

Status of leatherback turtles in Indonesia

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1. The legal protection status for leatherback turtles

1.1 Overview

Leatherback turtles and their eggs are fully protected under Indonesian law

1. Decision Letter (*Surat Keputusan*) from the Ministry of Agriculture No: 327/Kpts/Um/5/1978 regarding the protection status of leatherback turtles in Indonesia. In short it called SK 327/78

2. ACT (Undang – Undang) of the Indonesian Government Number 5/1990 regarding Conservation of Natural Resources and Their Ecosystems (*Konservasi Sumber Daya Alam Hayati dan Ekosistemnya*). In short it is called UU No. 5/90

Free translation of the relevant content:

- catching, harming, killing, storing, owning, keeping, transporting, trading in protected wildlife is prohibited, whether dead or alive;
- similarly transporting wildlife to places inside or outside of Indonesia is prohibited;
- trading in, storing or owning skin, bodies or parts of protected wildlife and things made from parts of protected wildlife is prohibited as is moving these to places within or outside Indonesia;
- getting, breaking, destroying, trading in, storing or owning eggs or nests of protected wildlife is also prohibited.
- Those who are undertaking activities as mentioned previously will be sentenced to jail for a maximum 5 years or will be fined a sum of Rp. 100.000.000 (one hundred million rupiah =~ \$11,000USD).

3. The Government Regulation (*Peraturan Pemerintah Republik Indonesia*) Number 7/1999. In short it is called PP 7/99

Free translation of the relevant content:

- Species listed in the attachment (including all species of marine turtles occurring in Indonesia) are protected AND THEREFORE are subject to the effects of other parts of this law and the effects of UU No.5/1990.
- Species can be added to the protected list (or removed from it) by further laws.
- Sending or transporting protected plants and wildlife can (whether within Indonesia or to outside destinations) can only be done with the permission of the Minister. It also requires a health certificate from a competent agency and can only be done according to technical regulations.

4. The Government Regulation (*Peraturan Pemerintah Republik Indonesia*) Number 8/1999 regarding the Use of Plants and Wildlife

Free translation of the relevant content:

- Those who are using protected plants or wildlife as listed in PP 7/99 for research and development without permit from the Minister of Forest Protection and Nature Conservation will be fined maximum a sum of 50,000,000.00 rupiah (fifty millions rupiah), and/or will not be allowed to carry out any activities that fall into category research and development for a maximum 5 years
- Without permit to take protected plants or wildlife as listed in PP 7/99 for study, ranching (*penangkaran*) and alike will be fined maximum a sum of 25,000,000.00 rupiah (twenty five millions rupiah) and/or their ranching (and alike) license will be disqualified
- Without permit to keep protected plants or wildlife as listed in PP 7/99 for ranching purposes and alike will be fined maximum a sum of 100,000,000.00 rupiah (one hundreds millions rupiah) and will be sentenced to jail for a maximum 5 years
- Captive breeders and alike (*penangkar*) undertaking trade activities of protected plants or wildlife without fulfilling a proper qualification standard or undertake smuggling activities will be fined maximum a sum of 100,000,000.00 rupiah (one hundreds million rupiah) and/or their license will be disqualified
- Captive breeders (*penangkar*) who are undertaking wildlife trade will be fined a sum of 200,000,000.00 (two hundreds millions rupiah) and/or their license will be disqualified.

1.2 Management agencies responsible for marine turtle conservation

Operational level	Name and type of agency
National level	The Directorate General of Forest Protection and Nature Conservation (<i>Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam – PHKA</i>), Department of Forestry, Indonesia
State level	The Nature Conservation Agency (<i>Balai Konservasi Sumber Daya Alam - BKSDA</i>). This is a functional unit of the PHKA
Local level	The Nature Conservation Agency (<i>Balai Konservasi Sumber Daya Alam - BKSDA</i>). This is a functional unit of the PHKA

2. Nesting populations

2.1 Summary of nesting records for Indonesia

There are some historical nesting sites for leatherback turtles in Indonesia as summarized below. However, apart from Meru Betiri and Alas Purwo National Parks (both are located in East Java) and the North Coast of Vogelkop - Papua, data are not quantified. While historical nesting populations for Meru Betiri and Alas Purwo are predicted to yield less than 50 nests per year (Table 3 and 4 and Figures 1 and 2), North Coast of Vogelkop particularly Jamursba Medi – Warmon is recorded to yield between 2000 – 4000 nests per year (Table 1 and 2). Survey methods vary between nesting sites. In most sites, surveys were done by means of questionnaire. Direct population monitoring or nest census was only conducted in Meru Betiri and Alas Purwo National parks (see Figures 1 and 2 for annual census data) and Jamursba Medi -Warmon.

Historical nesting sites

1. Sumatra

- a. Aceh:
 - (1) Blok Kluet - Tapaktuan, Gunung Leuser National Park ¹
 - (2) Simeulue island ¹
- b. North Sumatra:
 - (1) Batu islands (*kep. Batu*) ²
- c. West Sumatra:
 - (1) The islands of Pasaman, Siberut, Penyu, and Sipura ²
 - (2) Coast of the Regency of *South Pesisir* includes the island ³ of Penyu, Beringin, Kerabak Besar, Kerabak Kecil, Katang-Katang and Gosong island ³
- d. Bengkulu:
 - (1) The island of Pendek, Tikus, Sawangatung, Bintuhan, and Muko-Muko ²
- e. Lampung:
 - (1) Cina Peninsula (*Tg. Cina*) ²

2. Java

- a. West Java:
 - (1) Pangumbahan – Sukabumi of West Java ⁴
 - (2) Ujung Kulon and Panaitan island ²
- b. East Java:
 - (1) Sukomade – Meru Betiri National Park, East Java ²
 - (2) Alas Purwo National Park, Est Java ⁵

3. Bali

- a. Pecatu Beach - Southern part of Bali ⁶
- b. Lembang Beach – South Eastern part of Bali ⁶

4. West Nusa Tenggara

- a. South-West Coast of Sumbawa ^{2, 7}

5. Sulawesi

- a. North Sulawesi
 - (1) Tangkoko island – Batu Angus ²
- b. Central Sulawesi
 - (1) Tg Arus – Tg Dako ²
- c. South Sulawesi
 - (1) Selayar island, Tg Apatama ²

6. Maluku (Moluccas)

- a. North Coast of Morotai ²

7. Irian Jaya (Papua)

- a. Sayang island, Ayu islands, Asia islands, Dua islands ²
- b. North Coast of Vogelkop ^{2, 8, 9, 10, 11, 12} and Japen island, Inggresau ²

References cited:

- ¹ Database Wetlands International – Indonesia Program
- ² Cited from various sources by Tomascik et al. (1977)
- ³ Harfiandri Damanhuri quoted by Antara News, 4 November 2005
- ⁴ Natural Resources Management (NRM) Program, Headline News, Issue No. 2, 22 January 2003.
- ⁵ Database of Alas Purwo National Park
- ⁶ Database of Bali Post
- ⁷ A Quarterly Bulletin of *Suara Batu Hijau*, No. 12 Edition April – July 2004, Published by PT Newmont Nusa Tenggara – PTNNT
- ⁸ Putrawidjaja (2000)
- ⁹ Tapilatu (2000)
- ¹⁰ Hitipeuw and Maturbongs (2002)
- ¹¹ Sumanuma et al. (2005)
- ¹² Teguh (2000)

Current nesting

This section will focus on four leatherback turtle nesting sites in which direct population monitoring programs are in place, i.e. Jamursba Medi – Warmon (Papua) and Meru Betiri - Alas Purwo National Parks (East Java) (see Figure 3).

Jamursba Medi – Warmon

Jamursba Medi (JM) beach is located at 0°20'-0°22' S and 132°25' -132°39' E', between two headlands/cape *Jamursba* and *Medi*, in the north coast of *Vogelkop*, Papua. The northern border is the Pacific Ocean while the southern part is *Tamrau* Mountain with elevation of 45°. The beach is fairly flat and about 21 kilometres long. It is divided into three sections and sequentially disconnected by few small headlands/capes: (1) *Wembrak* beach (approx. 8.2 km) with black sand substrate, (2) *Baturumah* beach (approx. 5 km) with greyish white sand substrate, and (3) *Warmamedi* beach (approx. 4.8 km) with greyish white sand substrate. Based on the WWF study in 1999, the greyish sand of JM constitutes coarse 77.15 – 78.13% and fine 18.83 – 22.38% aggregates. It is suspected that the beach substrates originated from transported sediment from Pacific seabeds due to the high ocean dynamics (during the monsoons of November to February); since the nearby waterways are only perennial streams or dry stream beds. Being located in the southern part of the equator induces the tropical climate with relatively stable air temperature 29-32°C and humidity 75 - 80% (Petocz 1987). Annual rainfall density ranges from 1500 to 2500 mm during the west monsoon.

JM beach is located on the northern side of the mountain of North Tamrau, fringed by beach and lowland rain forest (0-100 m above sea level). Mangroves are absent due to the high dynamics of the Pacific Ocean. Littoral vegetation occupying the fringe are *Ipomea pes-caprae*, *Hibiscus tilleaceous*, *Barringtonia asiatica*, and *Pandanus canavalia*, *Pemphis acidula*, *Tournefortia orgentea*, *Scaevola sericea*, *Terminalia catappa*, *Calophyllum inophyllum*, *Crinum asiaticum*, *Spinifex sp.*

The northern Papua coast, on the eastern perimeter of Southwest Pacific Ocean, is inhabited by four marine turtle species, i.e. leatherback (*Dermodochelys coriacea*), green (*Chelonia mydas*), hawksbill (*Eretmodochelys imbricata*) and olive ridley (*Lepidochelys olivacea*). Leatherback turtles are widely distributed on the northern part of the Bird Head Peninsula. Tomascik et al. (1977) included the distribution of the species from *Waigeo* Island to *Yapen* Island. However, there is no reliable data on the population size except for JM. Nesting activities in the Bird's Head region are highly dictated by the monsoon. The nesting season in JM starts in March and terminates in September. The peak of the nesting season occurs around June when the sea is relatively calm. Numbers of clutches laid per day in a breeding season is about 20 to 30. Based on the 467 samples, Bhaskar (1987) found the average re-nesting interval to be 9.53 days and as many as eleven clutches were laid per female in a breeding season. Nesting activities later shifted to *War-Mon* beach (four-km beaches), eastward of JM. This is probably related to the strong eastward current (western monsoon) that made it difficult for the turtles to swim westward. It is possible that nesting period of this particular species occur throughout the year along the northern part of Papua, but concentrated at particular site of such an extended coastline

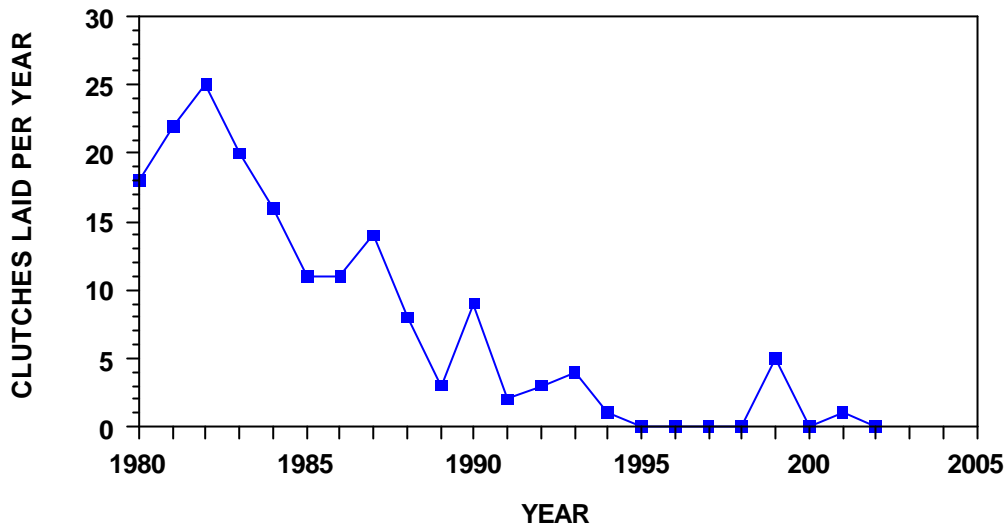
depends on the monsoon and consequently ocean current. Following a preliminary survey initiated in 1984, data on the status of the leatherback turtle nesting population has been collected intensively by WWF-Indonesia in collaboration with the Nature Conservation Agency of Sorong since 1993. In addition, several other turtle specialists also visited the area and conducted short-term surveys (e.g. Sukanuma et al. 2005). Most activities were conducted during the distinct nesting season (May-September). The data is provided in Tables 1 and 2 of section 2. There is a gap of information on population in 1998 and 2000 due to technical and financial constraint (transition of management authority).

Sukamade, Meru Betiri National Park (East Java).

Sukamade beach is located between 8°21' - 8°35' S and 113°40' - 113°58' E in the Coast of South-Eastern Part of Java. The south border is Indian Ocean while the northern part is the Forest of Betiri Mountain (1213 m); the previous home of the Javan tiger. The Sukamade beach is fairly flat (5 – 17⁰) and about three kilometres long, with greyish white sand substrate. The sand is dominated by fine (> 80%) aggregates measuring 0.02 – 0.2 mm. Annual rainfall density ranges from 2000 to 4000 mm during the west monsoon (November to March). Beach vegetation can be categorized into four, i.e.: beach forest (*Hibiscus telectus*, *Calophyllum inophyllum*, *Pandanus tectorius* and *Terminalia catappa*), mangroves (*Rhizophora sp*, *Avicennia marina*, *Bruguiera sp*, *Sonneratia sp* and *Nypafrutican*), swamp forest (*Gluta renghas*, *Lagerstromia sp*, *Alstonia scularis*), *Sterculia foetida* and *Coripha gebang*), and lowland rain forest (*Artocarpus elasticus*, *Pterospermum javanicum*, *Dendrocalamus asper*, and *Bambusa sp*). The beach has been known to have been visited by four marine turtle species, i.e. leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*). Based on the records compiled by National Park officers, the green turtle is predominant, while the other three species, including the leatherback turtle nest occasionally (see Table 1 in Section 2. 1 for data).

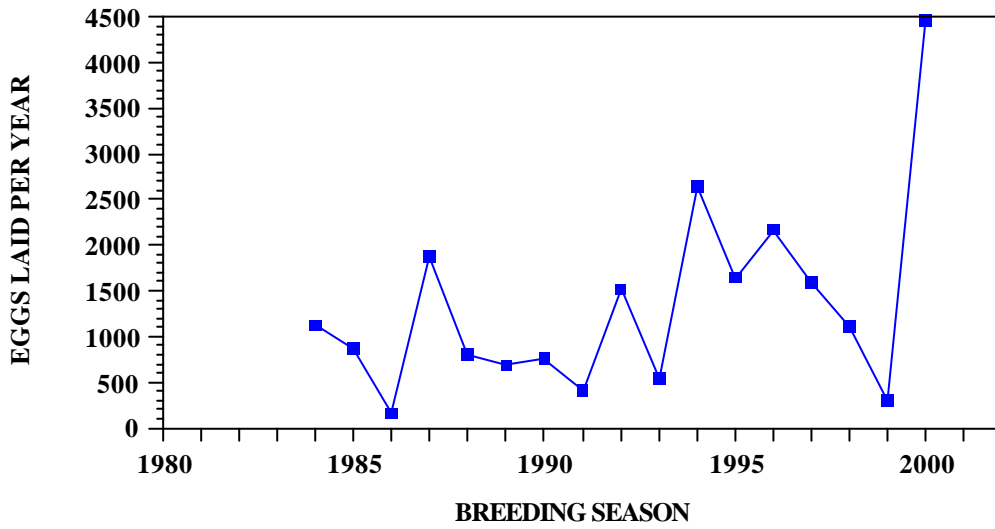
Alas Purwo National Park (East Java)

Alas Purwo National Park (East Java) is located in the eastern tip of Java island, between 8°26'46" - 8° 47'00" S and 114 ° 20'16" - 114 ° 36'00" E. Similarly, with Sukamade, the south border is Indian Ocean while the other side is lowland forest of Alas Purwo. Nesting occurs in Ngagelan beach, a fairly flat beach (0,86 ° – 10,76 °) about 18 kilometres long, with greyish white sand substrate with diameter between 0.05 – 0.2 mm. Annual rainfall density ranges from 1300 to 2000 mm during the west monsoon (November to March). Beach vegetation is predominated by *Pandanus tectorius*. The beach has been used by four marine turtle species, i.e. leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*). Based on the records compiled by the National Park officers, the latter species is predominant. The other three species, including the leatherback turtle nest occasionally (see Table 1 in Section 2.1 for leatherback turtle data).



Arinal (1997); Database of Muru Betiri National Park

Figure 1. Annual variation in the numbers of leatherback turtle clutches laid at Sukamade Beach in Meru Betiri National Park (East Java).



Database of Alas Purwo National Park

Figure 2. Annual variation in the numbers of leatherback turtle eggs laid at Alas Purwo National Park (East Java).

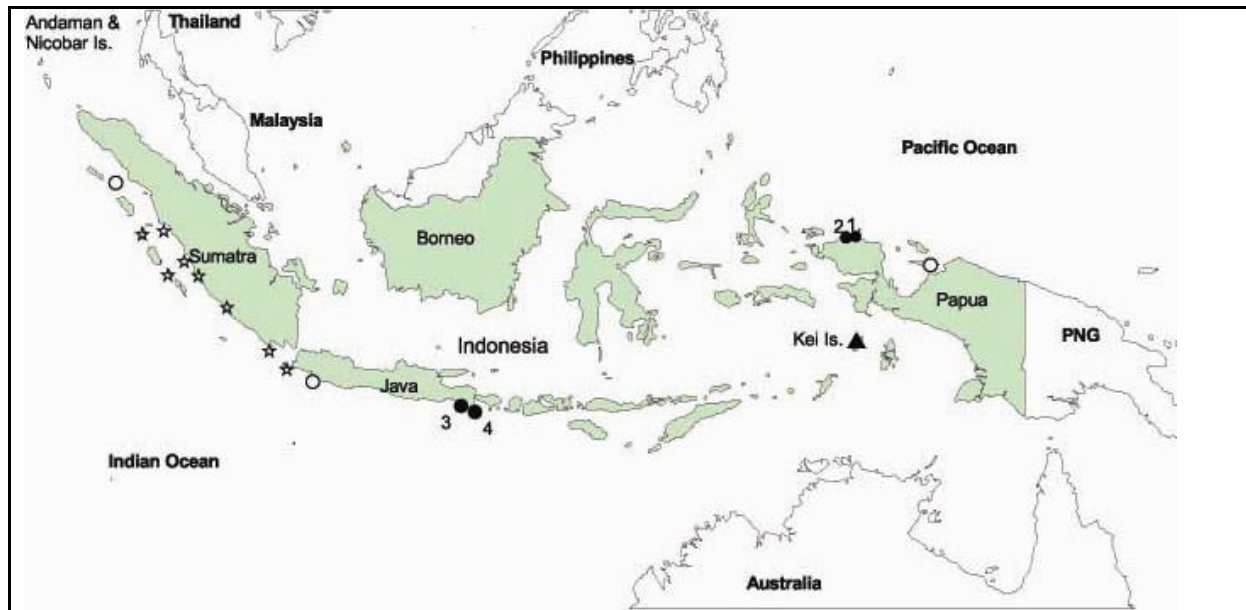


Figure 3. Locations of current leatherback turtle nesting sites in Indonesia. 1 = Jamursba Medi and 2 = Warmon Beach, 3 = Sukomade, 4 = Alas Purwo. Open circles = other minor leatherback turtle nesting sites and stars = sites where nesting has been recorded but not quantified

Table 1. Leatherback turtle nesting census data for Jamursba Medi – Papua

Beach name	Latitude of beach	Longitude of beach	Year of survey	Annual number*	Type of data	Reference
Jamursba Medi	0°20' – 0°22' S	132°25' – 132°39' E	Aug & Sept 1984	2210	Nests	Database WWF
Jamursba Medi			June to Sept 1993	3247	Nests	Database WWF
Jamursba Medi			June to Sept 1994	3298	Nests	Database WWF
Jamursba Medi			June to Sept 1995	3382	Nests	Database WWF
Jamursba Medi			June to Sept 1996	5058	Nests	Database WWF
Jamursba Medi			May – Aug 1997	4001	Nests	Database WWF
Jamursba Medi			May – Oct 1999	2983	Nests	Teguh (2000)
Jamursba Medi			March – Aug 2002	3646	Nests	Database WWF
Jamursba Medi			March – Nov 2003	3601	Nests	Database WWF

* the data for Jamursba presented here is not the annual number but total nests recorded during the survey.

Table 2. Leatherback turtle nesting census data for Warmon Beach – Papua (± 30 km toward North-East from Jamursba Medi)

Beach name	Latitude of beach	Longitude of beach	Year of survey	Annual number*	Type of data	Reference
Warmon Beach			January – May 2003	1442	Nest	Database WWF
Warmon Beach			Nov 2003 to June 2004	2320	Nests	Database WWF
Warmon Beach			July – Dec 2004	1191	Nests	Database WWF
Warmon Beach			Nov 2003 to Sept 2004 (continuous data) [#]	2881	Nests	Thebu & Hitipeuw (2005)
Warmon Beach			Jan – Feb 2005	460	Nests	Suganuma et al. (2005)

* data for Warmon presented here is not the annual number but total nests recorded during the survey.

[#] data incorporates the data listed in the data for the same time period contained in the WWF database.

Table 3. Leatherback turtle nesting census data for Sukomade (Meru Betiri National Park), East Java.

Beach name	Latitude of beach	Longitude of beach	Year	Annual number	Type of data	Reference
Sukomade	8°21' – 8°35' S	113°40' – 113°58' E	1980	18	Nests	Database of Meru Betiri National Park
Sukomade			1981	22	Nests	MBNP database
Sukomade			1982	25	Nests	MBNP database
Sukomade			1983	20	Nests	MBNP database
Sukomade			1984	16	Nests	MBNP database
Sukomade			1985	11	Nests	MBNP database
Sukomade			1986	11	Nests	MBNP database
Sukomade			1987	14	Nests	MBNP database
Sukomade			1988	8	Nests	MBNP database
Sukomade			1989	7	Nests	MBNP database
Sukomade			1990	9	Nests	MBNP database
Sukomade			1991	2	Nests	MBNP database
Sukomade			1992	3	Nests	MBNP database
Sukomade			1993	4	Nests	MBNP database
Sukomade			1994	1	Nests	MBNP database
Sukomade			1995	0	Nests	MBNP database
Sukomade			1996	0	Nests	MBNP database
Sukomade			1997	0	Nests	MBNP database
Sukomade			1998	0	Nests	MBNP database
Sukomade			1999	5	Nests	MBNP database
Sukomade			2000	0	Nests	MBNP database
Sukomade			2001	1	Nests	MBNP database
Sukomade			2002	0	Nests	MBNP database

2.2) Seasonality of leatherback turtle nesting

The nesting season for leatherback turtles in Jamursba Medi starts in March and terminates in September. The peak of the nesting season occurs around June. Nesting activities have lately shifted to *War-Mon* beach (four-km beaches), eastward of Jamursba Medi. This is probably related to the strong eastward current (western monsoon) that unable the turtles to swim westward. It is possible that nesting period of this particular species occurs throughout the year along the northern part of Papua, but concentrated at particular sites along the extended coastline depending on the monsoon and consequently ocean current (WWF 2003a).

The nesting season for leatherback turtles on Sukamade and Alas Purwo Beaches varies throughout the year, but most frequently between October – January (WWF 2003b).

2.3) Genetic studies on leatherback turtles

Leatherback turtle population genetic studies have been done only for Jamursba Medi. The work was done collaboratively between NOAA and WWF Indonesia in 2003 – 2004. The total number of genetic samples collected was 100. Dutton et al. 1999 and Benson et al. (in press) state that the nesting turtles in Jamursba Medi are in the same genetic population as those that nest in Papua New Guinea and the Solomon Islands.

2.4) Biological parametres.

The biological parameters for the nesting leatherback turtle population are detailed in Tables 5 and 6

Table 4. Leatherback turtle nesting census data for Alas Purwo National Park of East Java.

Beach name	Latitude of beach	Longitude of beach	Year of survey	Annual number	Type of data	Reference
Alas Purwo	8°26'46" - 8°47'00" S	114° 20'16" - 114° 36'00" E	1984	1,121	Eggs	Database of Alas Purwo National Park
Alas Purwo			1985	861	Eggs	Database of APNP
Alas Purwo			1986	158	Eggs	Database of APNP
Alas Purwo			1987	1,875	Eggs	Database of APNP
Alas Purwo			1988	804	Eggs	Database of APNP
Alas Purwo			1989	683	Eggs	Database of APNP
Alas Purwo			1990	758	Eggs	Database of APNP
Alas Purwo			1991	410	Eggs	Database of APNP
Alas Purwo			1992	1,513	Eggs	Database of APNP
Alas Purwo			1993	538	Eggs	Database of APNP
Alas Purwo			1994	2,647	Eggs	Database of APNP
Alas Purwo			1995	1,643	Eggs	Database of APNP
Alas Purwo			1996	2,166	Eggs	Database of APNP
Alas Purwo			1997	1,595	Eggs	Database of APNP
Alas Purwo			1998	1,105	Eggs	Database of APNP
Alas Purwo			1999	294	Eggs	Database of APNP
Alas Purwo			2000	4,452	Eggs	Database of APNP
Alas Purwo			2001	1,520	Eggs	Database of APNP
Alas Purwo			2002	1,748	Eggs	Database of APNP

Table 5. Details of clutch parameters for leatherback turtle nests in Papua

Average per nest	Bhaskar (1987) N=25	WWF (1994) N=27	WWF (2001) N=136
Eggs	107	109	70
Yolked eggs	72 (67% of total eggs)	72 (66% of total eggs)	45 (64% of total eggs)
Hatched eggs	31 (43% of Yolked eggs)	53 (73% of yolked eggs)	21 (47% of yolked eggs)
Hatchlings emerged	25 (80% of hatched eggs)	51 (96% of hatched eggs)	18 (72% of hatched eggs)

Table 6. Details of biological parameters for leatherback turtles nesting in Indonesia

Category of data	Average	Standard deviation	Range	Sample size	References
Size of nesting females	No data available				
Number of eggs per clutch	No data available				
Clutches per season	No data available				
Re-nesting interval (days)	9.53	-	-	467	Bhaskar (1987)
Number of years between breeding seasons (years)	No data available				
Size of eggs (cm)	No data available				
Size of hatchlings (cm)	No data available				

2.5). Pivotal temperature studies

None

2.6) Migration records

Post-nesting migration of Papuan leatherback have been studied extensively by satellite telemetry in 2003 – 2004 nesting season by NOAA and WWF - Indonesia. The turtles swam mostly into the waters of the northern Pacific – Philippines, Korea/Japan and mid northern Pacific Ocean (Dutton, Benson, Hitipeuw and Rei unpublished data).

2.7) Protection of nesting beaches

Name of the beach(s)	Name of the National Park
Jamursba Medi – Warmon	Proposed to be a turtle sanctuary
Sukamade beach	Meru Betiri National Park
Ngagelan beach	Alas Purwo National Park

2.8) Use of hatcheries to leatherback turtle nests

Hatcheries are not used to protect leatherback turtle nests in Indonesia

2.9) Threats to nesting populations of leatherback turtles

Threats to sea turtles are broadly defined as any factor that jeopardizes the survival of turtles and impedes the recovery of the populations. They exist in almost all phases of the sea turtle life cycle. Main threats identified for leatherback turtles in Indonesia are: adult poaching, egg harvests, feral predations and incidental take by fisheries. Additionally, natural threats such as tidal inundation and hatching failure were observed and therefore required specific studies to confirm impacts. Below is the short description for Jamursba Medi – Warmon. A similar situation is believed to occur in Meru Betiri and Alas Purwo National Parks. An overall summary of threats to nesting leatherback turtles in Indonesia is presented in Table 7.

Poaching of adult turtles and eggs

Poaching of the adult leatherback turtles while they are nesting does not occur. Leatherback turtle eggs, however, have become an important protein source for the coastal communities. Exploitation of turtle eggs on Jamursba Medi beach was relatively intense for a long time, mostly by outside fishermen (from Sorong, Manokwari, Biak, North Maluku). During 1984 and 1985, four to five fishing boats were observed visiting the beach weekly and loaded 10,000-15,000 eggs per boat. The right to collect eggs is given by local people through a trade with household needs such as sugar, rice, salt, soap, cigarettes, and cooking utensils. The beaches became crowded with temporary huts when the nesting season comes. This activity has declined significantly since the intensive monitoring initiated by WWF started in 1993 (Suarez et al. 2000).

Depredation of eggs

WWF preliminary work through Bhaskar in 1985 sought a more detail information about nest depredation by wild pigs (*Sus scrofa*). This animal was introduced long ago to the island of New Guinea and is probably responsible for the decline of the nesting population in addition to the human poaching. Nests located close to the fringe of the forests are likely safe from inundation and beach erosion, but vulnerable to the pig depredation. Besides, the wild pigs, monitor lizards (*Varanus salvator*) and domestic dogs also dig up nests which have been formerly raided by the pigs.

Based on the survey done in early July 1985 on JM, an average of 50 nests per night was being deposited and at hatching time, 56 days later, there was evidence that only three or four nests were successfully hatched per day. 17% of the nests were likely to have been inundated; up to 93% of the rest of the nests were destroyed by pigs. The situation in War-Mon Beach is also similar to the JM. Surveys done by WWF-Papua (Stark 1992) counted 387 leatherbacks nests destroyed by feral pigs on Warmamedi beach nest Lawalata et al. (2005) during daytime. The characteristic funnel shaped pit of a nest destroyed by feral pigs may extend up to one metre depth and two metres across, giving the beaches a pock-marked “war zone” appearance. Interviews done with local people and observations on numerous empty shells lying in and around the nest excavation clearly indicated that wild pigs were the greatest cause of egg mortality. In July to September 1993, 181 out of 1300 nests (14%) depredated by wild pigs. Monitor lizards and dogs also depredate the emerging hatchlings, in addition to ghost crabs (*Ocypode sp*), birds (crows, *Corvus orrea*), sea eagles (*Haliaeetus leucogaster*), brahmini kites (*Haliastur indus*), sharks and finally fishes (threadfin). Scavenging birds such as sea gulls usually wait for the hatching time in late afternoon.

In addition, Thebu and Hitipeuw (2005) examined 2881 leatherback turtle nests laid at Warmon beach between November 2003 and September 2004. These authors indicated that of the 2881 nests laid 369 (13%) were depredated by pigs, 136 (5%) were depredated by dogs and 310 (11%) were inundated.

Suganuma (2005) report data on egg predation from Jamursba-Medi beach for September 1999, July 2001, July 2002, September 2002 and September 2003. In this study he found that the predation rate in July 1999 was 63.3% of all nests laid in Jamursba Medi. Following this finding the beach was protected by a series of electric fences to prevent pig predation. The first fence was constructed in March 2001 – and in June 2001 predation rates were 24%. The second fence was constructed in July 2002 – and predation rates were 17.5% in July 2002, 11.2% in September 2002 and 7.1% in September 2003 (Suganuma 2005).

Fisheries impacts

Although the rapid collapse observed for most populations of leatherback turtles was due primarily to poaching of eggs, the indigenous harvest of adult leatherbacks, the high rate of incidental mortality in fishing gear probably accelerated this process. Facing the Pacific Ocean made the waters off the north coast of Papua potential for pelagic fisheries of both national or foreign fishing industries. Based on the licensing records issued by Department of Fisheries in Sorong, there has been a substantial increase of pelagic fishing activities (for boats less than 30 gross tonnage). These types of fisheries include tuna longline, gillnet, trammel net and some other traditional type of fisheries, trap nets, floating cages with submerged lights (*bagan*). In addition, being at the edge of national economic exclusive zone (over 200 nautical miles) illegal fishing activities occur in the area. Assuming that leatherbacks migrate across the Pacific Ocean, fisheries activities both on the west and east side will harm them. The Asian longline and drift net fisheries killed at least 500 to 1000 leatherbacks per year during the 1980s and they still kill hundreds of leatherbacks per year in the 1990s (Nishimura and Nakahigashi 1990; Wetherall et al. 1993). The Chilean swordfish fishery killed a minimum of 250 leatherbacks per year in 1988 and 1989 (Frazier and Brito 1990). Pritchard (1982) recorded many dead leatherbacks on nesting beaches along the Pacific coast of Mexico in 1980. Fishing activities around the north coast of Vogelkop occur during the eastern monsoon, when the sea surface is calm. Unfortunately, this period coincides with nesting season in JM beach. No quantification of the fisheries induced mortality problem being done so far. However, communities living along the north coast and north islands of Papua witnessed some leatherbacks entangled in fishing nets. Emerged Hatchlings seemed to attract sharks. This opportunity is taken by fishermen to catch sharks with gillnets. Adult turtles are often found entangled in the nets in front of the beach.

Nesting success and beach stability

Nesting success of leatherbacks is dependent on the dynamic seasonal erosion and accretion of the beaches. In JM beach three to six day periods of windy weather occurred each year in late August or early September. During this period the sea surface abruptly gets rough and this is probably associated with the beginning of the northwest monsoon. Most parts of the beach concurrently with the hatching eggs are washed away. From October onwards the sea is constantly rough. By December/ January there may be 5 to 10 m of beach left between the high tide mark and the forest, and nothing on other stretches. Accretion starts around April each year and the width of the beach slowly increased (coinciding with the increase in turtle nesting) and reached 65 m by late August. At present, the logging concessions are not allowed in the southern boundary of the nesting beach, which is gazetted as limited production forest. The logging activities include lumber harvest and transportation, and the construction of a log pond and base camps. These activities potentially threaten the beach structure, due to changes to the physical environment, not to mention a potential threat of increased opportunity for poaching in the future. Logging and log transportation will likely cause upstream erosion of rivers and consequently the degradation of nesting habitats. The use of the beach as an access for harvested lumber to log pond also has a direct impact on nesting turtles as the logs will potentially block turtle access to the nesting beach.

Hatchling failure and sex ratio variation are two areas in need of further study

Table 7. Summary of threats occurring towards leatherback turtles in Indonesia

Threats at this site/area	Current occurrence			Historical occurrence			
	Low	Med	High	Unknown	Low	Med	High
Exploitation of nesting females	X				X		
Egg collection			X				X
Agricultural development	X				X		
Tourist development	X				X		
Urban development	X				X		
Industrial development	X				X		
Artificial lighting	X				X		

Coastal erosion		X		X
Vehicles on the beach	X		X	
Sand mining	X		X	
Unregulated hatchery practices	NA		NA	
Natural threats/predation		X		X
Fisheries bycatch		X		X

2.10) Impacts of coastal development and/or sand mining on leatherback turtles nesting
None

2.11) Major existing threats to nesting leatherback turtles

- Priority 1: Egg poaching
Priority 2: Habitat degradation
Priority 3: Fisheries by catch

2.12) Other biological studies conducted on nesting leatherback turtles
None

3. Foraging populations

3.1) Overview

There have been no studies on foraging leatherback turtles in Indonesia

3.2) Seasonality of leatherback turtles in coastal or offshore waters

Lawalata et al. (2005) reports that Kei Islanders hunt leatherback turtles predominately during November to February when the waters are calm.

3.3) Size range of leatherback turtles in coastal or offshore waters

Size data (curved carapace length) of hunted leatherback turtles from the Kei Islands

- o October and November 1994 – ranged in size from 145 to 173 cm (average 154 and N = 22) Suarez and Starbird (1996)
- o October 1994 to November 1995 – average size 147cm (range 136 to 173; N = 65) Suarez (2000)
- o November 2003 and October 2004 - ranged from 52cm to 187 cm (N = 16) (Lawalata et al. 2005).

3.4) Information on the diet of leatherback turtles

The only available information is from the Kei Islands - Jelly fish (Kei island, Creusa Hitipeuw, pers. comm.).

3.5) Other biological studies

None have been conducted

3.6) Threats to foraging populations of leatherback turtles

Incidental catch of leatherback turtles in Indonesian waters, or by Indonesian fishing fleets is not quantified. However, the direct take (subsistence hunting) of leatherback turtles by people of Kei is a cultural practice that has occurred for generations (Suarez and Starbird 1996; Suarez 2000; Lawalata et al. 2005). Suarez and Starbird (1996) monitored the harvest between October and November 1994 and reported a catch of 23 leatherback turtles by Kei Islanders (six males and 17 females), and between October 1994 and February 1995 Suarez (2000) found 65 leatherback turtle captures (both sexes). More recently the Kei Islands were surveyed between November 2003 and October 2004 (Lawalata et al. 2005). Lawalata et al. (2005) found that at least 29 leatherback turtles were hunted from seven villages in the Kei Islands during this period (18 females and 11 males). An overall summary of threats to foraging populations of leatherback turtles in Indonesia is presented in Table 8.

Table 8. Summary of threats to foraging populations of leatherback turtles in Indonesia

Threats at this site/area	Current occurrence			Historical occurrence			
	Low	Med	High	Unknown	Low	Med	High
Directed take of leatherback turtles at sea			X				
Longline fisheries			X				

3.7) Fisheries bycatch of leatherback turtles and the fisheries involved

There are no data available, however, WWF –Indonesia, together with their partners are conducting studies to identify and quantify fisheries bycatch.

3.8) Other activities being undertaken to improve conservation of leatherback turtles foraging populations

- o Policy advocacy to manage fishery bycatch is being conducted by WWF
- o Community based conservation and awareness programs are being conducted in the Kei Islands (see Lawalata et al. 2005).
- o Substantial community based awareness raising and public discussions continue between WWF and the local communities with regard to leatherback turtle conservation (see Thebu & Hitipeuw 2005 and Lawalata et al. 2005)

4. Conservation actions

The following areas are currently being addressed in Indonesia to help protect leatherback turtles.

Areas of change	Summary including report references
Legislation changes	for fisheries licensing
Annual nesting beach surveys	Only for Jamursba Medi

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