of the prey taken by Fishing Cats, as compared to habitat preference of the Leopard Cat, a species not restricted to wetlands and coasts in Java (personal observations). However, aquatic habitats are not favoured by one smaller cat species alone in Southeast Asia, as prey consumption in association with water and swimming has been reported for Flat-headed Cats *Prionailurus planiceps* (MUUL & LIM, 1970; EWER, 1973). Due to the only marginal distributional overlap (possibly in the north of the Malay Pensinsula) and the preference for wetland environs, we tentatively conclude that *P. planiceps* replaces *P. viverrinus* in Borneo, Sumatra and most of Peninsular Malaysia.

Footprints

Data for measurable footprints are listed in Table 1. The measurements given in HOOGERWERF (1970) (front print maximum width 80 cm, sole pad 45 cm; rear print max. width 75, sole pad 35) correspond to our findings. In 1989, students from Universitas Nasional in Jakarta claimed to have positively identified footprints of a Fishing Cat from Citirem river in Cikepuh Wildlife Reserve on Java's south coast (UNAS, 1989). However, the authors do not exactly indicate which parts of the footprints were measured, and sizes given are very small (range 25-30 mm, n=6). Although the record may be a misidentification, we took it into consideration for the distribution map.

Food

Only scattered reports exist of the species' diet on Java (SODY, 1931; DELSMAN, 1932b), as most anecdotal discussions referring to Javan populations end up with the question whether it was a true »Fishing Cat« or not. Hence DELSMAN (1931) and SODY (1931) proposed a change of the Dutch vernacular name from ›viskat‹ to ›mangrovekat‹. SODY (1931) reported fish, mangrove snakes and freshwater molluscs as the cat's food and HOOGERWERF (1970) added shell fragments, crab claws and rat hair to the parts, found in faeces on the south coast of Ujung Kulon. Fishing cats have been blamed for attacking goats and even dogs (DELSMAN, 1932a), and they reportedly flick fish out of the water with their claws (in SODY, 1932; DENIS, 1964). The lack of larger or medium-sized mammal species in the Indramayu mangroves and the prevalence of aquatic prey indicates a diet consisting of rats, fish and aquatic invertebrates. A possible food complementation with avian prey may be assumed from remarks made by HOOGERWERF (1970), stating that trappers succeeded in catching Fishing Cats with poultry-baited traps.

Co-occurrence with two otter species *Lutrogale perspicillata* and *Aonyx cinerea* in Javan wetlands is understandable, as otters have a higher preference for aquatic prey. In Ujung Kulon and Indramayu mangroves *Lutrogale perspicillata* feeds on fresh and brackish-water shrimps and fish, whereas *Aonyx cinerea* has an overall preference for crustacean food, mainly consisting of crabs (ASMORO et al., 1994; LUBIS, 1995). Furthermore, the solitary hunting strategy of the Fishing Cat differs widely from group hunting behaviour of both otter species.

Threats and conservation

The main threat to the survival of the Fishing Cat on Java arises from human encroachment into forested and unspoilt wetland habitat. The important wetlands of Java have been listed in the Indonesian Wetland Inventory (SILVIUS et al., 1987), but mangrove and freshwater swamp-forest areas have decreased to 11 % and 1 %, respectively, of their original extent (GIESEN, 1994). Today there are virtually no mangroves left in the environs of Jakarta, which once was a stronghold of the Fishing Cat on Java. The main cause of habitat destruction on the island is encroachment of agriculture and aquaculture. Particularly important for the survival of the Fishing Cat's Javan race, are the remaining areas along the Javan North coast (Indramayu), which are managed by the state-owned forest enterprise Perum Perhutani. In none of these managed mangrove forests does wildlife receive proper protection, although various proposals have been submitted in the past aiming at establishing conservation areas (e.g. ALLPORT & WILSON, 1984; BScC, 1992). In addition to land reclamation, remaining coastal wetlands suffer from increasing pollution, particularly from pesticide misuse. Other than upstream ricefield contamination, pesticides are applied in all of the coastal fishponds within the Fishing Cat's habitat (100 %, n=25). Despite a ban of most types of pesticides in wetlands (PRESIDEN R.I. 1985: No. 9: 6[1], 7[1]), 80 % of these in use to eradicate both vertebrate and invertebrate pests in ponds, were found to be prohibited by law (MELISCH et al., 1994). Immediate toxicity causes harm to many aquatic organisms. Top wetland predators are under particular threat due to toxic accumulation in their fatty tissue (MASON, 1989; DJUANGSIH, 1994), which may result in decreased fertility or poisoning during periods of hunger.

Apart from direct hunting, indirect danger in Indramayu also originates from fish-traps big enough in their size for Fishing Cats to enter and drown (SODY, 1931; HOOGERWERF, 1970; HIMBIO, 1992).

Local trading of smaller wild cats as pets and trade in stuffed specimens is still common in Java. The fact that only individuals of *P. bengalensis* were found for sale does not indicate the absence of hunting for Fishing Cats, on the contrary, it might in turn prove the species' rarity. In Rotterdam Zoo, Fishing Cats show more social behaviour in comparison to other wild cats, e.g. pairs staying together while raising kittens (WESTERVELD, pers. comm. 1993). Where Fishing Cat kittens are hunted for the pet trade, this behaviour indicates an even more critical situation for this rare species, making the parents very vulnerable if they show the same behaviour in the wild.

In considering the present isolated records of the Fishing Cat on Java, we suspect that surviving

wild populations already suffer from immense genetic decline. The West Javan survey covered more than 90 % of the mangroves of West Java. From these facts we deduce a total of five, isolated subpopulations of Fishing Cat from West Java. On the assumption, that no significant numbers of Fishing Cat live further east (based on up-to-date AWB Wetland Database information for coastal wetlands, particularly mangroves, 1994), and considering the species longevity records (FLOWER, 1931) we conclude that, using the new criteria of IUCN (IUCN, 1995), the Javan Fishing Cat *P. viverrinus rhizophoreus* is now critically endangered. The effective reproducing number of wild individuals of this endemic race is split into geographically isolated subpopulations, all except the Ujung Kulon population are threatened by human pressures. Furthermore, the number of effective breeding Javan Fishing Cats is estimated to be less than 50 and most likely under the threat of extinction within a two or three generations of this subspecies. As a consequence, immediate conservation measures to safeguard the Fishing Cat's remaining, isolated populations on Java should be undertaken. Measures suggested include strict hunting and trapping control in Perum Perhutani areas, as well as a straight forward implementation of existing animal and fur trade laws in known market places. In addition we suggest the assessment of all captive *P. viverrinus rhizophoreus* to be included and established in the Fishing Cat's studbook (RAMOS, 1994). Supplementary awareness programmes should emphasize that the Fishing Cat remains the biggest feline predator on the Javan north coast. It is our hope that national authorities in conjunction with local NGOs will succeed in using such incentives to create local pride among the peasants. This might ultimately be the key to the Javan Fishing Cat's survival.

Acknowledgements

The authors are grateful to the Directorate General of Forest Protection and Nature Conservation (PHPA) and Perum PERHUTANI for giving permission to conduct this survey. We wish to express our thanks to all the rangers in the field for their help and hospitality, and to Antonius »Kelik« LEKSONO and Cecilia LUTTRELL for turning wetland survey work into real fun. Roland MELISCH expresses his gratitude to Alfred FEILER from Staatliches Museum für Tierkunde, Dresden and Ben WESTERVELD at Blijdorp Zoo, Rotterdam for most valuable information. We are also grateful to Pearl FOK, Institute of Zoology, University of Hohenheim, Stuttgart and to Peter JACKSON, IUCN/SSC Cat Specialist Group, Bougy-Villars for editing and comments on the manuscript. The survey of the Fishing Cat was part of the West Javan Otter Project, jointly supported by Aktion Fischotterschutz, Artists United for Nature, Asian Wetland Bureau (AWB), TÖB of German Agency for Technical Cooperation (gtz), Directorate General of Forest Protection and Nature Conservation (PHPA), Leica Camera GmbH, Carl Zeiss Germany, Kodak AG, Zoological Society for the Protection of Species and Populations, Singapore Airlines, British Airways Assisting Nature Conservation, Metropolitan Toronto Zoo and the University of Hohenheim, Stuttgart.

References

ALLPORT, G.A. & S.-A. WILSON (1984): Results of a census of the Milky Stork *Mycteria cinerea* in West Java. ICBP, Cambridge.

ALWIS, W.L.E. DE (1973): Status of Southeast Asia's Small Cats. In EATON, R.L. (ed.): The world's cats. Vol.I - ecology and conservation. World Wildlife Safari, Winston. pp. 198-208.

ANONYMOUS (1979): Surat Keputusan Menteri Pertanian, Tanggal 5 April. No. 247/Kpts/Um/4/1979 [Directive of the Minister of Agriculture]. Departemen Pertanian, Jakarta.

ASMORO, P.B., MELISCH, R. & L. KUSUMAWARDHANI (1994): Interaction between otters and people [In Indonesian]. In PHPA/AWB-INDONESIA: Prosiding Simposium Pertama mengenai Berang-berang di Indonesia. Peranan Berang-berang bagi Manusia. Bogor, 7 April 1994. Bogor. pp. 63-73.

BHATTACHARYYA, T. (1992): A brief note on some observations on the breeding biology of the Fishing Cat (*Felis viverrina*). Tigerpaper **19** (2): 20-21.

BScC (1992): Laporan hasil penelitian dan monitoring hutan mangrove di RPH Muara Gembong Tanjung Karawang Kabupaten DT II Bekasi, Jawa Barat. [Research and monitoring report

on the mangrove forest of Muara Gembong ...; in Indonesian] Unpublished report. Biological Science Club, Jakarta.

BREE, P.J.H. VAN & M.K.B.M. KHAN (1992): On a Fishing Cat, *Felis (Prionailurus) viverrina* BENNETT, 1833, from continental Malaysia. - Z. Säugetierkunde **57**: 179-180.

BRONGERSMA, L.D. (1935): Notes on some recent and fossil cats, chiefly from the Malay Archipelago. - Zool. Meded. **18**: 1-89, 11 plates.

CORBET, G.B. & J.E. HILL (1992): The mammals of the Indomalayan region. Oxford University Press, Oxford.

DELACOUR, J. (1940): Liste provisoire des mammifères de l'Indochine Française. Extrait de Mammalia **4** (1&2): 1-22.

DELSMAN, H.C. (1932a): De mangrovekat op Sumatra. - Trop. Nat. **21**: 50.

DELSMAN, H.C. (1932b): *Felis viverrina.* - Trop. Nat. **21**: 209.

DELSMAN, H.C. (1931): De vischkat. - Trop. Nat. **20**: 176.

DENIS, A. (1964): Cats of the world. Constable, London.

DJUANGSIH, N. (1994): Impact of pollutants on top predators [In Indonesian]. In PHPA/AWB-INDONESIA: Prosiding Simposium Pertama mengenai Berang-berang di Indonesia. Peranan Berang-berang bagi Manusia [First Symposium on Indonesian Otters ...; in Indonesian with English abstracts]. Bogor, 7 April 1994. Bogor. pp. 19-44.

FLOWER, S.S. (1931): Contributions to our knowledge of the duration of life in vertebrate animals. V. Mammals. - Proc. Zool. Soc., London (1931): 145-234.

GIESEN, W. (1994): Habitat changes in wetlands of the Greater Sundas and implications for biodiversity. In PHPA/AWB-INDONESIA: Prosiding Simposium Pertama mengenai Berang-berang di Indonesia. Peranan Berang-berang bagi Manusia. Bogor, 7 April 1994. Bogor. pp. 44-55.

GROOMBRIDGE, B. (ed.) (1993): 1994 IUCN Red List of Threatened Animals. World Conservation Monitoring Centre, Cambridge & IUCN, Gland & Cambridge.

GUGGISBERG, C.A.W. (1975): Wild cats of the world. David & Charles, London.

HIMBIO [Himpunan mahasiswa biologi Universitas Padjadjaran Bandung] (1992): Laporan sigi fauna di Suaka Margasatwa Berbak, Propinsi Jambi [Report of a faunal survey of Berbak Wildlife Reserve, Jambi Province; in Indonesian]. - PHPA/AWB Sumatra Wetland Project Report No. 34, Bogor.

HOOGERWERF, A.A. (1974): Report on a visit to wildlife reserves in East Java, Indonesia (August to November, 1971). Netherlands Commission for International Nature Protection, Austerlitz.

HOOGERWERF, A.A. (1970): Udjung Kulon. The land of the last Javan Rhinoceros. E.J. Brill, Leiden.

IUCN (1995): IUCN Red List categories. IUCN, Gland.

JACOBSON, E. (1933): Über javanische Tigerkatzen. - Zool. Garten (N.F.) **6** (10/12): 238-244.

LEKAGUL, B. & J.A. MCNEELY (1977): Mammals of Thailand. Association for the Conservation of Wildlife, Bangkok.

LUBIS, I.R. (1995): Analisis makanan Berang-berang Cakar Kecil (*Aonyx cinerea*) dan Berang-berang Bulu Licin *(Lutrogale perspicillata)* berdasarkan faeces dari Cagar Alam Rawa Danau, Hutan Bakau Pamanukan, dan Taman Nasional Gunung Gede-Pangrango [Food analysis of Small-clawed Otter and Smooth-coated Otter ...; in Indonesian]. Thesis, FMIPA, Jurusan Biologi, Universitas Padjadjaran, Jatinangor.

MASON, C.F. (1989): Water pollution and otter distribution: a review. - Lutra **32** (2): 97-131.

MELISCH, R. (1992): Checklist of the land mammals of Java. PHPA/Asian Wetland Bureau-Indonesia, Bogor.

MELISCH, R., NOOR, Y.R., GIESEN, W., WIDJANARTI, E. & RUDYANTO (1993): Assessment of the importance of Rawa Danau for nature conservation and an evaluation of its resource use. PHPA/Asian Wetland Bureau-Indonesia, Bogor.

MELISCH, R., KUSUMAWARDHANI, L., ASMORO, P.B. & I.R. LUBIS (1994): The role of otters (Mustelidae, Carnivora) in ricefields and fisheries in West Java, Indonesia. In: TROPENZENTRUM UNIVERSITÄT HOHENHEIM: Tropentag 1994 -»Nährstoffkreisläufe«, Zusammenfassung der Poster und Vorträge. Universität Hohenheim, Stuttgart.

MELISCH, R. (1995): Early record of Fishing Cat in Malaysia. -Cat News **22**: 19.

MUUL, I. & B.L. LIM (1970): Ecological and morphological observations of *Felis planiceps.* - J. Mammal. **51** (4): 806-808.

NASH, S.V. & A.D. NASH (1985): The large carnivores, primates, and ungulates in the Padang-Sugihan Wildlife Reserve, South Sumatra. WWF/IUCN 3133 PS/Final Report, Bogor.

NEUMANN-DENZAU, G. & H. NEUMANN-DENZAU (1986): Seltene Begegnungen mit der südasiatischen Fischkatze. - Tier und Naturfotografie **17** (1):28.

NOWELL, K. & P. JACKSON (1996): Wild cats: status survey and conservation action plan. IUCN, Gland.
PFEFFER, P. (1965): Esquisse écologique de la réserve de Baluran (Java-Est). - La Terre et la vie **112**: 199-215.
POCOCK, R.I. (1939): Mammalia. Vol. 1: Primates and Carnivora. The fauna of British India, including Ceylon and Burma. Taylor & Francis, London.
PRESIDEN REPUBLIK INDONESIA (1985): Undang-Undang Republik Indonesia Nomor 9 Tahun 1985 tentang Perikanan [The Republic of Indonesia's law on fisheries].
RAMOS, K.L. (1994): International Fishing Cat Studbook *Felis viverrinus*. Riverbanks Zoological Park and Botanical Garden, Columbia.
ROBERTS, T.J. (1977): The mammals of Pakistan. Ernest Benn, London.
SANTIAPILLAI, C. & W.S. RAMONO (1992): Status of the leopard (*Panthera pardus*) in Java, Indonesia. - Tigerpaper **19** (2): 1-5.
SILVIUS, M.J., STEEMAN, A.P.J.M., BERCZY, E.T., DJUHARSA, E. & A.W. TAUFIK (1987): The Indonesian wetland inventory. 2 Volumes. PHPA/AWB-Interwader/EDWIN, Bogor.
SODY, H.J.V. (1949): Notes on some primates, carnivora, and the Babirusa from the Indo-Malayan and Indo-Australian regions. - Treubia **20** (2): 121-190.
SODY, H.J.V. (1938): Lijst van de zoogdieren van Java. - Tectona **31:** 741-764.
SODY, H.J.V. (1936a): Die Fischkatze (*Prionailurus viverrinus* Benn.) auf Sumatra? - Zool. Garten (N.F.) **8**: 141.
SODY, H.J.V. (1936b): Seventeen new generic, specific, and subspecific names for Dutch East Indian mammals. - Natuurk. Tijdschr. Ned.-Indië **96**: 42-55, 147.
SODY, H.J.V. (1936c): Enkele eerste aanteekeningen over de sporen der javaansche zoogdieren. - Tectona **29** (4): 215-262.
SODY, H.J.V. (1932): *Felis viverrina*. - Trop. Nat. **21**: 165.
SODY, H.J.V. (1931): De vischkat, *Felis viverrina*. - Trop. Nat. 20: 152-154,176.
STRIEN, N.J. VAN (1983): A guide to the tracks of mammals of Western Indonesia. SECM, Ciawi.
SUNQUIST, M.E. & F.C. SUNQUIST (1989): In GITTLEMAN: Carnivore behaviour, ecology, and evolution. Chapman & Hall, London. pp. 283-301.
UNAS (1989): Pengenalan inventarisasi satwa mammalia besar di Suaka Margasatwa Cikepuh. Unpublished report. Jurusan Biologi, Universitas Nasional, Jakarta.
U TUN YIN (1967): Wild Animals of Burma. Rangoon Gazette, Rangoon.
ZON, A.P.M. VAN DER (1979): Mammals of Indonesia. UNDP/FAO National Park Project FO/INS/78/061, Bogor.

(Received on 28.III.1995 and 7.VIII.1996 [latest version])