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*"Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand"*

# NATIONAL REPORTS
# on
# Mangroves in the South China Sea

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Cover Photo: Propagules of *Rhizophora apiculata* in Koh Kong Province of Cambodia, by Mr. Ke Vongwattana

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*Reversing Environmental Degradation Trends*
*in the*
*South China Sea and Gulf of Thailand*

# Original Official Use for Meeting

**NATIONAL REPORTS**
**on**
**Mangroves in the South China Sea**

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# NATIONAL REPORT

on

# Mangroves in the South China Sea

# CAMBODIA

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# 1. GEOGRAPHIC DISTRIBUTION

## 1.1 Maps

Map of mangrove is not yet produced for specific mangrove protection and conservation or plan. It is just in the subcategories of the maps of forest covers or map of land use. This map is in the country scale as 1:500,000. The maps of forest cover were produced three times such 1993, 1997 and 2000. However, the method and approaches of interpretation, producing map and definition are different. Thus, it makes many troubles in the term of time series and spatial analysis for mangrove areas. Moreover, in the term of the planning and management purposes for mangrove on the specific site, it needs to be reproduced the new one with the detail scale that may be 1:50,000 or 1:25,000.

A degree of uncertainty surrounds current estimates on Cambodia's mangroves. The data were derived largely from a 1:25,000 aerial photographs taken in December 1994 that have not been systematically ground trusted due to safety and security constraints. The GIS land use maps that have been made by interpreting the 1991 aerial photographs were not systematically ground trusted either. Reports were based on small scale projects and on on-site reconnaissance of selected areas that are accessible by boat or road; there are very limited aerial reconnaissance in the vicinity of Koh Kong Province. Figure 1 shows the map of mangrove distribution along the coastline of Cambodia.

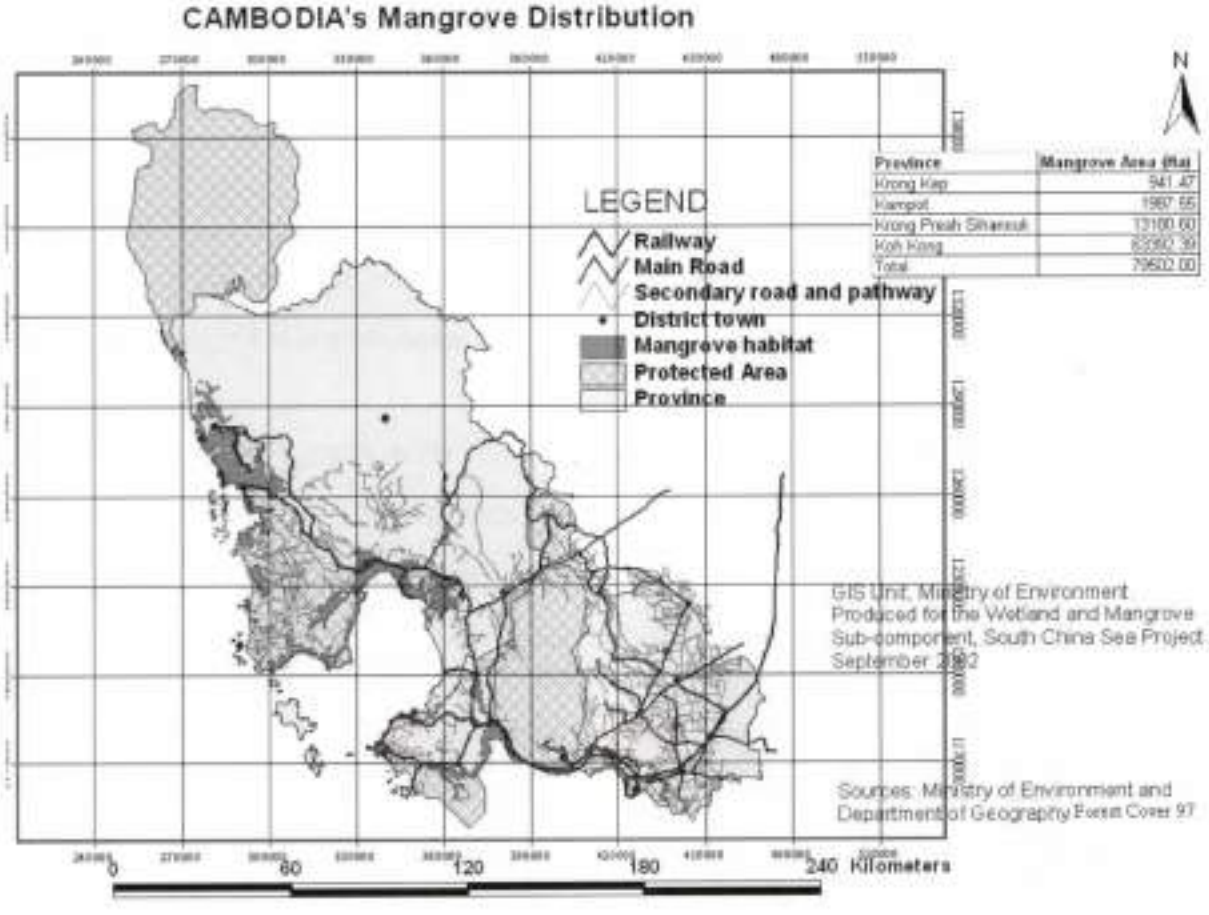


Figure 1 Map of Mangrove Habitat along the Coastline of Cambodia.

## 1.2 Areas

It was estimated in the past that mangrove forest covered only 37,000ha. The Land Cover maps published by the Mekong River Commission/UNDP/FAO (1994), however, show that in 1992-93, the mangroves consist of about 85,100ha. Of these land area, 63,700ha are located in Koh Kong Province, 13,500ha in Sihanoukville and 7,900ha in both Kampot Province and Kep Resort City

in fringe coastal areas along the Gulf of Thailand. The vast majority (63,700 hectares) are located in Koh Kong Province. While the total area of mangrove forest in Cambodia is small compared to surrounding countries in the Gulf of Thailand, these forests have been relatively undisturbed until recently. However, Cambodia's mangroves are now under intense pressure from competing resource uses. Two important threats to the mangrove resource are the clearance of mangrove areas for intensive shrimp farming and charcoal production. Neighbouring countries such as Thailand and Viet Nam have seen widespread destruction of their natural coastal resources as a result of unmanaged exploitation. Sound management strategies for Cambodia's mangrove areas are urgently needed to avoid a similar outcome. Percentage of Mangrove Areas by province is presented in Figure 2.

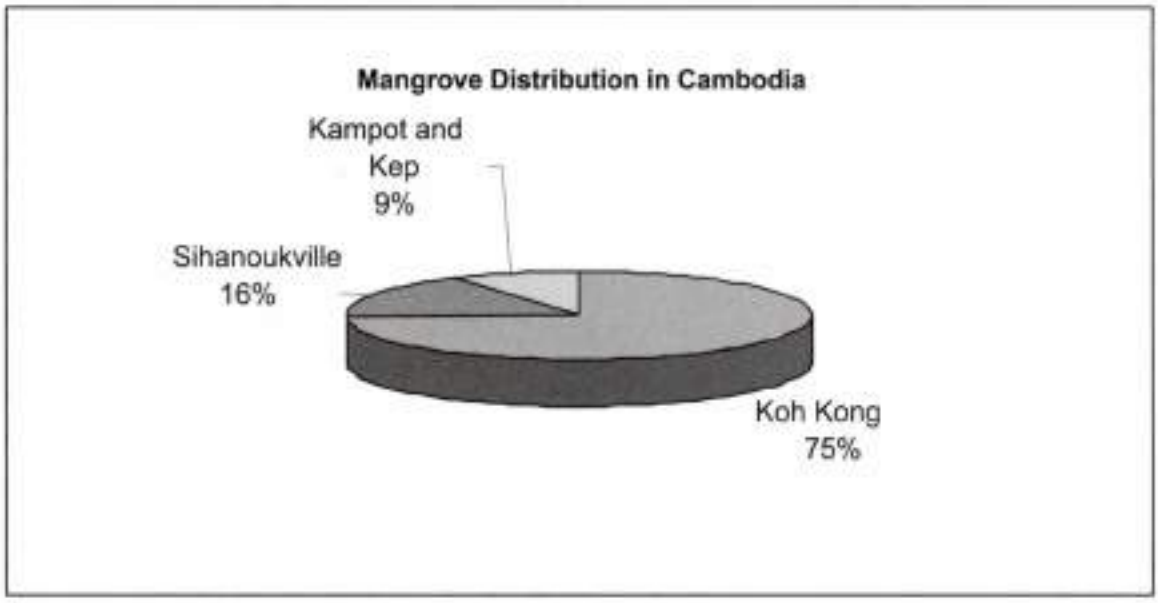


Figure 2 Percentage of Mangrove Areas by Province.

Based on a detailed study CZM-DANIDA (2001) covering of some districts in Kampot province the following were mapped:

- Kampot district:
  - Koh Toch commune: 500 hectares in 4 villages (Prek Ampil, Koh Toch, Prek Chek, Kilometer No. 12)
  - Beung Touk commune: 300 hectares in 4 villages (O Roluos, Koh Rokar, Beung Tuok, Totoeng Thngai)
  - Chum Kreal commune: 100 hectares in 3 villages (Kampong Treak, Chum Kreal, Kampong Kandal)
  - Koun Satt commune: 21 hectares in one village (Kampong Nung)
  - Trapeng Sangke commune: 71.93 hectares in 2 villages (Trapeng Sangke, Trapeng Thom)
  - Kampong Samrong commune: 5 hectares in a village
  - Prek Thanot commune: 275 hectares (Changhoun, Prek Thanoat, Prek Kreng)
  - Total area in the district was 1,273ha.
- Kampong Bay district:
  - Treuy Koh commune: 105 hectares in one village
  - Beung Tapream: 105 hectares.
- Kampong Trach district:
  - Russei Srok Khang Thbong 136 hectares (Thakov, Lork and Koh Sna).
  - Sihanoukville: Mangroves can be found in the estuaries, along the muddy seashore and on the swamps and river systems and some coastal areas. Based on information from the seventies and early nineties there are some indications of changes in the mangrove distribution.
  - Koh Kong: the information received from local areas indicated that mangrove areas have decreased over the past few years. Mangroves are a priceless resource, having

important roles in the fisheries and environment and providing protection of coastal environment. Mangroves of Koh Kong stretch along the coastal areas covering 637km$^2$. There are 64 species of mangroves.

Table 1 presents different figures of mangrove coverage found by different institutions and organisations.

Table 1 Mangrove Forest Coverage in (ha) in Cambodia.

| Province/Municipality | | | Whole Country |
|---|---|---|---|
| Koh Kong | Sihanoukville | Kampot | |
| 16,000 | 3,600 | 17,400 | 37,000 |
| 63,200 | 7,300 | 17,400 | 83,600 |
| | | | 83,700 |
| 31,000 | 3,600 | 3,700 | 38,300 |
| 31,100 | 2,300 | 2,300 | 37,000 |
| 63,700 | 13,500 | 7,900 | 85,100 |
| | | | 17,234 |
| 63,700 | 13,500 | 7,900 | 85,100 |

*Source: FAO, 1973.*

## 2. DISTRIBUTION OF SPECIES AND FORMATION

Mangrove communities can be classified into different types: riverine, basin or fringing. Mangrove species are generally arranged in zones from sea to land since they have adapted to a slightly different range of physical conditions. The mangorve zones in Cambodia are categorised into:

(a) The *Avicennia-Sonneratia* zone;

(b) The *Rhizophora* zone;

(c) The *Bruguiera-Kandelia-Ceriops* zone; and

(d) The *Lumnitzera-Xylocarpus-Bruguiera* zone.

In most mangrove forests, different species dominate certain zones. The characteristic zonation pattern results from differences in the rooting and growth of seedlings and competitive advantages which each species has along the gradient from mean sea level to above the high water lines. The dominant species in this forest type belong to the family of Rhizophoraceae, such as *Rhizophora conjugata* (Kongkang Nhy), *Rhizophora mucronata* (Kongkang Chmul), *Ceriops* spp., *Bruguiera* spp., *Caralia* sp. and the families of Verbenaceae (*Avicennia* sp.), Sonneratiaceae, and Palmae (*Nypa fruticans*).

The average annual growth rate of Cambodia's mangrove forests was estimated to be 7.2m$^3$/ha. In some areas, this amount is as large as 9.2-9.9m$^3$/ha. *Rhizophora conjugata* and *R. mucronata*. *Rhizophora* spp. reach a height of 15 to 20m and diametres measured at 1.3m high from ground vary from 30-40cm, depending on natural factors (soil condition, location etc.), compared to 30m high with diameter of 70cm in Viet Nam. Due to illegal logging in mangrove forests, the recent mangrove inventory shows that the growing stock of all standing trees within DBH greater than 5cm is 98m$^3$/h.

### 2.1 Species Distribution

There are reported to be 74 species of plants in the mangrove systems of Cambodia, from 53 genera and 35 families, however this number has yet to be verified. An initial list of 42 mangrove flora species belonging to 20 families has been identified during field surveys carried out from October to December, 1994 (IDRC, 1995). The dominant species belong to the genera *Rhizophora* (*R. mucronata, R. apiculata*) *Avicennia, Lumnitzera, Bruguiera, Ceriops* and *Xylocarpus*. In addition to mangrove trees, other associated species include the mangrove palm, *Nypa fruticans*.

An initial field study found 42 species of trees and shrubs belonging to 20 families in the mangrove forest of Koh Kong (DNCP[1], 1995). The most dominant species are of the family Rhizophoraceae (species *mucronata* and *apiculata*); family Combretaceae with genera *Lumnitora*; and, family Avicenniacae with genera *Avicennia*.

[1] *Department of Natural Resource Conservation and Protection, Ministry of Environment.*

Mangrove forest zonation in Koh Kong is believed to be similar to plant community structure in Chattaburi Province, Thailand. The edges of the estuaries and canals are dominated by *Rhizophora apiculata* and *R. mucronata*. Further inland are *Avicennia* and *Bruguiera* followed by *Xylocarpus*, *Ceriops* and *Lumnitzera*. Finally, a combination of *Nypa fruticans* and others can be found in the transitional zones between true mangroves at the seaward edge and inland forest (rear mangroves) which are dominated by *Melaleuca* trees.

Referred to the research of the CZM-DANIDA (1999) in November 1999 on the "Assessment of Sustainable Livelihood Alternative to Mangrove Exploitation", the mangrove forests are the prevailing ecosystem in many coastal zones of Cambodia. They commonly occur in estuarine systems and as fringing belt on near shore creeks, lagoons, and in marine sheltered bays. A total of some 30 true mangrove and about one dozen of mangrove associate species were identified during the field observations conducted by two different groups please see the attached Annex 1.

The *Rhizophora apiculata* is the predominant tree along most estuaries systems, while a mix of mangrove species each adapted to the soil and salinity condition forms the inners parts of extensive mangrove their tallest size (e.g., In Koh Kapik River system, where still some *Bruguiera* spp. And *Xylocarpus* trees remain intact at height of 25-30 metres. Typically, the mangrove vegetation changes gradually into freshwater riverine vegetation and/or terrestrial forest types, (e.g., *Melaleuca* or dense lowland evergreen forest) on the landward side what tidal influence is decreasing. Where infertile muddy/silt river banks occur in this part of the estuary, extensive stands of *Nypa* palms frequently occur, often accompanied by dense growth of mangrove ferns (*Acrostichum* spp.), which also can form dense aggregation as undergrowth in the higher portions of the rear mangrove communities, the so-called backmangal zone.

A part from common pattern of zonation of predominant species parallel to the riverine border, there is conspicuous variety of patchy distribution of specific stands of the certain mangrove species, e.g., *Ceriops* spp. and *Excoearia agallocha*. In some nearshore sandy elevated areas *Heritiera* develops in both Koh Kong and in Sihanoukville. It is note that many of these trees are affected by the natural decay, the so-called top-dying disease.

In coastal flats with highly saline sandy soils, like in areas where extensive slat farm development takes place (e.g., Kampot Province) the predominant mangrove species are *Avicennia* on the seaward side and *Lumitzera* in the landward side. In the latter environment, fringing mangroves tend to have stunted growth which is attributed to physiological stress for the vegetation which has to cope with infertile saline soils, fine sand accumulation and high evaporation rates due to wind exposure.

## 2.2 Formation

The mangrove communities in Cambodia were classified by the forest classification of the Ministry of Agriculture, Forestry and Fisheries and it is similar to what Viboth and Aswell classified as four types as following:

**Mangrove**: Most of the members of the mangrove community are characteristic of areas which are inundated only at some high tides and where there is a large degree of freshwater influence. The islands and creeks are typically fronted by *Rhizophora apiculata and Rhizophora mucronata*, two of the most common of the mangrove species present, and stands of *Nypa* palms. Immediately behind this fairly narrow strip of *Rhizophora* is an interesting mixture of other mangrove species, the most common of which are: *Brugiera gymnorrhiza*, *B. sexangula*, *Ceriops tagal*, *Lumnitzera littorea*, *Heritiera littoralis*, *Xylocarpus granatum*, *Hisiscus tiliaceus*, *Phoenix palludosa*, *Acrosthicum speciosum*, *Aegialitis* sp. and, *Acanyus* sp.

**Rear mangrove' community**: On some of the islands and on the mainland between Prek Khlang Yai and Prek Thnot, the mangrove community forms a narrow band. It is followed by a community above the high tide mark and probably only subject to freshwater inundation during the wet season. This community is dominated by *Melaleuca leucodendron*.

**Beach strand vegetation**: At the south side of Koh Kapik, and on the sandy areas of some of the islands, there are small areas of typical beach strand vegetation dominated by *Casuarina equisitifolia* with some *Terminalia catappa*.

## 3. ENVIRONMENTAL STATE

As mentioned previously, the coastal areas in Cambodia are formed into two municipalities as Krong Kep and Sihanoukville, and two provinces Kampot and Koh Kong Province.

These coastal provinces/municipalities under the effect of tropical weather and monsoon winds with all year around temperature from 24°C to 30°C. The rainy season is from May through October and the cool season is from November to January and the dry season is from February to April. The average rainfalls in Kep vary from 1,200mm to 1,875mm or a higher – 2,500mm. The moisture level is also moderately high.

In Koh Kong Province, the Rainfall ranges between 2,000mm and 5,268mm (according to Koh Kong Water Resource and Meteorological Department). The monthly average temperature is 27°C low and 38°C high. In rainy season, the wind comes from the west or from the sea that can cause storms with duration of 3 to 7 days rendering travel by sea difficult. During strong winds and storms waves can reach 2-3.5m in height.

## 4. THREATS, PRESENT AND FUTURE

### 4.1 Human Pressure

#### 4.1.1 Population Pressure

In 1995, the total population of the three coastal provinces was estimated to be 6.5% (675,000 populations) of the total national population. Population densities vary from 7.07 people/km$^2$ in Kampot province to 138 people/km$^2$ in Sihanoukville with an average density of 37 people/km$^2$. Average growth rates in 1993 range from 2.7 to 4.6% in Koh Kong and Kampong Som respectively.

#### 4.1.2 Coastal Development

The Royal Government's goals for Coastal provinces and municipality originally planned for economic development in Cambodia through the rebuilding of urban growth tourism port expansion and industry.

***Urbanisation***
Investment in coastal development will lead to increased urban growth as population from the rural areas move to tourism and associated services for increased economic opportunities The Urban environment infrastructure is current insufficient to meet the requirement of even the current urban population Without appropriate investments the environmental quality of this town will degrade.

***Tourism development***
Coastal area is a matter of great in importance to the future of Cambodia both in term of economical and environmental considerations. This development is expected to lead the way for Coast to develop as commercial centre which would substantially increase its population. The impact from this development may be affected to coastal inland resources coastal water resources. The number of tourists in the three coastal provinces has been estimated at 10,206. An approximately 9% growth in tourism arrivals in Cambodia is Japanese Taiwan and Chinese. This indicated that the positive growth in the potential tourism Development sector in the country.

***Port development***
Coastal ports expansions developments can make a contribution to the economy as a main hub for growth of maritime transport which should in turn attract manufacturing entries but may also have an adverse impact on the surrounding environment. These effects of new expansion port can be focused upon location port construction and port operation. These lead to impacts on water quality coastal hydrology bottom contamination marine ecology air noise waste management and visual quality.

***Industrial development***

The industrial development zone was established in Sihanoukville called "Stung Hav Sihanoukville Industrial Zone". This industrial zone include petrochemical production to exploit recently confirmed oil and gas reserves in the gulf of Thailand food processing based on the local fisheries in the area timber processing and re-manufacturing. However these industries pose potential damage to the environment.

### 4.2 Natural Phenomena

Because coastal zones are affected directly and indirectly by the impacts of climate change such as change in precipitation, hydrological pattern, and frequency and intensity of cyclones, storm surges, Cambodia's coastal zone is among the most vulnerable areas to global warming and climate change.

## 5. SOCIAL USE AND OWNERSHIP

### 5.1 Ownership

#### 5.1.1 Protected Areas

Most of the mangrove areas have been designated within the protected areas system under the Royal Decree Creation and Designation of Protected Areas' signed on November 1, 1993 by King Sihanouk (Table 2). These protected areas include the Peam Krasop Wildlife Sanctuary (31,022ha), and Botum Sakor National Park (171,250ha). In addition, Koh Kapik (12,000ha) and associate islets situated within Peam Krasop Wildlife Sanctuary, have been nominated as a wetland of international importance under the Ramsar Convention (ADB, 1995). All of these areas are under the responsibility of the Ministry of Environment (MoE). Management plans for these areas are yet to be developed.

Table 2 Protected Areas in the Coastal and Marine Zones of Cambodia.

| Name | Area (ha) | Province |
|---|---|---|
| **National Parks** | | |
| Phnom Bokor | 140,000 | Kampot |
| Kep | 5,000 | Kampot |
| Ream (Preah Sihanouk) | 15,000 | Kompong Som |
| Botum Sakor | 171,250 | Koh Kong |
| Kirirom | 35,000 | Koh Kong, Kampong Speu |
| **Wildlife Sanctuaries** | | |
| Peam Krasop | 23,750 | Koh Kong |
| Phnom Samkos | 333,750 | Koh Kong |
| Aural | 253,750 | Koh Kong, Pursat, Kampong Channang, Kampong Speu |
| **Multiple Use Management Areas** | | |
| Dong Peng | 27,700 | Koh Kong |

*Source: ADB, 1995.*

#### 5.1.2 Communities

The communities who live in the villages located inside or directly adjacent to the South-West Cluster Protected Areas come mainly from the Khmer, Cham, Pear, Chong and Sóach ethnic groups. The majority are Khmer, although there is a significant minority of Cham living in and around Ream and Bokor National Parks who are engaged in fisheries-related activities and farming. The park-adjacent and park-dwelling populations include a mix of more recent immigrants (most who came to the area during or after the Khmer Rouge era), and longer-term settlers.

Actually, the communities' development and the communities of conservation and protection have popularly been applied throughout the whole country. This term have been used in term of co-management of Protected Areas and Natural Resources that is adjacent to their communities.

### 5.2 Present Uses

Given the multiple use potential of mangrove ecosystems, an integrated approach to mangrove management is essential and should cover the full range of products and services which can be obtained from these areas.

The uses and values of the products obtainable from mangroves are many and important. The importance of the resource stems from the many products taken directly from the mangroves, including the non-wood products, as well as amenities provided from within and beyond its boundaries. Wood products range from timber, poles and posts to firewood, charcoal and tannin. Non-wood products include thatch, honey, wildlife, fish, fodder and medicine. In addition, mangrove lands are often converted to salt ponds or to agriculture or aquaculture purposes. Table 3 illustrates different kinds of mangrove products and uses along the costline of Cambodia.

Table 3 Different Kinds of Mangrove Products and Uses.

| | | |
|---|---|---|
| **Fuel**<br>• Firewood<br>• Charcoal<br>**Construction**<br>• Timber, scaffolds<br>• Heavy construction<br>• Railway sleepers<br>• Mining props<br>• Boat building<br>• Dock pilings<br>• Beams and poles<br>• Flooring, paneling<br>• Thatch or matting<br>• Fence posts, chipboards<br>**Fishing**<br>• Fishing stakes<br>• Fishing boats<br>• Wood for smoking fish<br>• Tannin for net/lines<br>• Fish attracting shelter | **Textile, leather**<br>• Synthetic fibers (rayon)<br>• Dye for cloth<br>• Tannin for leather preservation<br>**Food, drugs and beverages**<br>• Sugar<br>• Alcohol<br>• Cooking oil<br>• Vinegar<br>• Tea substitute<br>• Fermented drinks<br>• Dessert topping<br>• Condiments (bark)<br>• Sweetmeats (prop gules)<br>• Vegetables (fruit/leaves)<br>**Agriculture**<br>• Fodder | **Household items**<br>• Glue<br>• Hairdressing oil<br>• Tool handles<br>• Rice mortar<br>• Toys<br>• Match sticks<br>• Incense<br>**Other forest products**<br>• Packing boxes<br>• Wood for smoking sheet rubber<br>• Medicines<br>**Other natural products**<br>• Fish/Crustaceans<br>• Honey<br>• Wax<br>• Birds<br>• Mammals<br>• Reptiles/other fauna |

- **Services**
  a. Coastal protection against wave and wind erosion.
  b. Moderating the effects of coastal storms and cyclones.
  c. Shelter and habitat for diverse wildlife, particularly avifauna.
  d. Nutrient sink-effect and reduction in excessive amounts of pollutants.
  e. Entrapment of upland runoff sediments thus protecting near shore reefs and reducing water turbidity.
  f. Mangroves also provide opportunities for education, scientific research, recreation and eco-tourism.

- **Wood products**

Mangrove forests have favourable silvicultural characteristics which lend themselves to intensive forest management for wood products. Some of these characteristics are as follows:

- Rapid growth: mature stands under suitable conditions may yield over 270m$^3$/ha within 30 years, equivalent to an MAI of 9-10m$^3$/ha.
- Good regeneration potential: most mangrove species flower and fruit regularly and the prop gules are dispersed by tides. Thus, mangrove stands can recover rapidly from natural or man-made disturbances, including intensive logging.
- Tendency to form homogeneous/even-aged stands: pure stands of *Rhizophora* or *Avicennia* are not uncommon and even in mixed stands; the principal components are restricted to a handful of species.
- Diversity of forest products: a wide range of products are produced and as bioenergy plantations even the smaller thinning may be used as firewood.

- **Timber**

Under favourable conditions, mangrove trees can grow to large sizes. *Rhizophora* over 40m tall are not uncommon and individuals over 62.5m have been reported. However, large trees are becoming scarce, especially in South East Asia, as most of them are removed before they can attain such sizes.

*Rhizophora* spp. are, however, not valuable as timber because of their tendency to split and warp when dried. The wood is dense and difficult to work. The sapwood is easy to preserve but not the hardwood. It is resistant to decay but not to marine borers. Its possible uses include agricultural implements, boat construction (knees and ribs), general heavy construction (rafters, beams, joists), marine and bridge construction (underwater, non-teredo infested waters), marine and bridge construction (above water), fence posts and poles.

The wood of *Rhizophora* is exceedingly heavy with a specific gravity varying from 0.8-1.2. *Avicennia*, which has a lower density (about 0.64) and good nail holding qualities, is often used as railway ties.

- **Charcoal**

*Rhizophora* spp. is preferred for charcoal making. Their moisture content (MC) when felled is about 40 percent (as percent of oven dry weight) compared to *Avicennia* wood which ranges from 70-95 percent. *Rhizophora* wood dries to about 25 percent MC after two months, whereas *Avicennia* requires up to six months drying to 35 percent MC. This partly explains the popularity of *Rhizophora* wood, as predrying stock can be kept to a minimum. Other species (*Bruguiera gymnorhiza* and *Ceriops* sp.) are also used but in smaller quantities.

Charcoal is the main mangrove product in Cambodia. Industries are well developed at the village and cottage industry levels in most Asian countries where mangroves still abound. Charcoal is mainly used for cooking purposes and small-scaled industries.

- **Firewood**

*Rhizophora* in Cambodia are favoured as fuel wood for domestic purposes and are commercially removed, or collected by fishermen and villagers.

- **Fishing stakes/poles**

Actually in Cambodia, there is an established demand for mangrove piling poles used in land reclamation and the construction industry. Used in wet sites which are not infested by shipworms, such mangrove piles can outlast non-treated inland hardwoods.

Along the muddy river banks, small fishing stakes are used to support tidal fish nets. Mangrove poles are also used for scissor nets in housing construction. In countries in South East Asia, fishermen cut mangroves and dump them into the shallow coastal waters as a way of creating shade and thus attract fish (fish attraction devices).

- **Tannin**

*Rhizophora* bark produces very fine tannin suitable for leather work. Tannin from mangrove species has also been used for curing and dyeing of fishing nets made of natural fibred to make the nets more resistant to biological decay.

The production of tannin has declined greatly in recent years, in particular since local demands have been reduced after the introduction of nylon fishing nets and the use of chrome as the predominant agent for leather curing.

- **Nipa palm**

The uses of this palm are many and diverse. It yields an important thatching material, which is used for the roofs and walls of rural houses. The shingles produced are cheap, light to transport, easy to fix and can last several years, particularly when used in houses with open stoves. Cigarette wrappers are also made from the young shoots of Nipa.

- **Wildlife**

As in other forest types, the wildlife in the mangroves is an important source of protein for the local community. In addition, some species, especially reptiles, are hunted or reared for their hides.

Examples of traditional utilisation of selected wildlife species found in mangroves are described in the following.

The wild boar (Sus scrofa) is often found marauding in the swamp margin and it is a source of bush meat in Cambodia.

- **Fisheries products**

From an economic point of view, mangroves are often far more important for the aquatic production they support than for the wood production potential. Kapetsky (1985) estimated that the average yield of fish and shellfish in mangrove areas is about 90kg/ha, with maximum yield being up to 225kg/ha. According to this author, the total halieutic production of the world's mangroves would be around 1,000,000 tonnes per year (for an estimated area of 83,000km$^2$ of open water in mangroves), which is slightly more than 1 percent of estimated total world production in all waters per year.

- **Fish**

In Cambodia, the main commercial fish species caught in or close to mangrove areas include mullets (*Liza subviridis*), sea bass (*Lates calcarifer*), snappers (*Lutjanus* spp.), tilapia (*Tilapia* spp.), groupers (*Epinephelus* spp.), sea catfish (*Arius* spp.), threadfins (*Eleutheronema* spp.) and snake eel (*Ophichthus microcephalus)* (Christensen, 1979).

### 5.3 Potential Uses

Other animals and plants associated with mangroves. Mangroves help provide for a great diversity of plant and animal life. They provide essential habitats for aquatic inhabitants such as crabs, shrimp, fishes, and various invertebrates, as well as other species such as shorebirds and monkeys.

All these resources as mentioned above are very high potential in term of local use and external demands.

### 5.4 Current Management Regime

#### 5.4.1 Enforcement of Existing Laws

The environmental protection and natural resources management law is not adequately enforced. This is largely because of lack of human and financial resources. The fisheries law has many good provisions for the protection of marine habitats and fisheries resources. For instance, dynamite fishing trawling in coastal water pushing netting and cutting mangrove occurs daily but are rarely prosecuted.

#### 5.4.2 Decision-making Processes

The decision-making process relating the development in the coastal zone is poorly defined vague and ambiguous. It appears that whatever the official mechanisms are high ranking individuals can make decisions without consultation and participation. On the other hand, it appears to be conflict between provincial and national decision-makers with plans and policies developed independently by the two levels of government.

#### 5.4.3 Legal Framework

A legal framework does exist for management of the coastal zone. There are laws on protected areas fishing industrial development land use forestry environmental protection and natural resources management, environmental impact assessment, water pollution control and other important coastal zone issues. All governors and departments in all provinces and municipalities identified the lack of a legal and policy framework for coastal zone management and administrative structure to implement it as a major constraint on coastal zone management in Cambodia.

***Lack of Coastal Zone Planning***

All provinces and municipalities are required to prepare Master Plans. Planning has not occurred in the coastal zone. However, the plan prepared by provincial authorise specifies industrial tourism and residential zones but does not suggest any guidelines for development standards or further plans. Unplanned and unco-ordinated development is occurring all along the coast but is not yet viewed as a major problem because the rate of development is slow. However, it is envisaged that this is lack of planning result in haphazard development and will be a source of serious conflicts in the near future.

***Lack of Information about Distribution and Status of Natural Resources***
Information on marine habitats such as coral reefs, seagrasses and endangered species are still limited. The distribution of such these information and data both national and provincial levels are limited. Without information about what people are catching, it is not possible to estimate where the fisheries are over-fishing.

***Lack of Public Awareness and Participation and Capacity***
Many problems related to public and participation could be addresses. And actions to these should strengthen laws raising public awareness and doing research associated with this concern is a serious lack of technical capacity among government staff and minimal resources to prepare and disseminate information.

Participation is still low priority for most government officials that may be reflecting the historical lack of community participation in decision-making in Cambodia. The lack of participatory planning and management has meant that some solutions to environmental problems are unsatisfactory.

### 5.4.4 Cambodian Policy and Administrative Frameworks

The basic emphasis of the Cambodian government at present is to attempt to clarify the lines of responsibility for activities that currently transcend local, regional and national interests the intent is to manage and co-ordinate government actions to clarify ministry attributions and to ensure administrative effectiveness and propriety. The existing restructuring of administrative tasks is directed reshaping the civil service reforming the organisational framework for effective management and reforming the regulatory mechanisms. The effectiveness and efficiency of organising and managing planned coastal development and resources use is depending upon this successful restructuring of the state (reformed administration). The Royal Government of Cambodia is being emerged to develop Cambodia to become a state with a functional legal and administrative system.

Many Royal decrees laws, sub decrees and other legal instruments have been issued and are being developed. At the present, a process of making policy and law are done by a combination of national and international experts. These are law on Environmental Protection and Natural Resources Management, land law, Royal decree on the Creation and Designation of Protected Areas. Sub-decree on Environmental Impact Assessment and Water control Pollution, Fisheries and Forestry laws and Law on Land Management Urbanisation and construction. On the other hand, Cambodia became a member of the Coordinating Body of the Seas of East Asia (COBSEA) Association of South East Asian Nation (1999), MARPOL (1994), Biodiversity convention (1994), CITES convention (1997), Ramsar convention (1999), and Climate Change convention (1995).

### 5.4.5 Institutional Frameworks

The numerous institutions with statutory power or interests in coastal and marine areas give rise to the problems of overlap gaps in responsibilities and lack of co-ordination. The government has set up some organisational institutions in order to ensure overall co-ordination and co-operation of the different policies and measures taken by ministry levels of administration. A part from the existing coastal and marine co-ordination consists of the Ministry of Environment, Ministry of Agriculture Forestry and Fisheries, Coastal Co-ordinating Unit and the National Coastal Steering Committee.

The Ministry of Environment (MoE) was established in 1993 to address issues of environmental management in the country hold a number of responsibilities with respect to the coastal zone, the most obvious being the general protection of the environment in the coastal zone. More specific duties include the planning and management of the protected area system in the coastal zone. And its strategy is based on the execution of sole and joint responsibilities in conjunction with other ministries concerned with specific aspects of natural resources and infrastructure management.

The Ministry of Agriculture Forestry and Fisheries (MAFF) is the main ministry responsible for managing Cambodia' s forests including inundated forests mangrove as well as wildlife and fisheries. Two departments of MAFF are directly relevant to biodiversity management and protection in Cambodia. It is clear from the responsibilities of MAFF and MoE that close co-ordination between the

ministries and departments involved in nature conservation is essential to avoid conflicts and promote complementary activities towards implementing the coastal protected area plans.

National Coastal Steering Committee (NCSC) is an attempt to deal with the multi-sectoral natural of coastal resource issues. This committee was established in and meet on a quarterly basis Members of this Committee include the Minister of Environment (Chairman), Under Secretaries of State from Ministry of Agricultural Forestry and Fisheries (Vice-Chair), Ministry of Tourism, Industry Mines and Energy Public Works and Transport, Rural Development, Women's Affairs Planning, Council of Development for Cambodia, Governors of coastal provinces and others donors NGOs and related coastal projects are observers. The NCSC is responsible for the overall direction of coastal projects and activities. All members are asked to ensure the co-operation of their line ministries and provincial authorities. The committee assisted by secretariat calls Coastal Coordinating Unit (CCU) was created in the Ministry of Environment and is responsible for co-ordination of activities by international organisations governmental agencies and the private sectors in the coastal area in Cambodia Provincial working groups have been formed at the provinces and municipalities. These working groups are supported by Danida coastal zone project in its on-going technical assistance activities in the coastal zone.

## 6. ECONOMIC VALUATION

### 6.1 Direct Use Values

Today, 49 Village Fishing Groups and a Village Fisheries Committee work to regulate conserve and manage marine resources in the Park according to the fisheries management guidelines and regulations that they have developed.

Analysis of the value of resource use shows that overall; Ream National Park constitutes an extremely important economic resource for local communities. Up to 84% of households depend on the Park's resources for their basic subsistence and income, to a net value of some US$1.24 million a year or an average of US$233 for every household living in and beside the National Park.

In an area where the median family income is only US$316 a year and a third of families earn less than US$200, and where half of households can barely provide for their own subsistence.

A survey of 90 households was undertaken in three villages within Koh Kapik, the study area and proposed Ramsar site, in order to provide information on the traditional uses of the mangrove by local communities. The research focused on the economic valuation of non-timber forest products collected from the mangrove area by households; these include fuel wood, charcoal, construction materials, and crabs, shrimp, fish and snails. In addition, the important ecological functions of the mangroves, such as storm protection and biodiversity maintenance were identified. Eight shrimp farms were surveyed in order to assess the viability of shrimp farming in the area.

Over 90% of households are dependent on fishing for their livelihood. However, fish productivity has declined dramatically in recent years due to the increased number of fishers, the loss of mangrove areas to shrimp farms and water pollution from these farms. 90% of households involved in fishing claim that it was harder to fish now compared to 5 years ago. Local fishing benefits are estimated to be US$84 per hectare.

The area of mangrove forest required per charcoal kiln per year is estimated by this study to be between 0.20-0.40 hectares. Assuming a 30 year cutting cycle, and that only already disturbed mangrove areas would be allocated for charcoal production, potential returns per hectare per year for sustainably managed charcoal production are estimated at over US$400.

While 50% of farms made a profit in the past year, overall shrimp farms in the area suffered an average loss of over US$1,000 per hectare. Largely due to problems with disease associated with poor water quality management, it is rare for farms to have two successful harvests a year, and in some cases both harvests have failed. Individual farms have reported losses ranging from US$40,000-240,000.

The real costs of shrimp farming are in fact much higher since the analysis does not account for the environmental costs associated with shrimp farming. Unsustainable shrimp farming is linked to water pollution and the extensive clearing of mangroves for farm use, preventing accretion and wiping out of

nursery areas. There is also a social linkage: over 90% of local people oppose the shrimp farms. This could result in social unrest and security problems in the future if not adequately addressed.

The relocation of families out of sensitive mangrove areas is supported by provincial authorities. Land is available in upland areas in the province where crop cultivation is possible alongside fishing. Some households in Koh Kapik have expressed an interest in relocation. While an in-depth assessment of the suitability of relocation sites is lacking, the possibility of voluntary relocation could be considered as a way of protecting an ecologically valuable resource and improving the living standards of the local people. Relocation support is estimated around US$2,000 per household to cover the cost of house construction and living expenses before the first harvest.

Generally the Intensive shrimp farming covered an area of 850ha in 1994 with production of 450 tonnes a year. But disease outbreaks have since reduced the culture area to 20%, with estimate of national losses amounting to US$28.6 million a year. A moratorium on further licensing of shrimp farms has been enforced.

### 6.2 Environmental Service Values

***The value of mangrove conservation in Ream National Park***

In total there are approximately 1,800ha of mangroves in Ream, with a total volume of 111,645m$^3$. A simple cost-benefit analysis demonstrates the high value of mangrove conservation in terms of local socio-economic and environmental benefits. Under realistic recovery and harvesting conditions, clear-cutting the mangroves would yield a one-time income of less than US$630,000. Although prawn farms can, under the best conditions, realise a net income of almost US$4,500/ha/year, few actually do. In Koh Kong, a similar mangrove area lying to the west of Ream National Park, half of prawn farms are making a loss at a realistic productivity rate of 3.6 tonnes per harvest, this loss is nearly US$9,950/ha/year and in aggregate they show a loss of US$1,103 per ha per year. Yet even if only half of the forest, fisheries and agricultural production in surrounding villages depend on mangroves in the Park, their clearance would result in a loss of local income of around US$620,000 a year. It was confimed that US$344/ha/year is a realistic one data for similar mangrove areas in Thailand estimate local use of mangroves to be worth between US$230 (Christensen, 1979) and US$1,200 (Sathirthai, 1998) a year, and values in Koh Kong Province exceed US$500/ha, including charcoal. In fact many more economic losses would occur from mangrove clearance, such as the damage to houses, infrastructure, farmland, employment, markets and general local welfare that result from the loss of vital environmental functions and ecological services. In Southern Thailand, the economic benefits of mangroves in terms of coastline protection have been estimated to have a value of between US$76.5/ha/year and 165/ha/year (Christensen, 1979), carbon sequestration benefits US$2.2/ha, and mangrove storm protection functions have been valued at US$32/ha in Koh Kong Province. Taking into account these indirect economic benefits increases the annual economic value of conserving Ream's mangroves to US$900,000 a year. This is far more than the one-off gain (and long-term loss) of clear-cutting the mangroves and turning them over to prawn farms. The economic costs of estroying these valuable natural ecosystems, both immediate and long-term, far exceed the benefits or in other words, biodiversity conservation in Ream National Park is a demonstrably economically worthwhile activity to engage in.

| Net value (US$/ha/year) | Total Value (US$ '000/year) |
|---|---|
| Local use: | 344,619,200 |
| Storm protection: | 3,257,600 |
| Coastal erosion prevention: | 122,219,600 |
| Carbon sequestration: | 23,600 |
| Total Value: | 500,900,000 |

## 7. CONCLUSION AND RECOMMENDATIONS

Refereed to description above, the data and information is still very limited, especially for the specific issues such as mangrove composition and specie distributions. The most of the supports are likely to work just in this stage on a very small areas comparing to all the mangrove areas. In other words, nobody take it care yet for the whole mangrove areas even though the Cambodia is in progress of green development way. Regarding the local data and information, it is mostly focusing on the socio-economic and health issues which are the immediate objectives to help people to survive maintain and develop their own life. The environment issues are the secondary or long-term objectives.

In addition, no one institution is responsible for researches neither data and information co-ordination and management. Due to there are no research supports and its facilities, lack of financial supports; and very limited knowledge and skills. On the other hand there is no linking between the independent researches and project/programme realisations. So the data and information are available unless there is a project or programme in place.

Regarding the project or programme, it is unsustainable manner. It means some projects/programmes just for 1 year, 2 years, 3 years or... but no permanent. So when it is not permanent, its data is not fixed. When the project/programme finished, the data and information are also misplaced and disappeared.

Therefore the national self-management of the data and information is the key actor. Concerning its management, there are lack of knowledge and skill in information and data management and its supported infrastructures. The people are essentially less considered for the data and information for decision-making, planning and monitoring as well as evaluation. The principle causes are lack of mechanism for data and information sharing among other peoples and lack of its dissemination, which allows people to understand the important, use effectively and manage it.

In order to maintain and keep records up to date, the key issue is to compile and manage the existing data and information in a national database system that can be used by other people. As Cambodian human resources are very limited, thus the capacity building in data and information use and management is a prerequisite as the immediate objectives.

Gathering and giving data and information are the principle to promote and maximise for its sharing and dissemination. It needs to establish the co-ordination for data and information management with the enhancement of flow mechanism with its free access.

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Annex 1 List of Mangrove Species in Cambodia.

| No. | Khmer Name | Scientific Name | Family |
|---|---|---|---|
| 1 | Trochjiek cragn slekweng/trochjiekcragn pkapor sar | *Acanthus ebracteatus* (shrub) | Acanthaceae |
| 2 | Trochjiek cragn Slekbanla/trochejiekcragn pkapor svay | *Acanthus ilicifolius* (shrub) | Acanthaceae |
| 3 | Trochjiek cragn slek-eit banla | *Acanthus vulubilis* (shrub) | Acanthaceae |
| 4 | Brong | *Acrostichum aureum* (fern) | Pteridaceae |
| 5 | Brong/Khnagn | *Acrostichum speciosum* (fern) | Pteridaceae |
| 6 | Smair | *Aegialites rotundifolia* (tree) | Plumbaginaceae |
| 7 | ??? | *Aegiceras corniculatum* (tree) | Myrsinaceae |
| 8 | ??? | *Amoora cucullata* (tree) | Meliaceae |
| 9 | ??? | *Atalantia monophylla* (tree) | Rutaceae |
| 10 | Kbagnsor/Sman/Mouroujsrotorb | *Avicennia alba* (tree) | Verbenaceae |
| 11 | Kbagn Sporng/Mouroujsrotorb | *Avicennia marina* (tree) | Avicenniaceae |
| 12 | Kbagnkmao/Spong | *Avicennia officinalis* (tree) | Avicenniaceae |
| 13 | Dawmtrojiekbres/Pchek tekbray | *Barringtonia racemosa* (tree) | Lecythidaceae |
| 14 | ??? | *Brownlowia tersa* (shrub) | Tiliaceae |
| 15 | Basac/Omlann | *Bruguiera cylindrica* (tree) | Rhizophoraceae |
| 16 | Basac Kroahom | *Bruguiera gymnorrhiza* (tree) | Rhizophoraceae |
| 17 | Basacsor | *Bruguiera sexangula* (tree) | Rhizophoraceae |
| 18 | ??? | *Caesalpinia crista* (shrub or climber) | Leguminosae-Caesalpinoideae |
| 19 | ??? | *Calycopteris floribunda* (climber) | Combretaceae |
| 20 | Dawmcheungtia/Pilpicht/Chompourey | *Cerbera odollam* (tree) | Apocynaceae |
| 21 | Smairsor | *Ceriops decandra* (tree) | Rhizophoraceae |
| 22 | Smerkrohorm | *Ceriops tagal* (tree) | Rhizophoraceae |
| 23 | Dawmchheongpurs | *Clerodendrum inerme* (shrub) | Verbenaceae |
| 24 | ??? | *Combretum tetralophum* | Combretaceae |
| 25 | Dyerohatt | *Cordia cochinchinesis* (tree) | Boruginaceae |
| 26 | ??? | *Derris trifoliata* (climber) | Leguminosae Papilionoideae |
| 27 | Tatom/Chheu chhor | *Excoecaria agallocha* (tree) | Euphorbiaceae |
| 28 | ??? | *Finlaysonia maritima* (vine) | Asclepiadaceae |
| 29 | Pdaoondawk/Voirre | *Flagellaria indica* (climber) | Flagellariaceae |
| 30 | Kann-kai/Dawmklai/Semornsakmot | *Heritiera littoralis* (tree) | Sterculiaceae |
| 31 | Dawm-beus/Kabbaspreyteukbrey | *Hibiscus tiliaceus* (tree) | Malvaceae |
| 32 | Krokosteukpray/Krongnungteukbray | *Intsia bijuga* (tree) | Leguminosaecae-salpinoiddeae |
| 33 | ??? | *Kandelia candel* (tree) | Rhizophoraceae |
| 34 | Krognyeppka krohom/Krognyep-krohom | *Lumnitzera littorea* (tree) | Combretaceae |

Annex 1 *cont.* List of Mangrove Species in Cambodia.

| No. | Khmer Sound | Scientific Name | Family |
|---|---|---|---|
| 35 | Krognyep pkasor/Krognyep sor | *Lumnitzera racemosa* (tree) | Combretaceae |
| 36 | Chark | *Nypa fruticans* (palm) | Palmae |
| 37 | Peng | *Phoenix paludosa* (palm) | Palmae |
| 38 | ??? | *Premna obtusifolia* (tree) | Verbenaceae |
| 39 | Kongkangslektoch | *Rhizophora apiculata* (tree) | Rhizophoraceae |
| 40 | Kongkang slekthom | *Rhizophora mucronata* | Rhizophoraceae |
| 41 | ??? | *Sapium indicum* (tree) | Euphorbiaceae |
| 42 | Ampouthmar/Rompea chheu | *Sonneratia alba* (tree) | Sonneratiaceae |
| 43 | Ampoukrohom | *Sonneratia caseolaris* (tree) | Sonneratiaceae |
| 44 | Ampea | *Sonneratia griffithii* | Sonneratiaceae |
| 45 | Ampea | *Sonneratia ovata* (tree) | Sonneratiaceae |
| 46 | Porhteukpray | *Thespesia populnea* (tree) | Malvaceae |
| 47 | Tabonsor | *Xylocarpus granatum* (tree) | Meliaceae |
| 48 | Tabonkmao | *Xylocarpus moluccensis* (tree) | Meliaceae |
| 49 | Tabann | *Xylocarpus rumphii* (tree) | Meliaceae |
| 50 | Khontrianket sahmot | (fern/herb ??) | |
| 51 | Voartrohkhuntek sahmot | (vine) | |
| 52 | Voarsoandeik kmouch | (vine) | |
| 53 | Nonoung sahmot | (vine) | |
| 54 | Voartadet | (vine) | |
| 55 | Rhumjeik sahmot | *Pandanus tectorius* (palm/tree) | Pandanaceae |
| 56 | ??? | *Scaevola taccada* (shrub) | Goodeniaceae |
| 57 | Vorprieng | (vine) | |
| 58 | Phut-tria sahmot | (tree/shrub) | |
| 59 | Thaw-sai (Thai) | | |
| 60 | Lambit thalay (Thai) | | |
| 61 | Phosai | | |
| 62 | Thuk-kai | | |
| 63 | Phat-yanman (Thai) | | |
| 64 | Lang-katsaa (Thai) | | |

*Source: IDRC, 1995.*

Annex 2 Different Types of Mangrove Values in Cambodia.

| Description | Gross value (US$/year) | Net value (US$/year) | Average value per user household (US$/year) |
|---|---|---|---|
| Firewood | 125,133 | 112,062 | 25 |
| Construction wood | 23,659 | 23,659 | 18 |
| Medicinal plants | 10,788 | 10,788 | 11 |
| Food | 17,695 | 17,695 | 18 |
| Roofing materials | 13,397 | 13,397 | 84 |
| **Sub-total, forest products** | **190,672** | **177,601** | |
| Crops | 316,594 | 316,594 | 119 |
| Livestock | 203,750 | 227,702 | 143 |
| **Sub-total, farming** | **520,344** | **544,296** | |
| **Total forest products and farming** | **711,015** | **721,897** | |

UNEP
United Nations Environment Programme

UNEP/GEF South China Sea Project

GEF
Global Environment Facility

**NATIONAL REPORT**

**on**

# Mangroves in the South China Sea

## CHINA

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# 1. GEOGRAPHIC DISTRIBUTION

## 1.1 Maps

Natural mangroves in China are found along the coastlines of Hainan, Guangxi, Guangdong, Fujian, Taiwan, Hong Kong, and Macao. Fuding city (27°20'N) of Fujian province is considered as the northmost boundary for natural mangroves, but for artificial mangroves, Yueqing (28°25'N) of Zhejiang province is the northmost border, where *Kandelia candel* was transplanted successfully in 1950s. Figure 1 shows Map of Mangrove Distribution in China.

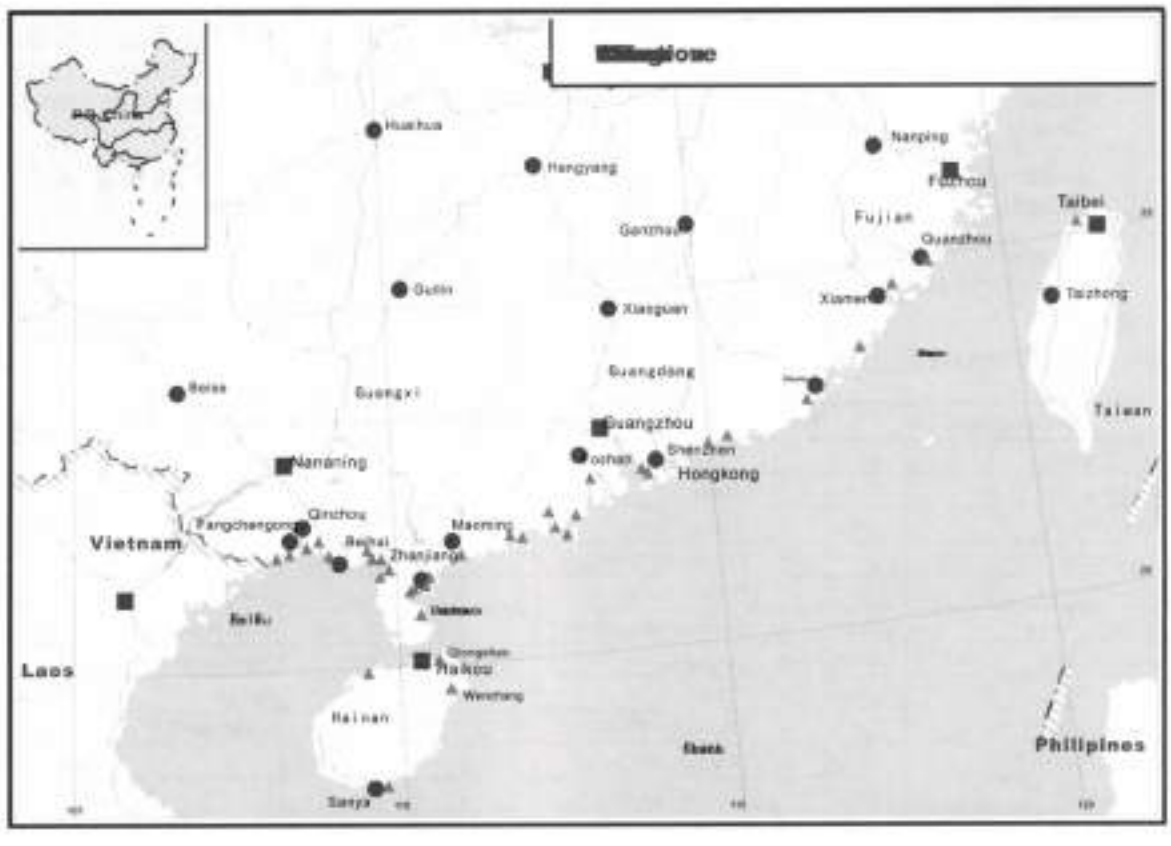


Figure 1 Map of Mangrove Distribution in China.

## 1.2 Area Distribution

Generally, in terms of administrative region, mangroves in China mainly occur in three provinces, Guangdong (9,891ha), Guangxi (8,375ha), and Hainan (3,930.3ha), constituting an area of 22,196ha, which accounts for 94.67% of the total China mangroves.

Generally, in terms of administrative region, mangroves in China mainly occur in three provinces, Guangdong (9,891ha), Guangxi (8,375ha), and Hainan (3,930.3ha), constituting an area of 22,196ha, which accounts for 94.67% of the total China mangroves.

It is believed that the coverage of mangrove in China was around 40,000ha in 1950s (He, 1999). Now, the area of existing mangrove, according to some scholars (He, *et al.*, 1995; Fan, 2000; Zhang and Sui, 2001), is estimated to be about 15,000ha. However, the result of an overall survey on mangroves conducted in 2001 showed that mangrove area in China was 23,445.7ha (Table 1).

The latter figure, though it suggests 8,445.7ha more mangrove area than the widely accepted figure, is believed to be more accurate, for it was figured out by using remote sensing technology in combination with field surveys. The difference of the two figures implicates only an underestimate of mangrove area by the scholars, but not an increase of mangrove area in China. China has seen a sharp decrease in mangrove area in the past fifty years. To demonstrate this trend, Fan Hangqing estimated (Fan and Li, 1997), based on an analysis on reclamation land along Guangxi coast, that mangrove forest in Guangxi has been depleted from 24,066ha about 150 years ago to 15,951ha in 1950s and to 5,654ha (scholars' estimate) or 8,375ha (remote sensing data) in 2001.

With respect to geographical distribution, mangroves in China mainly occur in three regions:

1) North-eastern coast of Hainan Island, including Qiongshan City (1,701ha, including1,572.6ha mangrove in Dongzhai Harbour Mangrove Nature Reserve) and Wenchang County (1,519ha, including 1,188.8ha mangrove in Qinglan Harbour Mangrove Nature Reserve), where mangrove area is 3,220ha, making up 13.73% of China mangroves.
2) Leizhou Peninsula of Guangdong province (7,306ha), which making up 31.16% of China mangroves.
3) Guangxi coast of Beibu Gulf (8,375ha), making up 35.72% of China mangroves. Mangrove area in the three regions constitutes 78.66% of total mangrove coverage in China.

Table 1 Mangrove areas in China.

| Guangdong | | Source | Guangxi | | Source | Fujian | | Source |
|---|---|---|---|---|---|---|---|---|
| Grand Total | 9,890.8 | | Grand total | 8,374.9 | | Grand total | 615.1 | |
| **Zhanjiang** | | | **Beihai** | | | **Zhejiang** | | A |
| Wuchuan City | 75.6 | A | Hepu County | 2,595.6 | A | Grand total | 20.6 | |
| Potou District | 210.1 | A | Haicheng District | 28.9 | A | **Taiwan** | | D |
| Xiashan District | 50.7 | A | Yinhai District | 448.0 | A | Grand total | 287.0 | |
| Mazhang District | 1,986.8 | A | Tieshangang District | 50.8 | A | **Hong Kong** | | D |
| Donghai Island | 1,475.3 | A | Sub-total | 3,123.3 | | Grand total | 263.0 | |
| Leizhou City | 1,064.6 | A | **Qinzhou** | | | **Macao** | | E |
| Xuwen County | 726.9 | A | Sub-total | 3,057.3 | A | Grand total | 64.0 | |
| Suixi County | 354.2 | A | Fangchenggang | | | | | |
| Lianjiang City | 1,361.6 | A | Dongxing City | 801.8 | A | | | |
| Sub-total | 7,305.8 | | Fangcheng District | 566.4 | A | | | |
| **Maoming** | | A | Gangkou District | 826.1 | A | | | |
| Maokang District | 53.0 | A | Sub-total | 2,194.3 | | | | |
| Dianbai County | 159.2 | A | | | | | | |
| Sub-total | 212.2 | | **Hainan** | | | | | |
| **Yangjiang** | | A | Grand total | 3,930.3 | A | | | |
| Yangdong County | 24.2 | A | Qiongzhou | 1,701 | C | | | |
| Jiangcheng County | 157.0 | A | Wencang | 1,519 | C | | | |
| Hailing County | 48.2 | A | Chengmai | 305 | C | | | |
| Yangxi County | 420.7 | A | Zhanzhou | 274 | C | | | |
| Sub-total | 650.1 | | Sanya | 77 | C | | | |
| **Jiangmen** | | | Lingao | 43 | C | | | |
| Sub-total | 500.5 | A | Dongfang | 4 | C | | | |
| **Enping** | | | Linshui | 4 | C | | | |
| Sub-total | 134.4 | A | Wangning | 2 | C | | | |
| **Taishan** | | | Qionghai | 1 | C | | | |
| Sub-total | 366.1 | A | | | | | | |

Table 1 *cont.* Mangrove areas in China.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Zhuhai** | | | | | | | | |
| Qi'ao District | 74.6 | A | | | | | | |
| Sanhong District | 5.7 | A | | | | | | |
| Doumen County | 0.0 | A | | | | | | |
| Hengqin District | 20.4 | A | | **Whole China** | | **23,445.7** | | |
| Sub-total | 100.7 | | | | | | | |
| **Guangzhou** | | | | | | | | |
| Sub-total | 10.0 | A | | | | | | |
| **Shenzhen** | | | | | | | | |
| Sub-total | 330.0 | A | | | | | | |
| **Huizhou** | | | | | | | | |
| Sub-total | 170.0 | B | | | | | | |
| **Shanwei** | | | | | | | | |
| Sub-total | 31.0 | B | | | | | | |
| **Chaozhou** | | | | | | | | |
| Sub-total | 10.0 | B | | | | | | |
| **Shantou** | | | | | | | | |
| Sub-total | 70.0 | B | | | | | | |

*Notes:*

*A: Results from remote sensing and ground surveys in 2001.*
*B: Cheng Yuansheng, et al., 2001.*
*C: Data were calculated through the total area of 3,930.3ha multiplying the relative proportions given by Mo Yanni et al., 2002. The current status of Hainan mangrove resources and protection strategies. Tropical Forestry; 30 (1).*
*D: Fan (2000). Mangroves: Guard for Coastal Environmental Protection. Nanning: Guangxi Sci. and Tech. Press.*
*E: Leung, (1998). The distribution pattern of mangrove plant populations and its species composition in Macao. Ecologic Science. 17(1): 25-31.*

## 2. MANGROVE SPECIES DISTRIBUTION AND FORMATION

### 2.1 Species Distribution

36 species of mangrove have been recorded in China; of which 26 species in 13 families are true mangrove trees and 10 species in 9 families are mangrove associates (Table 2). From south to north, the species of mangrove reduce gradually, with 35 species occurring in Hainan, 19 species in Guangdong, 18 species in Guangxi, 17 species in Taiwan, 9 species in Fujian, 5 species in Macao, and 1 species in Zhejiang. *K. candel* is the species occurring in all seven regions, for this species has developed a cold resistant adaptation. Among all the species, only *Sonneratia hainanensis* is category 1 protected national plant. Now only five trees of this species exist in China.

Table 2 Trees and Shrubs of Mangroves in China and Their Distribution.

| Scientific Name | Family | Distribution | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | HN | HK | MC | GD | GX | TW | FJ | ZJ |
| **True mangrove** | | | | | | | | | |
| 1. *Acrostichum aureum* | Acrostichaceae | + | + | + | + | + | + | + | |
| 2. *A. speciosum* | Acrostichaceae | + | | | + | + | | | |
| 3. *Bruguiera cylindrical* | Rhizophoraceae | + | | | | | | | |
| 4. *B. gymnorrhiza* | Rhizophoraceae | + | + | | + | + | + | + | |
| 5. *B. sexangula* | Rhizophoraceae | + | | | | | | | |
| 6. *B. s. var. rhynochopetala* | Rhizophoraceae | + | | | | | | | |
| 7. *Ceriops tagal* | Rhizophoraceae | + | + | | + | | + | | |
| 8. *Kandelia candel* | Rhizophoraceae | + | + | + | + | + | + | + | + |
| 9. *Rhizophora apiculata* | Rhizophoraceae | + | | | | | | | |
| 10. *R. stylosa* | Rhizophoraceae | + | + | | + | + | + | | |

Table 2 *cont.* Trees and Shrubs of Mangroves in China and Their Distribution.

| Scientific Name | Family | Distribution | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | HN | HK | MC | GD | GX | TW | FJ | ZJ |
| 11. *Acanthus ebracteatus* | Acanthaceae | + | | | + | | | | |
| 12. *A. ilicifolius* | Acanthaceae | + | + | + | + | + | + | + | |
| 13. *A. xiamenensis* | Acanthaceae | | | | | | | + | |
| 14. *Lumnitzera littorea* | Combretaceae | + | | | | | | | |
| 15. *L. racemosa* | Combretaceae | + | + | | + | + | + | | |
| 16. *Excoecaria agallocha* | Euphorbiaceae | + | + | | + | + | + | + | |
| 17. *Xylocarpus granatum* | Meliaceae | + | | | | | | | |
| 18. *Aegiceras corniculatum* | Myrsinaceae | + | + | + | + | + | + | + | |
| 19. *Nypa fruticans* | Palmae | + | | | | | | | |
| 20. *Scyphiphora hydrophyllacea* | Rubiaceae | + | | | | | | | |
| 21. *Sonneratia alba* | Sonneratiaceae | + | | | | | | | |
| 22. *S. caseolaris* | Sonneratiaceae | + | | | | | | | |
| 23. *S. hainanensis* | Sonneratiaceae | + | | | | | | | |
| 24. *S. ovata* | Sonneratiaceae | + | | | | | | | |
| 25. *Heritiera littoralis* | Sterculiaceae | + | | | + | + | | | |
| 26. *Avicennia marina* | Verbenaceae | + | + | + | + | + | + | + | |
| | | 25 | 10 | 5 | 13 | 11 | 10 | 8 | 1 |
| **Associated mangrove** | | | | | | | | | |
| 1. *Barringtonia racemosa* | Barringtoniaceae | + | | | | | | | |
| 2. *Cerbera manghas* | Apocynaceae | + | | | | + | + | | |
| 3. *Dolichandrone spathacea* | Bignoniaceae | + | | | + | | | | |
| 4. *Pluchea indica* | Compositae | + | | | + | + | + | | |
| 5. *Hernandia sonora* | Hernandiaceae | + | | | | + | | | |
| 6. *Pongamia pinnata* | Leguminosae | + | | | + | + | + | | |
| 7. *Pemphis acidula* | Lythaceae | + | | | | | + | | |
| 8. *Hibiscus tiliscus* | Malvaceae | + | + | | + | + | + | + | |
| 9. *Thespesia populnea* | Malvaceae | + | | | + | + | + | | |
| 10. *Premna obtusifolia* | Verbenaceae | + | | | + | + | + | | |
| | | 10 | 1 | 0 | 6 | 7 | 7 | 1 | 0 |

*Note: HN-Hainan, HK-Hong Kong, MC-Macao, GD-Guangdong, GX-Guangxi, TW-Taiwan, FJ-Fujian, and ZJ-Zhejiang.*

## 2.2 Formation

Based on species composition, appearance, and community characteristic, mangrove communities are grouped into seven formations (Lin, 1988), which are *Bruguiera* Formation, *Rhizophora* Formation, *Kandelia* Formation, *Aegiceras* Formation, *Avicennia* Formation, *Sonneratia* Formation, and *Nypa* Formation.

### 2.2.1 *Bruguiera* Formation

*Bruguiera* Formation refers to as the community dominated by trees of *Bruguiera*, which is mainly composed of two communities, *B. gymnorrhiza* community and *B. sexangula* community.

*B. gymnorrhiza* community distributes along coastline to the south of Xiamen city in Fujian province, well developed in clay loam land near estuaries where are occasionally inundated by high tide. Soil salinities range from 8% to 20%. Dark green in its community physiognomy, trimness in canopy, coverage degree 70-85%, height of trees 3-7.5 metres, diameter at base 14-25cm, diameter of crown of tree 3.6-4.7 metres. Associate species are *K. candel*, *A. marina*, *A. corniculatum*, *E. agallocha* at coast areas in Mainland China, and *Bruguiera sexangula*, *B.* s. var. *rhynochopetala* and *X. granatum* in Hainan Island.

*B. sexangula* community is only found in Hainan province, growing in sandy clay loam soil, salinity 3.26-14%, fusccpiceous or ruricans in soil colour, dark green in its community physiognomy, scattered with yellow green patches, 3-8 metres tall, 7-8cm in diameter at breast height, associated species are *K. candel* and *Ceriops taga*.

### 2.2.2 *Rhizophora* Formation

This formation consists of two communities, *R. apiculata* community and *R. stylosa* community. *R. apiculata* communities occurred only in Hainan, growing in muddy soil (salinity 7.1-9.5%), inconsistent in height, dark green or yellow green in its community physiognomy, coverage of canopy 80%-90%, 3-6 metres tall, 8-10cm dbh, associated with *B. sexangula* and *A. corniculatum*. *R. apiculata* communities are mostly located in mid tidal or high tidal muddy flats with dark grey soil (salinity 9.26-19.7%), consistent in height, dark green in physiognomy, coverage 70-90%, 3.5-4.5 metres tall, associate species are *K. candel*, *A. corniculatum*, *B. gymnorrhiza*, and *C. tagal*.

### 2.2.3 *Kandelia* Formation

The formation is composed of *K. candel* community, distributing widely on all kinds of flats. Trimness in forest form, grey brown in soil colour, salinity 10-20%, yellowish green in physiognomy, 0.6-0.9 in degree of closeness, tall 1.5-6 metres, 10-30cm dbh, usually form two layers of community with *A. corniculatum*, associated with few *A. marina* and *A. ilicifolius*.

### 2.2.4 *Aegiceras* Formation

The formation is constituted by *A. corniculatum* community that widely distributes in China. Sandy or clay loamy soil (salinity 6-27%), yellow green in community physiognomy, trimness in canopy, coverage 50-90%, 4-5 metres tall in Shenzhen and mostly 1-1.5 metres tall, 15cm in diameter at base and 5-10cm dbh, associated with few *K. candel*, *R. stylosa*, and *A. marina*.

### 2.2.5 *Avicennia* Formation

The formation consists of *A. marina* community, widely distributing at low tidal flats. Soil salinity is between 5-20% (extremely at 25%), grey green in community physiognomy, 70-95 in degree of coverage, 2-3 metres tall (8 metres the tallest), 8-10cm in diameter at base (23cm the biggest).

### 2.2.6 *Sonneratia* Formation

The formation only occurs in Hainan, mostly locating at coast of bay or estuary. Aqueous soil of silt (rarely sandy clay), 5-20 in salinity, yellow green in community physiognomy, dominated by *Sonneratia* association, 10-13 metres tall, trimless in forest form, 60-80% in coverage degree, associated with *R. stylosa* and *A. marina*.

### 2.2.7 *Nypa* Formation

The formation is mostly composed of *N. fruticans* community, mainly distributing at shelter harbour or alluvial fan at estuary. Aqueous soil of silt, salinity low at 5%, dark green in community physiognomy, 80% in coverage degree, 3-4 metres tall (5 metres the tallest), dominated by *N. fruticans*, associated with *A. aureum* and *Acanthus ebrecteatus*.

## 3. ENVIRONMENTAL STATE

### 3.1 Physical Characteristic

The distribution of the mangrove in China is strongly influenced by two kinds of physical factors, macroscopic factors and microcosmic factors. Macroscopic factors include the physical factors like climate, salinity and ocean current, and microcosmic factors contain those of geomorphology, tide, sediment, and so on.

### 3.1.1 Macroscopic Factors

#### *3.1.1.1 Climate*

In China, mangrove species and their heights vary with latitude, i.e., mangrove species decrease and mangrove tress become small as latitude increases. Such latitudinal influence on mangroves implicates, deduced from the relation between temperature and latitude, that temperature is one of key factors limiting the occurrence of mangrove. Among the major mangrove areas, Hainan Island is the province with highest average temperature and lowest latitude, in which 35 species of true mangroves and associated mangrove occur. Mangrove trees there are well developed, and most of them are less than 10 metres tall. Mangrove communities are comparatively simple, characterised with trim canopy. The highest tree is the 14-metre tall *B. sexangula* tree. Guangdong and Guangxi are two neighbouring provinces in south China at similar latitude, thus in same climatic zone. In Guangxi 11 species of true mangrove and 7 species of associated mangrove occur and in Guangdong 13 species of true mangrove and 6 species of associated mangrove happen. Research demonstrated that the mangrove forests in Guangxi are better developed than those in Guangdong, but not as good as those in Hainan. A record shows that in Guangxi the tallest *H. littoralis*, *E. agallocha* and *P. pinnata* are 15 metres, 13 metres and 13.5 metres in height and 80cm, 25cm, and 23cm diameter at breast height respectively, and these figures emphasize that the mangrove in Guangxi is comparatively well-developed. In Taiwan province, where the Kuroshio Current passes nearby and exerts large influence on the climate, 17 species of mangrove are found even if it is at higher latitude. However, in Fujian province, which is opposite to Taiwan across the Taiwan Strait, mangrove communities are less developed, and mangrove species are fewer. Fuding, Fujian province is considered as the northernmost boundary for the naturally mangrove in China. To the north of Fujian province, so far, only the species of *K. candel* has been successfully introduced into Zhejiang province. Table 3 shows temperature conditions in some major mangrove areas of China.

Table 3 Temperature Conditions in Some Major Mangrove Areas of China.

| Major mangrove areas in China | Qinglan Harbour, Hainan | Shankou, Guangxi | Beilun Estuary, Guangxi | Futian, Shenzhen, Guangdong | Jiulong Estuary, Fujian | Fuding, Fujian |
|---|---|---|---|---|---|---|
| Latitude (N) | 19°34' | 21°28' | 21°33' | 22°32' | 24°54' | 27°20' |
| Average Temperature(□) | 24.3 | 22.4 | 22.5 | 22.5 | 21.0 | 18.5 |
| Lowest Monthly Average Temperature(□) | 18.6 | 15.0 | 14.1 | 15.0 | 12.2 | 8.4 |
| Minimum Temperature(□) | 6.2 | 0.5 | 1.0 | 0.2 | 0.5 | -4.3 |

Mangrove in China were classified by two Chinese botanists, Zhang and Lin (1984), into three ecotypes based on their adaptability to temperature, namely cold tolerant polytopic species, thermophilic polytopic species, and thermophilic stenotopic species, respectively.

Temperature is the key factor controlling the introduction of mangrove from low latitude areas to high latitude areas. So far, two mangrove transplanting approaches have been successfully conducted in China, one is the transplantation of mangrove in an area with suitable temperature and another is the introduction of mangrove with a cold resistant ability into an area in high latitude. To promote such activities in China, in 1999 Wang *et al.* (1999) proposed to establish a national mangrove gene bank in Hainan Island and to transplant mangrove trees from domestic and abroad in the island where the most favourable temperature prevail, hoping this pilot trial will benefit the similar approaches in other areas of China.

#### *3.1.1.2 Salinity*

The occurrence of mangrove in high salinity intertidal flat can attribute to its physiological adaptation, such as the salt resistance and salt excretion mechanism, but this adaptation does not support normal growth of mangrove in any saline environment. The research of two Chinese scientists (Lin and Wei,

1981) indicated that *K. candel* trees grown in different saline conditions showed huge differences in growth, flowering, and fruiting. In the salinity of 7.5-21.2%, the tree could grow well into 1.6-2.0 metres high with normal flowering and fruiting. However, in the salinity range of 1.04-5.3% and 25.6-37.5%, the growth of the trees, flowering, and fruiting were hindered. It was concluded (Lin, 1995) that the upper limit of salinity is the main factor to impact the growth of mangrove.

#### *3.1.1.3 Ocean current*

Viviparous propagules are an exclusive ecological adaptation of mangrove. When tide out, the torpedo shape propagules that drop from mangrove trees can make a penetration into the soft muddy sediment, and then grow there; when tide in, the propagules that fall from mangrove trees can float in seawater and be carried away by sea current to other places, where the germination of the propagules may happen randomly. It was believed that this reproductive mechanism, the ocean current dependent shift of mangrove seeds, is vital to the gene exchange among mangrove populations. After exploring the gene structure of the population of *K. candel*, the most common mangrove in East Asia, by using mtDNA and cpDNA as genetic labels, a Chinese scientist (Huang, *et al.*, 2001) discovered that the Sarawak population has a close genetic relation with the Ranong population in the Indian Ocean. But the gene structure of the Sarawak population differs from that of the population at northern coast of the South China Sea. He also believed that the tiny differentiation of the gene structure between the *K. candel* population at northern coast of the South China Sea and *K. candel* population in the Ryukyu Archipelago and Taiwan was an implication of gene exchange between two populations in the form of propagules transfer by sea current in summer time.

### 3.1.2 Microcosmic Factors

#### *3.1.2.1 Geomorphology*

Mangrove forest is a typical appearance in tropical and subtropical areas and it occurrence is limited in the areas with suitable geomorphology. Mangrove is commonly found in sheltered coast, usually flourishing along creeks and growing on muddy flats of soft sediment comprised of tiny grains.

The accumulation of sediment derived from coasts and riverbanks and the degradation of organic matters, such as mangrove leaf litter, in mangrove areas creates mangrove soil and alters mangrove landform as mangrove flat level being raised. It is reported that the ascending rate of mangrove flats is 2.3cm/year in Shankou mangrove area of Guangxi (Mo and Fan, 1999), 1.2-3.6cm/year in Fujian, and 5.7cm/year in Guangdong (Wang, *et al.*, 1991). It is also concluded, deriving from an analysis of the sections of four mangrove flats in Guangdong and Hainan (Tan, *et al.*, 1997), that the gradients of mangrove flats are bigger than that of open flats. With regard to mangrove landform, all the four mangrove flats share a common characteristic, more obvious in well-protected mangrove areas, of a special formation of the flat with three rises along with adjacent slightly sunken land, and this formation can be regarded as a result of long lasting process of tide movement, wave action, and deposition in mangrove areas.

However, mangrove landform, whose formation is hydrodynamic dependent, will undergo a reshape in response to hydrodynamic change resulted from human activities, such as coastal levee construction. A typical reshape of mangrove landform was illustrated (Fan, 1996) with the sandy mangroves at Daguansha, Beihai, Guangxi, where the invasion of sand dune caused by hydrodynamic change arising from the building of coastal dike has damaged the habitat of a *A. marina* vegetation belt of 100-300 metres wide, degrading the mangrove and even killing the mangrove trees.

#### *3.1.2.2 Tide*

Mangroves are a diverse group of plants that share a common ability to live in waterlogged soil subjected to tidal inundation, but differ in the tolerance to inundation. The zonation of mangrove, a regular series of vegetational bands parallel to the coastline, is the response of the mangrove ecosystem to a number of external factors. In intertidal mangrove flats, the existence of zones is evident in mangrove environments, representing a specific occupation of one species of mangrove in certain area.

The harmful impacts of the fouling organisms on mangroves are also controlled by tidal movement, which can change living conditions of biofouling organisms, such as feed and wetness of the habitat, and hence

the number of attached biofouling organisms. It was pointed out (Fan, *et al.*, 1992; Chen, *et al.*, 1992) that the comprehensive influences of tidal movement on mangroves reduce in degree from open coast to estuarial coast to sheltered coast and from seaward forests to middle forests to landward forests.

#### *3.1.2.3 Mechanical composition of sediment*

The mechanical composition of sediment of mangrove flats can influence the insertion and germination of viviparous propagules; soft muddy flats allow easy penetration of propagules, but hard sandy flats handicap the insertion of propagules. In addition, the mechanical composition of mangrove soil is related to soil nature and textures. It was suggested (Lan, *et al.*, 1993) that the quantity of tiny glutinous grains (<0.01mm) of mangrove soil are positively correlated to the amount of organic matter, total N, total P, and total K in the soil. The cementation and agglomeration of tiny soil grain with organic matter forms nutritious soil for mangrove forests.

### 3.2 Chemical Characteristic

The intensive biological reaction in mangrove soil, which is subject to regular tidal influence, produce a unique saline environment characterised with acidification, deoxidation, and heavy load of organic matter.

### 3.2.1 pH in Mangrove Soil

A lasting absorb of SO42- in soil by mangrove trees results in high sulfur content in the trees, and its concentration usually five times that in terrestrial plants in subtropical region. The degradation of mangrove leaf litter and other organic matter by bacteria, which produce hydrogen sulphide, results in a drop of pH value in the soil. It was found (Lan, *et al.*, 1993) that the pH value of mangrove soil is at a lower level, 3.3-6.9 in surface layer and 3.02-3.8 in the bottom layer.

### 3.2.2 Electric Potential of Oxidation Reduction

Mangrove soil, influenced by tidal inundation, belongs to deoxidized soil with lower electric potential of oxidation-reduction. Mangrove soil is moisture saturated soil (air content below 1%), and no oxygen can infiltrate past the top few horizons, an oxidized layer that can be recognised by its yellow brown colour. In mangrove soil, the content of deoxidized substance, such as active iron, is high, and decreases by the depth of soil layer (Yang, *et al.*, 1987).

### 3.2.3 Organic Matter in the Soil

The content of organic matter in mangrove soil is comparatively high at an average rate of 4.48% (Liao, 1995). This higher load of organic matter in the soil can partly attributed to the decomposing of large mass of leaf litter and rotten roots in the soil. Contrary to higher content of organic matter in mangrove soil, the content of organic matter in soil of open beach is lower. It is reported (Lan, *et al.*, 1994) that the average load of organic matter in soil of open beach in Guangxi is only 0.92%.

### 3.2.4 The Salt Content of Mangrove Soil

The higher salt content (generally above 10%) of mangrove soil can be regarded as a result of salification of mangrove trees that inhabit in waterlogged soil subjected to tidal inundation. An analysis of top layer of mangrove soil in Guangxi (Luo, 1986) revealed that the salt content is less than 10% in sandy soil, 10-30% in light clayey soil and above 40% in clayey soil.

In mangrove soil, among the ion of salinity, Cl- is the dominant anion followed by SO42-, and Na+ the dominant cation. In the soil layer where mangrove litters are buried, the content of SO42- is higher than that in other layers (Liao, 1995).

### 3.2.5 Nutrients in Mangrove Soil

Mangrove soil with tiny glutinous grains and rich organic matter contribute to the maintaining of nutrients in soil. Generally, the soil is higher in content of total K and K2O, average in Total P, and lower in P2O5. The content of total N, total P and total K in mangrove soil is much higher than that in the soil of open beach, implicating that intensive bioaccumulation is happening in mangrove area. It was indicated that in well-developed mangrove area, the nutrient level in mangrove soil is higher (Liao, 1995).

## 3.3 Biological Characteristic

### 3.3.1 Phytoplankton

Phytoplankton is the primary producers in mangrove ecosystem, most of them can be directly fed by larvae and juveniles of marine animals, and some of them can be used as indicators of marine pollution.

231 species of phytoplankton (see Annex 1) in 62 genera were recorded from mangroves in China, 195 species in 46 genera belonging to Bacillariophyta (account for 84.3% of the total species number), 17 species in 4 genera belonging to Euglenophyta, 3 species in 2 genera belonging to Chlorophyta, 3 species in 1 genera belonging to Cyanophyta, 7 species in 3 genera belonging to Pyrrophyta, 4 species in 4 genera belonging to Cryptophyta, and 2 species in 2 genera belonging to Chrysophyta. Diatoms are the dominant category in waters of mangrove areas in China, whether their species composition or biomass are concerned. The genera with more species are Nitzschia, 32 species, Chaetoceros, 25 species, Rhizosolenia, 25 species, Coscinodiscus, 15 species and Navicula, 14 species, respectively.

### 3.3.2 Mangrove Trees and Shrubs

36 species of mangrove trees have been recorded from the mangrove trees in China, of which 26 species in 15 genera of 13 families are true mangroves, and 10 species in 10 genera of 9 families are associated mangrove. The mangrove communities in China were classified as seven groups in terms of their species composition and the characteristic of community appearance (Lin, 1988), which are *Bruguiera* formation, *Rhizophora* formation, *Kandelia* formation, *Aegiceras* formation, *Avicennia* formation, *Sonneratia* formation, and *Nypa* formation.

### 3.3.3 Zooplankton

110 species of zooplanktons (see Annex 2) in 68 genera have been reported occurring in mangroves area in China, including 1 species in Protozoa, 49 species of Coelenterate in 34 genera (mostly jelly fish); 48 species of Arthropod in 29 genera (2 species in 2 genera belonging to Cladocerans, 2 species in 2 genera belonging to Ostracoda, 35 species in 20 genera belonging to Copepoda, 2 species in 2 genera belonging to Amphipoda, 2 species of Euphausiid in 1 genera, and 5 species in 2 genera belonging to Decapod), 9 species of Chaetognath in 1 genera, and 3 species of Urochordata in 3 genera, and as well as many unidentified larvae, fish eggs, and juvenile fishes.

### 3.3.4 Macrobenthos

Intensive surveys have been conducted in most mangrove areas in the four provinces of Guangxi, Hainan, Guangdong, and Fujian in China. A total of 650 species of Macrobenthos (see Annex 3) belonging to 12 phyla have been identified as inhabiting in these areas (351 species more than the statistics record of Lin peng (year?)), of which 8 species in 8 genera belong to Coelenterate, 1 species in 1 genera belong to Platyhelminthes, 1 species in 1 genera belong to Nemathelminthes, 2 species in 2 genera belong to Nemertea, 120 species in 72 genera belong to Annelida, 10 species in 5 genera belong to Sipunculoidea, 3 species in 3 genera belong to Echiura, 231 species in 131 genera belong to Mollusk, 208 species in 88 genera belong to Arthropod, 1 species in 1 genera belong to Brachiopod, 27 species in 18 genera belong to Echinoderm, 3 species in 3 genera belong to Urochordata, and 30 species in 27 genera belong to Chordate.

Lingula anatina, mainly inhabiting in the mangrove flats in Qinglan Harbour and Beilun estuary, is under protection by the state as an animal at the top list of protected animals. In addition, horseshoe crabs (*Tachypleus tridentatus, Carcinoscorpins routnolicauda, Tachypleus* sp.) are also national protected animals.

### 3.3.5 Fish

Fan Hangqing *et al.* (1998) recorded 42 species of fishes occurring in the waters 30 metres outside the fringe of mangrove forests in Yingluo Harbour, of which *Stolephorus chinensis*, *Harengula ovalis*, *Stolephorus tri*, *Ambassis gymnocephalus*, *Hemirhamphus limbatus*, *Leiognathus daura*, *Tylosurus strongylurus* and *Atherina bleekeri* were abundant. Of the total 42 species, 26 species are mangrove-associated fishes (7 species highly associated). Most of the fishes are small in size (<10cm), implicating that small fishes and fish fries are common near mangrove fringe. In this mangrove area, the fish density was 75,466/net, and the fish biomass was 39.38kg/net.

In Yingluo Harbour, 54 species in 29 families were observed in tidal creeks (He, *et al.*, 2000), most of them appearing occasionally or seasonally and only 14.5% of the species occurring in four seasons which are *Ambassis gymnocephalus*, *Stolephorus chinensis*, *Leiognathus* ruconius, Clupanodon punctatus, Osteomugil ophuyseni, Zenarchopterus buffoni, Liza carinatus, and Butis butis. With respect to fish community in this mangrove area, dominant species and the number of species varied seasonally, with occurring of 30, 30, 26, and 22 species in spring, summer, autumn and winter respectively. The results of surveys on fishes in the two mangrove sites showed that fish community in tidal creeks was more diverse than that in waters outside mangrove fringe.

In summer of 1999, 27 species of fishes in 19 families were observed in the tidal waters 10 metres outside mangrove fringe in Zhenzhu Bay (He, *et al.*, 1995), the fish community in the area can be categorised as two groups in terms of thermophily, dominated by the species which only occur in warm waters (92.6%). In this mangrove area, most of the fishes are benthic fishes, with *Leiognathus brevirostri* and *Harengula ovalis* being the dominant species.

With respect to fish standing stock in the waters near mangrove areas, Lin (2001) recorded 141 species in 96 genera from the waters between Zhangjiang Estuary and Dongshan Bay in Fujian province; the third Institute of Oceanography, SOA conducted a visual census of 115 species belonging to 59 families from Quanzhou Bay in Fujian; Jiang Jinxiang *et al.* (1997) recorded 300 species in 90 families in Qinglan Harbour and 212 species in Dongzhai Harbour in Hainan province. All the species of fishes were observed in the waters far from mangrove forests; hence their association with mangroves has not been confirmed.

80 species of fishes in 40 genera have been recorded in mangrove areas in Guangxi, all of them belong to Oteichthyes (Annex 4). 59 species in 59 genera of 36 families were recorded in SMNR (He, *et al.*, 2001) and 27 species in 23 genera of 19 families were recorded in BEMNR.

### 3.3.6 Reptiles and Amphibians

Few surveys have been conducted in China on the reptiles and amphibians inhabiting in mangrove forests. So far, only one paper (Wang, *et al.*, 1998) addressing such issue has been published.

#### *3.3.6.1 Reptiles in mangroves forests in China*

A total of 38 species of reptiles observed in mangrove forests were identified, of which 8 species in 3 families belong to Testudinata, 5 species in 3 families belong to Sauria, and 25 species in 5 families belong to Serpentiformes. All these animals were rated as endangered species, for they are targeted as food and medicine and have reduced to a small number due to over exploitation.

#### *3.3.6.2 Amphibians found in mangroves of China*

Few survey focused on amphibians in mangroves of China has been conducted. Only 13 species of amphibians in 5 families were found inhabiting in mangroves, and all of them are the species belonging to Salientia. *Rana rugulosa* is the only one category 2 national protected animals among the animals of Batrachia.

Mangrove usually occurs at transitional zone from sea to land, where habitats are diverse and complex. From seaward to landward side, the habitats in this junction zone of water and land can be categorised as five habitats: seawater zone, tidal flat zone, mangrove forest zone, shrubbery zone, and terrestrial zone. And practically, the terrestrial zone can then be classified as several kinds of habitats such as paddy field, shrubbery, sparse shrubbery, forest, and so on. To be high in heterogeneity and perimetery efficiency, the habitats in the junction zone are endowed with unusual biodiversity and richness in birds.

Most of birds present in mangrove areas are found in not only mangrove but also other habitats near mangrove. Nidified in mangrove, some birds in the family of Ardeidae are commonly seen foraging in tidal flats and paddy fields nearby. Some birds have never been found foraging in mangrove forest even if they nidify in mangrove, such as *Streptopelia chinensis*, this herbivore bird only forages its food in paddy fields. Centropus toulou and Centropus sinensis are examples of those birds that nidify outside mangrove but hunt for food inside mangrove forest when tide is out. Birds in the family of Anatidae are often found dropping in mangrove forest by tidal creeks when tide is in and foraging on tidal flats beyond mangrove when tide is out. The frequent in and out of birds among differents habitats in mangrove areas will benefit the flow of substance and energy inside and among systems.

286 species of birds (see Annex 5) associated with mangroves in Mainland China (including Guangxi, Guangdong, Hainan, and Fujian) were identified, which belong to 50 families in 19 orders, with 47% (139 species) being water birds. Of these birds, 4 species were rated as category 1 protected bird, and 36 species category 2 protected birds.

### 3.3.7 Mammals

Mangrove associated mammals are not restricted to the mangrove ecosystem. In China, few survey focused on mammals in Mangrove forests has been conducted. The species of mammals listed below, in scientific sense, are not restricted to mangrove.

So far, only 28 species in 24 genera of 15 families of mammals have recorded occurring in mangrove areas (18 species more than the statistic record of Lin Peng in 1995). Of which, *Viverricula indica* and Lutra lutra are category 2 national protected animals. Further understanding of mammals in mangrove areas in China still relies on more in-depth research on these animals. Mangrove forests, which are comparatively small and easy to open access duo to their locations in relatively developed coastal areas in China, are subject to human disturbance that will inevitably disorders the life of mammals in mangroves. In consequence, mammals are much less abundant in mangroves than in other forests, and most of the mammals are adaptable animals such as rats and bats. Though these mammals are on top trophic level of food chains, they are less significant than birds.

## 4. AFFORESTATION

### 4.1 Afforestation Activities

Mangrove afforestation was initiated in the late 1950s in China, interrupted from 1966 to 1979 and resumed in 1980. At its early stage, only small-scale mangrove afforestation was performed in China. The only exception was mangrove planting in small area under the classification of "fodder and protection forest forestation", e.g., the planting of 7ha fodder forest of *A. marina* at Qinzhou of Guangxi and 100ha protection forest of *R. stylosa* at Haikang of Guangdong. Since 1966, land reclamation along the coastline in Mainland China has not only stopped mangrove afforestation, but also destructed mass mangrove habitats. During this period, a large number of mangrove forests were logged for salt industry and paddy fields. Mangrove afforestation was restored in early 1980, and meanwhile several national level mangrove reserves were created, to prevent existing mangrove resources from being damaged and restore mangroves. Perceiving the significance of mangroves by scientists, government, and communities of China has changed the status of mangroves and attracted more attention on it. Afforestation attempts have gained some momentum in China. Based on the scheme of protection forest project, 60,000ha of mangroves will be planted at coastal region in South China to establish a mangrove forest system that will function along the coastline.

With regard to mangrove protection and restoration, the mangrove reserves in China have played a vital role and achieved recognition for their significant work.

Mangrove afforestation in mangrove reserves has been practiced mainly in small area for scientific research purpose.

### 4.1.1 Shenzhen Futian Mangrove Reserve

In 1986 the afforestation of mangrove, *K. candel*, *A. comiculatum*, was initiated in the reserve, which is found in 1984. In 1990, a trial of planting two ha mangrove trees with propagules succeeded. Subsequently, in 1991 about four million mangrove saplings were planted in the reserve, forming 50ha mangrove plantation. In 1992, workers in the reserve, assisted by the Tropical Forestry Institute of Chinese Academy of Forestry, successfully raised over 6ha demonstration forests of *K. candel*, *B. gymnorrhiza*, which are thriving now (Liu, 1995).

### 4.1.2 Guangdong Zhanjiang Mangrove Nature Reserve

Mangrove forestation was started during the late l990s in this reserve after it was created in 1990. So far 100ha mangrove trees of *B. gymnorrhiza*, *R. stylosa*, *K. candel*, *A. marina* and *A. comiculatum* have been planted and 50ha second growth of mangrove rehabilitated (Lin, *et al.*, 1990).

### 4.1.3 Guangxi Shankou Mangrove Nature Reserve

The reserve was set up in 1990 under the approval of the State Council of China as a national level reserve. Mangrove afforestation has been practiced in the reserve since 1992. Mangrove afforestation attempts started with the foundation of two sapling nursery gardens, where 62,100 propagules of *R. stylosa*, *R. apiculata*, *C. tagal*, *B. gymnorrhiza*, *K. candel*, *R. stylosa*, *C. tagal* and *B. sexangula* have been raised to saplings at an average survival rate of 63% from 1992 to 1994. From 1994 to 1995, planting trial of the introduced mangrove species of *R. apiculata*, *C. tagal*, *B. sexangula* and *Sonneratia apetala* was carried out in the reserve for the first time, and only the seedlings of *S. apetala* were successfully raised. In addition, planting trial of mangrove to their natural regeneration, comparative afforestation experiment, and mangrove second growth rehabilitation were also successfully conducted in the reserve.

With the assistance of local government, communities and youth volunteers, SMNR has worked hard on planting mangrove, increasing mangrove coverage in the reserve from 730ha to present 806.2ha (He, *et al.*, 1995).

### 4.1.4 Guangxi Beilun Estuary Marine Nature Reserve

The reserve, founded in 1990, is situated at the delta near Beilun estuary, where planting practice of mangrove has been carried out over a period time. Mangrove afforestation, initiated in 1987 by Qinzhou Forestry Institute, started with the planting of propagules of *K. candel*, *A. marina*, *A. comiculatum*, *B. gymnorrhiza* and *R. stylosa* at 1.5 x 1.5m spacing. 90ha mangrove plantation has been developed in this way. According to a survey conducted in 2002, the mangrove trees, though comparatively smaller, still in healthy condition. In 1991 wildlings of *A. comiculatum*, *A. marina* were planted at 1 x 1m matrix on 10ha flats, and now the trees have grown to an average height of 50cm. Since 1998, Guangxi Mangrove Research Centre has also conducted trials of planting mangrove trees in the reserve, such as rehabilitating *R. stylosa* population, reconstructing second growth of *K. candel* community, planting *B. gymnorrhiza* with seedlings and planting *R. stylosa* with propagules. The planted *B. gymnorrhiza* and *R. stylosa* survived at a rate 61% and 76% one year later and grew to a height of 37.3cm and 35.8cm respectively. Four year later, the *B. gymnorrhiza* and *R. stylosa* grew to a height of 50cm and 70cm at survival rate of 56% and 71%. Besides, local communities also have been involved in planting mangrove. From 1991, the students of local elementary schools started to plant mangrove seedlings at the fringe of mangrove forests. To date, they have developed four ha new mangrove plantation.

### 4.1.5 Hainan Dongzhai Harbour Mangrove Reserve

The reserve was established in 1980 under the approval of the State Council of China. Mangrove coverage is 1,733ha. In the reserve, the species of *K. candel*, *B. gymnorrhiza*, *B. sexangula*, *R. apiculata*, *R. stylosa*, and *X. granatum* have been planted on denuded flat at seaward edge, open flat in the forest, and within second growth shrubs. Low survival and even 100% mortality were observed of the mangrove

sapplings planted on unsuitable spots (high salinity, hard soil). In 1999, Liao *et al.* (1999) reported a low survival (30%) of *B. gymnorrhiza*, *B. sexangula* trees planted at Tashi. Since 1981, mangrove planting, mangrove introduction, and second growth rehabilitation have been performed in the reserve (Zhen, 1999). So far, 285ha mangrove have been planted and 251ha mangrove have survived. In the reserve, planting techniques have been developed through mangrove afforestation experiment and practices, and the pioneer species, such as *S. apetala*, *S. cylindrica*, *S. abla*, *K. candel*, and *A. marina*, suitable for planting in lower intertidal flats have also been screened out.

A 5 year plan (from 2000 to 2004) of mangrove ecosystem restoration was initiated in 2000, with the intention of planting 135ha mangrove of *B. sexangula*, *B. gymnorrhiza*, *B.* s. var. *rhynochopetala*, *K. candel*, *S. apetala* and *A. marina* in the area. Planted trees will be monitored regularly and replanting will be conducted if survival is lower than 90%.

To meet the increasing demand on mangrove saplings, a nursery garden (2ha) with an annual capacity of producing 300,000 seedlings is going to be set up. The nursery will be managed by qualified technicians.

Additionally, a mangrove forestation scheme of planting fast growing mangroves trees, *S. apetala* and *A. marina*, in the areas subject to erosion will be implemented in the reserve. Rare species such as *S. hainanensis*, *S. alba*, *S. ovata*, *Sonneratia paracaseolaris*, *N. fruticans*, L. littorea, *X. granatum* will be planted in larger area.

### 4.2 Evaluation of Mangrove Afforestation

Forestry administration is the government organ in charge of management of mangrove resource, including mangrove afforestation and appraisement of afforestation practice and outcome (Chen, 1993). As the afforestation techniques have not yet been standardised, to substantially appraise the results of mangrove planting require an overall consideration of all aspects of mangrove planting practice. In spite of this, the outcome of mangrove afforestation can be evaluated simply by measuring the area of successfully raised mangrove forests.

## 5. SOCIAL USE AND OWNERSHIP

### 5.1 Ownership

According to Chinese law, land is owned by the state, including mangrove land. Even if ownership of land is unalterable, mangrove forests can be private property. In China, most of mangrove forests belong to the state; some are in the possession of communities; and few are private forests.

According to the survey data of 2001, 97.5% of China mangrove land is state-owned, 2.5% are community-owned; 82.7% of China mangrove forests are state-owned, 17.3% are community-owned. As for the mangroves forests in Guangxi, relevant statistics showed that 66% of mangrove forests belong to the state, 33% are owned by communities, and 1% are private property.

To encourage private investment in forestry, Chinese government has adopted some policies to allow private management of state owned forests in the form of contract (lease term 50-70 years), hoping that the investment in forestry will be increased and the management of forests will be improved. For this reason, private mangrove forests can be expected to expand in the future.

### 5.2 Utilisation

#### 5.2.1 Wise Utilisation

Mangrove forest is considered as a component of wind protected forests at the front along coastline in southeast China. Consequently, Chinese government ranked all mangrove forests in China as non-profit ecological forests in 2002 for their effective protection and management. So far, 30.6% of mangrove forests in China have been protected under the form of mangrove reserves. 66.5% of mangrove forests

are designated as wind shelter forests. The remaining 2.9% of the mangroves are used for special purpose.

### 5.2.2 Destructive Utilisation

#### *5.2.2.1 Use of mangrove land for construction of shrimp ponds*

Illegal encroachment of mangrove land for alternative uses of the land, especially for the production of shrimp and fish, has converted vast mangrove area to shrimp ponds. Mangroves in Zhuhai, which used to occur in 25 habitats, have decreased from 93ha to 6.8ha during previous ten years, and the habitats reduced to six at the same time. In Leizhou Peninsular of Guangdong, mangrove habitats are also destroyed for construction of shrimp ponds. From 1999 to 2001, in Hepu of Guangxi province, 353ha of mangroves in intertidal flats were depleted to build shrimp ponds. The so-called "coastal development" such as shrimp industry has destroyed mangroves in many places in China.

#### *5.2.2.2 Digging eatable invertebrates*

Traditionally, mangrove habitats are important seafood providers along the coastline in south China. The major commercial invertebrates are sea worms of Phascolosoma esculenta within mangroves and *Sipunculus nudus* outside mangroves. Shellfish of Anomalocordia flexuosa and Meretrix meretrix are found both inside and outside mangrove forests.

Eatable benthos digging is the major income-generating practice of the people who live in and around mangroves or within a reasonable proximity of the mangroves (about 3km). Along the coast of Leizhou Peninsula, nearly 30% of mangrove habitats suffer from such a situation all year round. In some mangrove areas, digging happens so often to more than 20 times per year, which not only severely damages mangrove roots but also destroys the habitats of invertebrates. Fan Hangqing (2000) demonstrated that digging had degraded the urban mangroves in Beihai (Table 4).

Table 4 Degradation of an *A. marina* Community caused by Digging at Beihai Urban Area.

| Year | Mean Density (ind./m$^2$) | Mean Height (m) | Mean area of canopy (m$^2$/ind) | Coverage (%) | Associate species | Occasional species |
|---|---|---|---|---|---|---|
| 1992 | 0.68 | 2.05 | 2.92 | 96 | *K. candel*, *A. comiculatum* | *B. gymnorrhiza*, *R. stylosa* |
| 2001 | 0.49 | 0.88 | 0.35 | 35 | *A. comiculatum* | *None* |
| Decline | 27.94% | 57.07% | 88.01% | 63.54% | Lost one species | Lost two species |

#### *5.2.2.3 Other destructive utilisations*

Fruits of *A. marina* are traditional foods of the people at Guangdong and Guangxi coast. Mangrove fruits have become more popular as people adore natural food or green food. Fruits are usually colleted from June to October, and this will inevitably hinder the growth and reproduction of *A. marina*. Raising ducks in mangroves is becoming another problem now. The eggs laid by ducks growing in mangroves are believed to be more nutritious because of the red colour of egg yolk, and the high price of such eggs has stimulated raising duck in mangrove forests. This practice will pose some threats to biodiversity in mangroves. Mangrove forests are also used as anchorage ground for small fishing boats. Besides, city expansion and industry development will use mangrove land for purposes such as construction of ports, roads, and urbanisation, etc.

### 5.3 Potential Utilisation

Fast growing economy and public awareness of the importance of sustainable development may inspire the utilisation of mangrove in following pursuits:

- Eco-tourism in mangrove areas.
- Mangrove afforestation to make greenbelts and birds sanctuary to cope with city expansion.
- Wise mariculture in mangrove areas.
- Mangrove education and technical training.
- Construction of demonstration zone of mangrove restoration.
- Material supply for producing foods and medicines.

## 5.4 Current Management Regime

### 5.4.1 Current Status

With respect to the conservation of mangrove resources, government regulations and management are too complicated. The government agencies involved in mangrove management include the administrations of forestry, ocean, environmental protection, fishery, water resource, and planning, and this often lead to inefficient management and obscure regulations.

The Forestry Ministry is the government organ in charge of the management of forests in China, including mangrove forests, which, in terms of wetland, are also managed by the Forestry Ministry, the executive agency of International Wetland Convention in China. All mangrove resources in China, except SMNR and BEMNR, are under jurisdiction of the Forestry Ministry of China.

According to the Law of Maritime Space Administration, All the intertidal flats and maritime space below high tide line are under the jurisdiction of State Oceanic Administration (SOA). As a result, all mangrove land is placed under SOA for management, and now two mangrove reserves in Guangxi, SMNR and BEMNR, are under SOA.

Environment Protection Bureau is the organ in charge of the management of environmental resources, responsible for the assessment of resources and approval of creation of nature reserves, including mangrove reserves. Fishery department is also involved in mangrove management, for mangroves are closely linked with fishery resources. Being valuable natural resources capable of functioning as "coast guard", mangroves are also considered the natural resources managed by water resource department. Besides, in making city expansion plan, city planning commissions of local governments also take mangrove into consideration. Figure 2 illustrates Current Management Regime of Mangrove Ecosystem of China.

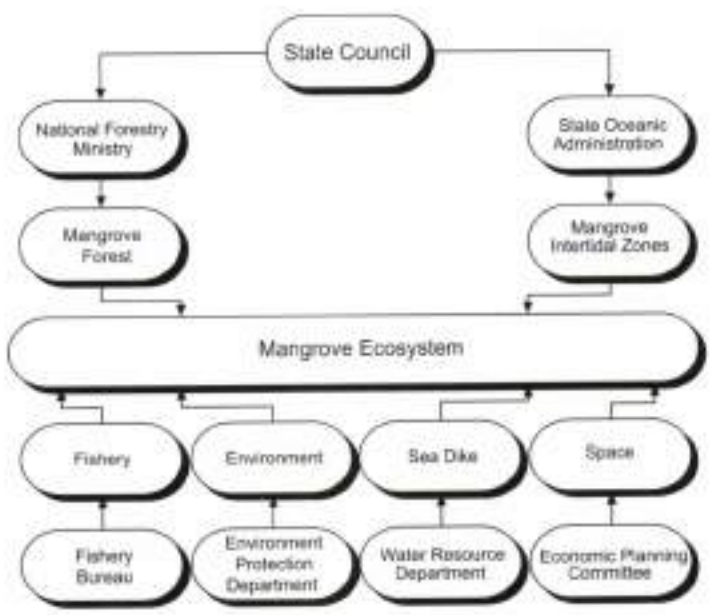


Figure 2 Current Management Regime of Mangrove Ecosystem of China.

Fundamentally, with respect to mangrove management, mangrove land is placed under oceanic administration, while mangrove forests are under the jurisdiction of forestry administration. Other government organs are involved by their links with mangrove.

### 5.4.2 Ambiguous Status of Mangrove in China

In terms of management, the status of mangrove in China is quite ambiguous. This ambiguity, which arises from the complexity of mangroves, has confused the management of this unique ecosystem. The following aspects concerned with mangrove management can explain such ambiguity of mangrove status.

Naturally, mangrove is the unique natural forests occurred in transition zone from land to sea, where the life of the sea and the life of the land merge in a biological blur. The dynamic properties of mangrove ecosystem with large biodiversity require a multiple involvement of government agencies for proper management.

Legislatively, laws and regulations of China are drafted by administrative organs and then passed by the People Congress before they come valid. Such a law making procedure usually causes dissension among different government organs that determine their function on their own account. For this reason, mangrove has become a cross sector management resource.

## 6. ECONOMIC VALUATION

### 6.1 Direct Use Values

Young leaf of certain mangrove plants, *A. aureum*, *H. tiliscus*, are edible. The ripe fruits of *S. cylindrica* can be directly eaten or used as ingredient of soft drinks. *Nypa* fruit can be consumed immediately or used to make chowchow, sugar, vinegar, and alcohol. The fruits of *A. marina*, termed as "Lanqian" by local people, are consumed widely at coast areas of Guangxi; the famous dish "Clam and Lanqian Soup" is so tasty and refreshing that make it one of the top choices of consumers who believe in its function of purging fire and relieving summer-heat. It was estimated that the annual output of the fruits of one-hectare *A. marina* forests could reach 1.2t and have a worth of 3,600 Yuan (calculated at the market price of 3.00 Yuan/kg).

### 6.2 Indirect Use Values

It is believed that both inshore and offshore fishery depends on inshore nursery areas, some of which are associated with mangrove. On the other hand, being the unique coastal forests at subtropical and tropical areas, mangrove can be regarded as a tourist attraction for developing eco-tourism and recreation industry.

### 6.2.1 Benefits to Inshore Fisheries

The average rate of leaf litter production of *Bruguiera sexangula* forests in Hainan, *R. stylosa* forests in Guangxi, and *K. candel* forests in Fujian are estimated to be 1,255g/m$^{-2}$ year-1, 631.3g/m$^{-2}$ year-1, and 920.8g/m$^{-2}$ year-1 respectively, with leaf constituting large parts of leaf litter at a rate of 64%, 89%, and 70%. Table 5 illustrates the quanity of leaf liter in different parts of three mangrove species.

Table 5 Quantity of Leaf Litter of Different parts of three Mangrove Species.

| Formation | Latitude (N) | Quantity of leaf litter of different parts g/m$^2$ | | | | | Sources |
|---|---|---|---|---|---|---|---|
| | | Leaf | Branch | Flower | Fruit | Total | |
| *B. sexangula* | 19° | 807.2 | 46.2 | 133.4 | 267.8 | 1255.0 | Lin, *et al.*, 1990 |
| *R. stylosa* | 21° | 561.5 | 23.2 | 19.4 | 27.1 | 631.3 | Yin, *et al.*, 1992 |
| *K. candel* | 24° | 644.6 | 140.9 | 37.5 | 96.6 | 920.8 | Lu, *et al.*, 1988 |

The leaf litter production varies seasonally, which is usually high in summer-autumn and low in winter. In general, leaf litters are decomposed before they are consumed by other consumers; only few of them are consumed directly. Decomposition rate of leaf litter is an index of the conversion speed of energy and matter. Research showed that the half decomposition of leaf litter of the species of *B. sexangula*, *R. stylosa*, and *K. candel* are 20-45d (Lu, *et al.*, 1990), 9-13d (Lu, *et al.*, 1994), and 18-56d (Lu, *et al.*, 1988) or 20-71d (Fan, *et al.*, 1992).

Inferred from relevant research results, the average leaf litter production rate of mangrove in China is estimated to be 6,310-12,550kg dry weight ha-1year-1. Being decomposed by microorganisms, leaf litter will become the important food source of primary level consumers such as mollusks, crabs and worms, which in turn will be consumed by secondary consumers, including small fish and juvenile predators.

### 6.2.2 Mangrove Values in Tourism

Measuring mangrove values in tourism is not easy. So far, no assessment on the eco-tourism value of mangrove reserves has been conducted in China. To figure out the value of mangrove reserves in eco-tourism, we can use the income from eco-tourism in SMNR as an example. Statistics showed that the annual revenue of the reserve is 2.72 million Yuan (40,000 visitors at an average spending of 68 Yuan). In consequence, the total income from eco-tourism in seven mangrove reserves of China can be expected to be 19.04 million Yuan, and this number can be modified to 42.00 million Yuan with exclusion of the income leakage (usually 55% in developing country in respect of tourism).

## 6.3 Value of Mangrove's Contribution to Environment

From a scientific perspective, the values of mangroves can be divided into ecological, community and economic values. Values of mangrove on its contribution to environment include the ecological values and community values.

So far, four research projects have been conducted with regard to the values of mangrove on its contribution to environment; they are "Environmental Ecology and Economic Utilisation of Mangroves in China", "Mangroves in Beihai City and Public Participation", "Interactions between Mangrove and People in Beihai City and Environmentally Friendly Economy", and "Eco-tourism in Shankou Mangrove Reserve and Public Participation".

The approach on mangrove service to environment was started in 1980s (Zhou, *ef al.*, 1980). Since then, some researchers such as Zhang (1993) and Yie and Pang (1987) had also attempted to value mangrove service to environment qualitatively.

Because of the difficulties of determining the ecological and community values of mangroves, no quantification assessment of mangrove values on its contribution to environment has been tried until Dr. Fan Hangqing (1995) attempted to identify the ecological and community values of mangroves in Guangxi (see Table 6). In Guangxi, if a 100 metres wide green belt of mangrove trees were planted along the coast, mangrove area in Guangxi would expand from 5,654ha to 9,599.8ha, of which 592.4ha were rehabilitated from second growth along 59.24km coastline and 3,945.8ha were replanted along 394.6km coastline, meanwhile, 226.92ha farming ponds would be created within. The environmental contribution of the green belt of mangrove trees would be 61,900 Yuan/ha/year or 1.3102 million Yuan/km/year (Fan, 2000).

Table 6 Ecological and Community Values of Mangroves in Guangxi.

| Items | Assessment coefficient | Scope of project | Annual Benefits (million Yuan) |
|---|---|---|---|
| Reduce loss caused by cyclone 60% | / | 9,599.8ha | 13.8084 |
| Lower coastal levee maintenance70% | / | 9,599.8ha | 16.7862 |
| Paddy fields protection | 14,927.9km/km/year | 453.84km | 6.7749 |
| Fruits of *A. marina* | 3,600.0 Yuan/ha/year | 3,359.9ha | 12.0956 |
| Lumber | 1,050.0 Yuan/ha/year | 9,599.8ha | 10.0798 |
| Erosion control | 465.0 Yuan/ha/year | 9,599.8ha | 4.4639 |
| Soil fertility Maintain | 200.0 Yuan/ha/year | 9,599.8ha | 1.9200 |
| Oxygen release | 70.0 Yuan/ha/year | 9,599.8ha | 0.672 |
| Sustain fauna | 15,000.0 Yuan/ha/year | 9,599.8ha | 143.9970 |
| Purify air and water | 25,000.0 Yuan/ha/year | 9,599.8ha | 239.9950 |
| Benefit inshore fishery | 15,000.0 Yuan/ha/year | 9,599.8ha | 14399.70 |
| Total | / | | 594.5898 |

Han *et al.* (2000), by using some valuation approaches such as market value approach, shadow project approach, opportunity cost approach, and substitution cost approach, also tried to identify the service of 13,646ha mangrove in the three South China's provinces of Hainan, Guangxi, and Guangdong. He indicated that the service of the mangrove to environment was worth 2,365.31 million Yuan, of which biomass value is worth 81.63 million Yuan, coast protection 992.06 million Yuan, soil conservation 1,156.92 million Yuan, CO2 fixation and O2 release 67.06 million Yuan, animal habitat 54.70 million Yuan, Nutrient accumulation 10.12 million Yuan, pollutant degradation, disease and insect damage prevention 2.82 million Yuan.

Disease and insect damage prevention value was calculated with substitution cost approach. The average cost for controlling plant diseases and insect pests in China in 1995 was 3.57 Yuan/ha, so it is reasonable to calculate the value in controlling plant diseases and insect pests by multiply mangrove area with estimated prevention cost (5 Yuan/ha, slightly higher than actual cost in 1995). Then the value of mangrove in controlling plant diseases and insect pests is 70,000 Yuan (5×13,646). It is estimated that cost in controlling plant diseases and insect pests only accounts for 10% of the cost for comprehensive prevention of disease and insect damage, so the disease and insect damage prevention value of mangrove can be quantified to be the sum of both, i.e., 0.77 million Yuan (70,000 + 70,000/10%).

## 7. THREATS, PRESENT AND FUTURE

### 7.1 Human Pressure

Human activities in mangrove area inevitably cause stresses on mangrove ecosystems. To manage mangrove effectively and protect the unique ecosystem in the world, we are obliged to know these human activities first (Fan, 2000).

#### 7.1.1 Reclamation for Paddy Field and Salt Industry

From 1949 to 1980, two third mangrove areas in China were depleted due to the land reclamation in coastal area. Land reclamation used to be the major reason for the destruction of mangroves, but now such reclamation hardly happens again because of the strict control of government and low price of salt and rice.

#### 7.1.2 Conversion of Mangrove Land for Shrimp Farming

Rapid expansion of shrimp farming in 1990s has converted vast tracts of mangroves into shrimp ponds. Illegal encroachment of mangrove land for shrimp farming was encouraged by the high monetary return of shrimp culture within a short period. In late 1980s, 200ha mangrove forests in Dongzhai Mangrove Nature Reserve were destroyed illegally for shrimp farming, and 157ha mangrove stands in Chengmai County of Hainan were depleted as well. In early 1990s, 2,557ha shrimp ponds were also constructed in mangrove area at Guangxi coast. In Qinzhou of Guangxi, many small shrimp ponds have been built in mangrove area, destructing the mangrove forests near Qinzhou port.

### 7.1.3 Building Materials

Mangrove trees, mostly *B. gymnorrhiza*, *A. corniculatum*, used to being used as building materials to build sea wall and dike of shrimp ponds. In 1960s, mangrove trees, exp. *B. gymnorrhiza*, *A. corniculatum* were cut in Fangcheng to build coastal levee. In Qinzhou and Fangcheng, *A. corniculatum* trees were also cut for building shrimp pond dikes. It is estimated that every 100 metres long dike will cost 0.38-0.60ha *A. corniculatum* forests. All trees were cut illegally by shrimp farmers.

### 7.1.4 Coastal Levee Construction

The construction of coastal levee in mangrove area may destroy mangrove habitats, resulting in thinning and second growth of mangroves and shortening of mangrove trees, and hence weakening the role of mangroves in coastal protection. Southeast coast of China is regularly hit by typhoon every year, mostly between July and September. Though mangrove has been recognised to be wind protection trees, effective in combating waves and accelerating deposition, more money is still spent in building coastal levee instead of planting mangrove. Levee construction, unfortunately, may disturb or even destroy mangrove trees and habitats, resulting in second growth and sparse and dwarf mangrove trees beyond coastal levee.

### 7.1.5 Construction of Ports and City Expansion

As economy is growing fast in China, the use of mangrove land for various purposes such as construction of ports, industries, urbanisation, etc., has become a serious threat to mangroves. Such destruction of mangrove forests happens consistently. For example, in 1998, 60ha of mangroves was cleared for the construction of Qinzhou port; in Fangcheng, the most flourishing *A. corniculatum* forests were cut to build a port; In Beihai, Sanya, Shenzhen, Xiamen, large area of mangroves was destroyed or degraded for the purpose of urbanisation, industry and construction of roads and ports.

### 7.1.6 Grazing

Grazing animals in mangroves is routine practices of villagers in proximity to mangroves. They usually graze cattle and goats in *A. marina* and *K. candel* forests, where buffalos and goats graze young leave and twigs of mangrove trees. Trampling and herbivory of animals can damages mangroves, killing saplings mortality, producing sparse communities and dwarf trees, and subsequently hindering mangrove restoration.

### 7.1.7 Fruit Collecting

Fruits of *A. marina*, which is commonly found along coastline of Beibu Gulf, are consumed widely by the people in coast area of Guangxi. Fruit collecting is regular practice of local people. However, fruit collecting causes no damage to mangrove trees unless it is handled improperly.

### 7.1.8 Firewood

In remote coastal area, mangrove trees (mainly *A. corniculatum*, *A. marina*, *K. candel*) used to be used as firewood by mangrove dwellers. Such pressure on mangrove is becoming less, as people can find an alternative in cheaper cost (liquid gas or electricity).

### 7.1.9 Medicine and Green Manure

Medicine is traditional utilisation of mangrove by local people. No serious stresses on mangrove have been produced by such utilisation, except for *A. ilicifolius*. Use of mangrove trees (*A. marina*), as green manure was traditional practice, but seldom conducted now.

### 7.1.10 Digging

Digging for invertebrates such as bivalve shells and mangrove worms are regular in mangrove forests, and such practice will inevitably damage mangrove habitats and harm mangrove roots. Mangrove roots injured frequently by digging cannot function normally to provide mangrove trees enough nutrients, so that slow growth, sparse forests and dwarf trees occur in disturbed mangrove forests. Digging and

trampling can also kill mangrove saplings, thus will hinder natural regeneration of mangrove forests. Expanding market demand on mangrove worms and bivalve shells has further intensified such digging. More and more mangrove habitats have been damaged and the output of marine animals from mangroves has reduced sharply.

### 7.1.11 Overfishing

Fishing in mangrove area with small mesh (<2.5mm) net will inevitably reduce fish resource, for mangroves provide a home for a variety of organisms, including many juvenile species of fish and prawns. Besides, illegal fishing, such as dynamite fishing, poison fishing, and electric shock fishing, also happen occasionally in mangrove area. Research showed that from 1990 to 1994 the output of benthos and fish in mangrove areas of Guangxi had reduced by 60% and 80% respectively.

### 7.1.12 Feed Collecting

Collecting of barnacles, clams, oysters, and other small snails in mangrove forests for feeding crab and shrimp also produces some stresses to mangroves. The reduction of these primary level consumers will result in the decline of secondary level consumers such as small fish, crabs, etc. In consequence, the productivity of mangrove ecosystem will decrease.

### 7.1.13 Poultry Raising and Apiculture

Raising poultry, mainly duck and goose, in mangrove forests are at large in coastal villages, where ducks and geese prey on mollusks, crustaceans, and small fishes. Such practices will reduce the biodiversity of mangrove and disturb the insertion and sprout of propagules. However, apiculture in mangrove forests can benefit mangrove through entomophilous pollination by bees.

### 7.1.14 Tourism

Eco-tourism in mangrove initiated in 1992 and developed quickly. However, inadequate manpower and logistics for the implementation of effective management has caused some damages of mangrove resource and decline of environmental quality. Tourists' improper behaviour, such flower and fruit picking, has also damaged mangrove trees and reduced the aesthetic value of mangrove; noises generated by boats have disturbed the birds in mangrove forests; and spill from boat and waste water released from the restaurants nearby also have polluted the mangrove environment.

### 7.1.15 Pollution

Heavy pollutants such as spill, industry effluent, etc., may damage mangrove ecosystem, including mangrove flora and fauna. Even though mangrove ecosystem can resist doses of organic pollution, heavy organic pollution entering mangroves can be harmful to mangrove trees, for instance, in 1995 in Futian, Shenzhen, some *K. candel* trees were burned by waste released from a pig farm nearby. Oil may be another threat to mangroves. There are four major sources of oil pollution, leakage from vessels, nearshore bilge, accidental spills and refinery effluent. Oils entering mangroves will damage and even kill mangrove trees, for oil covers the pneumatophores and leaves, thereby preventing access of oxygen to the roots and retarding photosynthesis. Compared with mangrove, marine animals are more sensitive to pollution and vulnerable. Even though the different types of pollutants (sewage, pesticide, spills, heavy metals, etc.) may not be affecting the mangrove growth, they are certainly toxic to animals living in mangroves and may eventually destroy it. As economy at coastal areas of China is growing fast, pollution has become a potential threat to mangroves.

### 7.1.16 Engineering Impacts

The construction of ports and coastal levee may change hydrodynamic conditions, which may be harmful to mangroves. Hydrology variation may result in sand invasion into mangrove land or slow the flow of fresh water from mangrove forests after heavy rain, and these disturbances will destroy mangrove and even kill mangrove trees. For example, between June and July of 1994, heavy rain caused flood at coast of Guangxi, *A. corniculatum* forest (5ha) at Shankou was killed after being submerged for three times at

duration of 5 to 8 days each time. In 1958, several hundred-hectare natural mangrove areas at Daguansha of Beihai were reclaimed for salt industry, and hydrodynamic conditions were changed. Subsequently, mangrove trees nearby became sparse and sand invaded duo to such variation.

## 7.2 Natural Phenomena

### 7.2.1 Typhoon

Typhoon's impact on large and sparse mangrove trees is more serious than on small and dense mangrove trees. In 1996, a strong typhoon broke many large *B. gymnorrhiza* trees in SMNR of Guangxi. A study on the effects of typhoon on the mangroves were conducted in Shenzhen Mangrove Nature Reserve, concluding that only grade 11-12 wind can damage mangrove trees (Chen, *et al.*, 2000). The damage rate of typhoon to mangrove like *Sonneratia* species can be high up to 80%. The destruction of typhoon to mangroves was correlated to the origin, density and age of the mangrove stands: the *Sonneratia* plantation was destroyed severely by typhoon, while the natural forests were little influenced; the sparse *Sonneratia* plantations were destroyed more seriously than the younger.

### 7.2.2 Pest Insects

It was observed that mangrove diseases were increasing in most of China mangrove habitats during the past decade. Jia Fenglong *et al.*, reported in 2001 that there were several pest insects damaging Shenzheng's mangroves: Oligochroa cantoneella Carad ja and Pseudocatharyll Hampson harm to *A. marina*, and Amatissa sp. and Zeuzera coffeae harm to*K. candel*. It was reported that six species of mangrove trees in Guangxi were infected by Colletotrichum (Huang and Zhou, 1997). It was found that *A. corniculatum* in Guangxi estuarine area was infected by pathogenic fungi of sooty mold. The occurrence of these diseases can be attributed to degradation of coastal environment in China.

### 7.2.3 Erosion

Erosion is another threat to mangroves. In some places, mangrove forests were eliminated by erosion resulted from natural coastal changes accelerated by human activities. For instance, there was a small mangrove islet about 15 x $5m^2$ at SMNR before 1995, and it disappeared by the end of 1998. The possible reason may be the rise of mean sea level and erosion caused by local people's digging for eatable benthos.

## 7.3 Causal Chain Analysis

Direct threats to mangrove include:

- Conversion of mangroves for shrimp ponds, coastal highway, harbour, industry, urbanisation, etc. Shrimp farming, which is believed to be the major threat, is widespread at coast areas in South China and hard to control.
- Mangrove worm digging. Mangrove worm is popular seafood at coast areas in South China. Since mangrove worm mainly occurs in mangroves, digging for this commercial organism will hurt mangrove roots, creating extensive second growth and hindering mangrove regeneration.
- Exotic species introduction. *S. apetala* has been transplanted extensively at coast areas in Mainland China since 1995. Now *S. apetala* is found even thriving in the core zones of some mangrove reserves. Introducing *S. apetala* may change original mangrove community and generate ecological risks.
- Pollution. As economy is growing fast in China, in particular along the coastline of South China, more and more pollutants, such as shrimp farm effluents, industry effluents, and domestic sewage, will find their way into mangroves. Even though organic matter seems to encourage the growth of mangroves, the transfer of pollutants through food chain cannot be ignored.

The causes for mangrove degradation and destruction in China are diverse. At social-economic aspects, low public awareness on mangroves and pursuit for short-term benefit are two main causes; in addiction, it is clear that natural resources are shared by all communities, but obscure that who is responsible for

mangrove conservation; economic benefit weights more than ecological benefit when local government is evaluated; long-term benefit is usually despised and short-term benefit is overweighted; cross sector management on mangroves hampers co-ordination; non-profit approach in natural resource conservation conflicts with profit making economy; etc.

The 11 main causes are listed below:

- Aquafarming can generate quick money for mangrove residents.
- No alternative wise use technique and mechanism has been developed to generate more tangible benefits than shrimp farming.
- Short of funds for mangrove conservation, management, and research.
- No national criteria and technical norms for planting, monitoring, and evaluating mangroves have been established.
- Sometime, marine environment and maritime space use are evaluated without mangrove experts being involved duo to short of money, which will weaken the conclusion.
- No special national law has been made for mangrove management. Cross-sector management often brings about sectorial conflicts.
- Most of mangroves are state-owned forests, but investment on mangrove development by government is insufficient. A mechanism to compensate for private investment on mangrove should be developed to encourage multi-channel investing in ecological maintenance at coastal areas.
- Decisions regarding mangroves are usually madeby government with few public involvements.
- Few opportunities have been offered to mangrove staff in mangrove reserves for exchange of experience.
- Materials and means for mangrove education are not available.
- Poor information share among different institutons limits the utilisation of mangrove data for effective management of mangroves. Co-operation is also not common.
- Improve mangrove education and strengthen exchange and co-operation, so as to promote mangrove management and research in China.

Figure 3 shows the Causal Chain Analysis for China Mangrove Ecosystem.

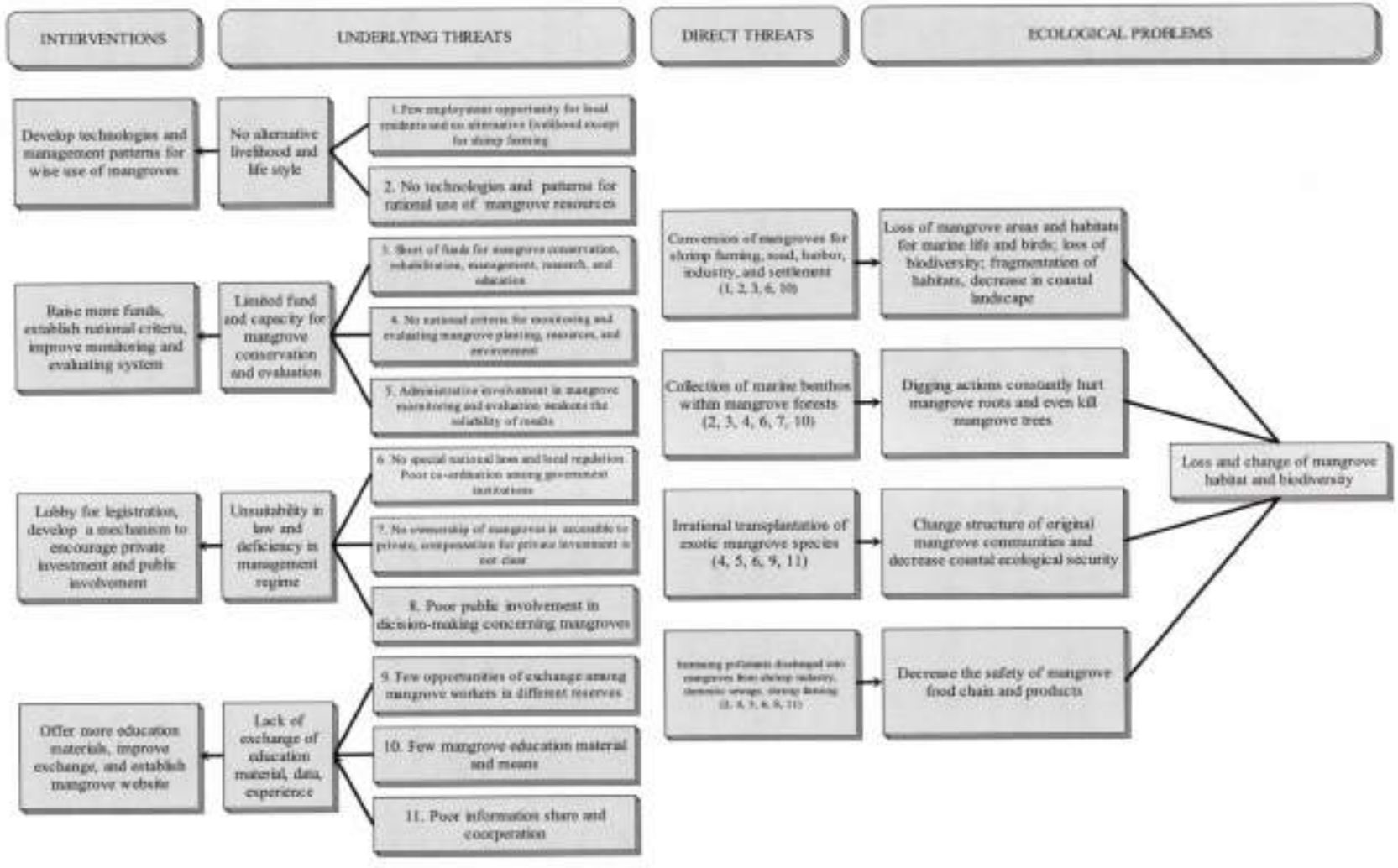


Figure 3 The Causal Chain Analysis for China Mangrove Ecosystem.

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Annex 1 List of Phytoplankton recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name | No. | Scientific name |
|---|---|---|---|---|---|
| | **Bacillariophyta** | 79 | *Diatoma hyline* | 158 | *Pleurosigma intermedium* |
| 1 | *Actinocyclus crassus* V. Heurck | 80 | *Diatoma vulgare* var. *capitualta* | 159 | *Pleurosigma naviculaceum* |
| 2 | *Amphiprore alata* | 81 | *Diploneis bombus* Ehr. | 160 | *Pleurosigma normani* |
| 3 | *Amphora coffeaeformis* (Ag.) Kutzing | 82 | *Diploneis fusca* var *pelagica* | 161 | *Pleurosigma rectum* |
| 4 | *Amphora coffeaeformis* v. *acutiuscula* (Kutz.) Hustedt | 83 | *Diploneis papula* | 162 | *Pleurosigma salinatum* |
| 5 | *Amphora exigua* | 84 | *Diploneis rutilans* | 163 | *Pleurosigma* sp. |
| 6 | *Amphora laevis* | 85 | *Diploneis splendica* | 164 | *Pseudo - Eunotia doliolus* |
| 7 | *Amphora lineolata* | 86 | *Ditylum brightwelli* (West) Grun. | 165 | *Pseudo - Nitzschia sicula* |
| 8 | *Amphora lineolata* var. *chinensis* | 87 | *Dylindrotheca gracilis* | 166 | *Pseudo - Nitzschia sicula* var. *bicuneata* |
| 9 | *Amphora proteus* Gregory | 88 | *Eucampia cornuta* (Cl.) Grun. | 167 | *Rhizosolenia acuminata* |
| 10 | *Amphora* sp. | 89 | *Eucampia zoodiacus* Ehr. | 168 | *Rhizosolenia alata* f. *genuine* |
| 11 | *Astereionella japonica* | 90 | *Guinardia flaccida* (Castr.) Per. | 169 | *Rhizosolenia alata* f. *gracillima* (Cl.) Grun. |
| 12 | *Axhnanthes brevipes* | 91 | *Gyrosigma apeneri* | 170 | *Rhizosolenia bergonii* |
| 13 | *Axhnanthes brevipes* var. *angustata* | 92 | *Gyrosigma balticum* (Ehr.) Rabh. | 171 | *Rhizosolenia calcar-avis* Schultz |
| 14 | *Axhnanthes clevei* | 93 | *Gyrosigma fasciola* v. *arcuata* (Donk.) Cl. | 172 | *Rhizosolenia clevei* Ostf. |
| 15 | *Bacillaria paradoxa* Gmelin | 94 | *Gyrosigma fasciola* v. *tenuirostris* (Grun.) Cl. | 173 | *Rhizosolenia crassispina* Schrod. |
| 16 | *Bacteriastrum comosum* v. *hispida* (Castracane) Ikari | 95 | *Gyrosigma macrum* (W. Sm.) Gr. et Hen. | 174 | *Rhizosolenia fragilissima* Berg. |
| 17 | *Bacteriastrum cosmosum* Pav. | 96 | *Gyrosigma obliquum* (Grun) Boyer | 175 | *Rhizosolenia hebetata* v. *semispina* (Hens) Gran. |
| 18 | *Bacteriastrum hyalinum* Laud. | 97 | *Gyrosigma qasciola* | 176 | *Rhizosolenia imbricata* Brightw. |
| 19 | *Bacteriastrum* sp. | 98 | *Gyrosigma* sp. | 177 | *Rhizosolenia robusta* Norm. |
| 20 | *Bacteriastrum varians* Laud. | 99 | *Hemiaulus hauckii* Grun. | 178 | *Rhizosolenia* sp. |
| 21 | *Bellerochea malleus* | 100 | *Hemiaulus membranaceus* Cl. | 179 | *Rhizosolenia stolterfothii* Per. |
| 22 | *Biddulphia aurita* | 101 | *Hemiaulus sinensis* | 180 | *Rhizosolenia styliformis* Brightw. |
| 23 | *Biddulphia heteroceros* Grun. | 102 | *Lauderia borealis* Gran | 181 | *Rhizosolenia styliformis* v. *latissima* |
| 24 | *Biddulphia mobiliensis* (Bail.) Grun. | 103 | *Leptocylindrus danicus* Cl. | 182 | *Schroederella delicatula* |
| 25 | *Biddulphia obtusa* Kutzing | 104 | *Mastogloia inaequalis* | 183 | *Skeletonema costatum* |
| 26 | *Biddulphia regia* (Schultze) Ostf. | 105 | *Mastogloia pusilla* var.*subcapitata* | 184 | *Stephanopyxis palmeriana* (Grev.) Grun. |
| 27 | *Biddulphia sinensis* Grev. | 106 | *Melosira sulcata* (Ehr.) Kutz. | 185 | *Streptotheca thamesis* |
| 28 | *Campylodiscus biangulatus* Grev. | 107 | *Navicula dicephala* | 186 | *Surirella gemma* Ehr. |
| 29 | *Cerataulina bergonii* Per. | 108 | *Navicula directa* | 187 | *Surirella gluminensis* |
| 30 | *Cerataulina campacta* Ostenfeld | 109 | *Navicula directa* var.*javanica* | 188 | *Thalassionema nitzschioides* Grun. |
| 31 | *Chaetoceros affinis* | 110 | *Navicula distans* | 189 | *Thalassiosira rotula* Meunier |
| 32 | *Chaetoceros affinis* v. *willei* (Gran) Hust. | 111 | *Navicula gracilis* | 190 | *Thalassiothrix frauenfeldii* Grun. |
| 33 | *Chaetoceros brevis* Schutt | 112 | *Navicula lyra* v. *insignis* A. Schmidt | 191 | *Thalassiothrix longissima* |
| 34 | *Chaetoceros compressus* Land. | 113 | *Navicula membranacea* Cl. | 192 | *Triceratium formosum* |
| 35 | *Chaetoceros constrictus* Gran | 114 | *Navicula minima* | 193 | *Triceratium favus* Ehr. |
| 36 | *Chaetoceros convolutes* | 115 | *Navicula pinna* | 194 | *Triceratium gibbosum* |
| 37 | *Chaetoceros costatus* Pav. | 116 | *Navicula placentula* fo *lanceolata* | 195 | *Chaetoceros lauderi* Ralfs |

Annex 1 *cont.* List of Phytoplankton recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name | No. | Scientific name |
|---|---|---|---|---|---|
| 38 | *Chaetoceros curvisetus* | 117 | *Navicula salinarum* | | **Euglenophyta** |
| 39 | *Chaetoceros debilis* | 118 | *Navicula* sp. | 196 | *Colacium cyclopicola* |
| 40 | *Chaetoceros decipiens* Cl. | 119 | *Navicula viridula* var. *silesvicensis* | 197 | *Eguleropsis vorax* |
| 41 | *Chaetoceros decipiens* f. *singulari* Gran | 120 | *Nitzschia acuminate* | 198 | *Euglena bracilis* |
| 42 | *Chaetoceros densus* Cl. | 121 | *Nitzschia amphbia* | 199 | *Euglena caudate* |
| 43 | *Chaetoceros denticulatus* Land. | 122 | *Nitzschia closterium* Ehr. | 200 | *Euglena deses* |
| 44 | *Chaetoceros didymus* Ehr. | 123 | *Nitzschia cocconeiformis* | 201 | *Euglena ehrenbergii* |
| 45 | *Chaetoceros distans* Cl. | 124 | *Nitzschia delicatissima* | 202 | *Euglena geniculata* |
| 46 | *Chaetoceros diversus* Cl. | 125 | *Nitzschia dissipata* | 203 | *Euglena mutabilis* |
| 47 | *Chaetoceros indicum* | 126 | *Nitzschia filiformis* | 204 | *Euglena pisciformis* |
| 48 | *Chaetoceros lorenzianus* Grun. | 127 | *Nitzschia frustulum* | 205 | *Euglena polymorpha* |
| 49 | *Chaetoceros peruvianus* Brightw. | 128 | *Nitzschia granulate* | 206 | *Euglena tritella* |
| 50 | *Chaetoceros pseudocurvisetus* Mang. | 129 | *Nitzschia hungarica* | 207 | *Euglena variabilis* |
| 51 | *Chaetoceros radians* | 130 | *Nitzschia hydrida* Grun. | 208 | *Euglena viridis* |
| 52 | *Chaetoceros socialis* | 131 | *Nitzschia lanceolata* | 209 | *Phacus acuminatus* |
| 53 | *Chaetoceros subsecundus* (Grunow) Hust. | 132 | *Nitzschia logissimia* f. *reversa* W. Smith | 210 | *Phacus caudatus* |
| 54 | *Chaetoceros* sp. | 133 | *Nitzschia longissima* (Breb) Ralf | 211 | *Phacus longicauda* |
| 55 | *Cocconeis scutellum* Ehr. | 134 | *Nitzschia longissima var.re-versa* | 212 | *Phacus* spp. |
| 56 | *Cocconeis scutellum* var. *varians* | 135 | *Nitzschia lorenziana* Grun. | | **Chlorophyta** |
| 57 | *Corethron hystrix* Hens. | 136 | *Nitzschia lorenziana* v. *denisestriata* (Per.) A. Sch. | 213 | *Ulothrix aequalis* |
| 58 | *Coscinodiscus argus* | 137 | *Nitzschia marina* | 214 | *Ulothrix tenerrima* |
| 59 | *Coscinodiscus astromphalus* Ehr. | 138 | *Nitzschia navicularis* | 215 | *Scenedesmus* sp. |
| 60 | *Coscinodiscus bipartitus* | 139 | *Nitzschia obtuse* | | **Cyanophyta** |
| 61 | *Coscinodiscus centralis* Ehr. | 140 | *Nitzschia obtusa* v. *scalpelliformis* Grun. | 216 | *Oscillatoria lacustris* |
| 62 | *Coscinodiscus curvatulus* v. *Minor* | 141 | *Nitzschia panduriformis* | 217 | *Oscillatoria tenuis* |
| 63 | *Coscinodiscus divisus* | 142 | *Nitzschia punctata* | 218 | *Oscillatoria* sp. |
| 64 | *Coscinodiscus excentricus* Ehr. | 143 | *Nitzschia pungans* Grun. | | **Pyrrophyta** |
| 65 | *Coscinodiscus gigas* v. *praelexta* (Janisch) Hust. | 144 | *Nitzschia sigma* | 219 | *Ceratium fusus* |
| 66 | *Coscinodiscus oculus-iridis* Ehr. | 145 | *Nitzschia sigma* v. *Intercedens* | 220 | *Ceratium macroceros* |
| 67 | *Coscinodiscus radiatus* Ehr. | 146 | *Nitzschia sigmoidea* | 221 | *Ceratium tripos* |
| 68 | *Coscinodiscus reniformis* | 147 | *Nitzschia* sp. | 222 | *Ceratium fusus* (Ehr.) Dujardin |
| 69 | *Coscinodiscus* sp. | 148 | *Nitzschia spectabiles* | 223 | *Ceratium fusus trichoceros* (Ehr.) Kofoid |
| 70 | *Coscinodiscus spinosus* Chin. | 149 | *Nitzschia subtilis* | 224 | *Dinophysis caudata* Saville-Kent |
| 71 | *Coscinodiscus wailesii* | 150 | *Nitzschia vitrea* | 225 | *Peridinium depressum* |
| 72 | *Cyclotella comta* var. *oligactis* | 151 | *Pinnularia molaris* | | **Chryptophyta** |
| 73 | *Cyclotella stelligera* | 152 | *Plagiogramma vanheurckii* | 226 | *Cyptomonas salinax* |
| 74 | *Cyclotella striata* | 153 | *Planktoniella sol* | 227 | *Hemiselmis cycolpea* |
| 75 | *Cyclotella stylorum* Brightw. | 154 | *Pleurosigma pelagicum* Per. | 228 | *Nephroselmis olivacea* |
| 76 | *Cymbella gravilis* | 155 | *Pleurosigma affine* Grun. | 229 | *Protochrysis phaeophycearum* |
| 77 | *Cymbella* sp. | 156 | *Pleurosigma angulatum* | | **Chrysophyta** |
| 78 | *Dactyliosolen mediteraneus* | 157 | *Pleurosigma formosum* | 230 | *Chrysococcus rufescens* |
| | | | | 231 | *Mallomonas longiseta* |

Annex 2 List of Zooplankton recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name |
|---|---|---|---|
| | **I PROTOZOA** | 38 | *Acrocalanus gibber* Giesbrecht |
| 1 | *Noctiluca miliaris* Suriray | 39 | *Acrocalanus gracilis* Giesbrecht |
| | **II COELENTERATA** | 40 | *Calanopia thompsonis* A. Scott |
| 2 | *Aeginura rgimaldi* | 41 | *Calanus sinicus* Brodsky |
| 3 | *Aeguorea macrodactyla* | 42 | *Candacia bradyi* A. Scott |
| 4 | *Aeguorea* sp. | 43 | *Canthocalanus pauper* (Giesbrecht) |
| 5 | *Aglaura hemistoma* Peron et Lesueur | 44 | *Centropuges tenuiremis* Thompson |
| 6 | *Beroe cucumis* Fabricius | 45 | *Eucalanus subcrassus* Giesbrecht |
| 7 | *Bougainvillia britannica* | 46 | *Euchaeta concinna* |
| 8 | *Densia subtiloides* | 47 | *Euchaeta plana* |
| 9 | *Diphyes chamisonis* | 48 | *Labidocera bipinnata* |
| 10 | *Ectopleura dumortieri* (Van Beneden) | 49 | *Labidocera euchaeta* Giesbrecht |
| 11 | *Eirene ceylonensis* Browne | 50 | *Oithona brevicornis* |
| 12 | *Eirene hexanemalis* (Goette) | 51 | *Pontellopsis tenuicauda* |
| 13 | *Eirene menoni* | 52 | *Pontellopsis yamadae* |
| 14 | *Eirene* sp. | 53 | *Schmackeria poplesia* |
| 15 | *Euphysora bigelowi* | 54 | *Sinocalanus tenellus* |
| 16 | *Eutima japonica* | 55 | *Temora turbinata* (Dana) |
| 17 | *Eutima modesta* | 56 | *Tortanus derjugini* |
| 18 | *Helgicirrha maleyensis* (Stiasny) | 57 | *Tortanus forcipatus* |
| 19 | *Lensia subtiloides* (Lens et van Riensdijk) | 58 | *Tortanus gracilis* |
| 20 | *Liriope tetraphylla* | | **AMPHIPODA** |
| 21 | *Malagazzia carolinae* (Mayer) | 59 | *Lestrigonus larva* |
| 22 | *Moerisia inkermanica* Paltschikowa- Ostroumova | 60 | Gammaridea |
| 23 | *Mugglaea atlantica* | | **EUPHAUSIACEA** |
| 24 | *Obelia* spp. | 61 | *Pseudeuphausia sinica* |
| 25 | *Phialidium folleatum* | 62 | *Pseudeuphausia* sp. |
| 26 | *Physophora hydrostatica* | | **DECAPODA** |
| 27 | *Pleurobrachia globosa* Moser | 63 | *Acetes japonicus* |
| 28 | *Podocoryne apicata* | 64 | *Lucifer faxoni* |
| 29 | *Tumitopsis lata* | 65 | *Lucifer hanseni* Nobili |
| 30 | *Zanclea costata* Gegenbaur | 66 | *Lucifer intermedius* Hansen |
| | **III ARTHROPODA** | | **IV CHAETOGNATHA** |
| | Cladocera | 67 | *Sagitta bedoti* Beraneck |
| 31 | *Evadne tergestina* Claus | 68 | *Sagitta delicata* |
| 32 | *Penilia avirostris* Dana | 69 | *Sagitta enflata* Grassi |
| | **OSTRACODA** | 70 | *Sagitta larva* |
| 33 | *Cypridina dentata* | 71 | *Sagitta nagae* |
| 34 | *Euconchoecia aculeata* | 72 | *Sagitta neglecta* |
| | **COPEPODA** | 73 | *Sagitta pulchra* |
| 35 | *Acartia erythraea* Giesbrecht | | **V UROCHORDATA** |
| 36 | *Acartia pacifica* Steuer | 74 | *Oikopleura dioica* Fol |
| 37 | *Acartia spinicauda* Giesbrecht | | |

Annex 3 List of Macrobenthos recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name | No. | Scientific name | No. | Scientific name |
|---|---|---|---|---|---|---|---|
| | **COELENTERATA** | 158 | *Brachidontes variabilis* (Krauss) | 323 | *Natica vitellus* (Linnaeus) | 486 | *Charybdis hellerii* (A Milne-Edwards) |
| 1 | *Eudendrium racemosum* Pallas | 159 | *Hormomya mutabilis* (Gould) | 324 | *Natica tigrina* Lamarck | 487 | *Charybdis japonica* (A Milne-Edwards) |
| 2 | *Haliplanella luciae* (Verrill) | 160 | *Septifer bilocuakis* (Linnaeus) | 325 | *Natica didyma* (Ruding) | 488 | *Charybdis variegata* (Fabricius) |
| 3 | *Metridium* sp. | 161 | *Modiolus* (*Modiolus*) *comptus* Sowerby | 326 | *Natica zebra* Lamarck | 489 | *Charybdis vadorum* Alcock |
| 4 | *Cancrisocia* sp. | 162 | *Modiolus* (*Modiolus*) *metcalfei* (Hanley) | 327 | *Phalium strigatum strigatum* (Gmelin) | 490 | *Charybdis bimaculata* (Miers) |
| 5 | *Cerianthus* sp. | 164 | *Perna viridis* (Linnaeus) | 328 | *Apollon olivator* (Fulton) | 491 | *Thalamita danae* Stimpson |
| 6 | *Cavernularia habereri* Moroff | 165 | *Musculista senhausia* (Benson) | 329 | *Drupa margariticola* (Broderip) | 492 | *Thalamita* sp. |
| 7 | *Virgularia gustaviana* (Herclots) | 166 | *Musculista japonica* (Dunker) | 330 | *Rapana venosa* (Valenciennes) | 493 | *Euxanthus exsculptus* (Herbst) |
| 8 | *Pteroeides chinensis* Hardots | 167 | *Xenostrobus atrata* (Lischke) | 331 | *Thais gradata* Jonas | 494 | *Leptodius exaratus* (H. Milne-Edwards) |
| | **PLATYHELMINTHES** | 168 | *Lioderus vagina* (Larmarck) | 332 | *Thais clavigera* Kuster | 495 | *Parapenope euagora* de Haan |
| 9 | *Planocera* sp. | 169 | *Atrina* (*Servatrina*) *pectinata* (Linnaeus) | 334 | *Thais carinifera* | 496 | *Heteropilumnus subinteger* (Lanchester) |
| | **NEMATODA** | 170 | *Chlamys nobilis* (Reeve) | 335 | *Thais* sp. | 497 | *Heteropilumnus* sp. |
| 10 | *Mesacanthion* sp. | 171 | *Enigmonia aenigmatica* (Holten) | 336 | *Mitrella bella* (Reeve) | 498 | *Pilumnopeus makiana* (Rathbun) |
| | **NEMERTEA** | 172 | *Placuna placenta* (Linnaeus) | 337 | *Nassarius variciferus* (A. Adams) | 499 | *Heteropanope glabra* Stimpson |
| 11 | *Cerebratulina natans* Punnet | 173 | *Parahyotissa imbricata* (Lamarck) | 338 | *Nassarius festivus* (Powys) | 500 | *Xantho distinguendus* (de Haan) |
| 12 | *Procephalathrix* sp. | 174 | *Saccostrea cucullata* (Born) | 339 | *Nassarius* (*Zeuxis*) *succinctus* (A. Adams) | 501 | *Xantho* sp. |
| | **ANNELIDA** | 175 | *Saccostrea echinata* (Quoy et Gaimard) | 340 | *Nassarius siquijorensis* (A. Adams) | 502 | *Ser fukiensis* Rathbun |
| 13 | *Phyllodocidaes* spp. | 176 | *Dendostrea crenulifera* Sowerby | 341 | *Nassarius hepaticus* (Pulteney) | 503 | *Typhlocarcinus* sp |
| 14 | *Lepidonotus* sp. | 177 | *Ostrea nigromarginata* Sowerby | 342 | *Nassarius thersites* (Bruguiere) | 504 | *Typhlocarcinus nudus* Stimpson |
| 15 | *Lepidosthemia* sp. | 178 | *Ostrea glomerata* Gould | 343 | *Nassarius dealbatus* (A. Adams) | 505 | *Typhlocarcinus villosus* Stimpson |
| 16 | *Sigalion* sp. | 179 | *Otrea denselamellosa* Lischke | 344 | *Nassarius* sp. | 506 | *Hexapus anfractus* Rathbun |
| 17 | *Sthenolepis japonica* (McIntosh) | 180 | *Alectryonella plicatula* Gmelin | 345 | *Semiretusa borneensis* | 507 | *Tritodynamia hainaensis* Dai |
| 18 | *Synelmis albini* (Langerhans) | 181 | *Talonostrea pestigris* Hanley | 346 | *Conus* sp. | 508 | *Neoxenophthalmus obscurus* (Henderson) |
| 19 | *Ancistrosyllis* sp. | 182 | *Anodontes philippinana* (Reeve) | 347 | *Inquistor flavidula* (Lamarck) | 509 | *Xenophthlmus pinnotheroides* (White) |
| 20 | *Sigambra hanaokai* (Kitamori) | 183 | *Anodontia Stearnsiana* Oyama | 348 | *Gemmula deshayesii* (Doumel) | 510 | *Mortensenella forcepe* Rathbun |
| 21 | *Sigambra* sp. | 184 | *Pseudopythina ochetostomae* Morton et Scatt | 349 | *Turricula javana* (Linnaeus) | 511 | *Mictyris longicarpus* Latreille |
| 22 | *Ceratonereis burmensis* (Monro) | 185 | *Mactra veneriformis* Reeve | 350 | *Turricula nelliae spurius* (Hedley) | 512 | *Ocypode ceratophthalmus* (Pallas) |
| 23 | *Ceratonereis erythraeensis* Fauvel | 186 | *Lutraria* (*psonmophila*) *maxima* Jonas | 351 | *Brachystomia vexillum* Habe et Kosuge | 513 | *Ocypode cordimana* Desmarest |
| 24 | *Dendronereis Pinnaticirris* (Grube) | 187 | *Meropesta nicobarica* (Gmelin) | 352 | *Cinguloterebra torquiata* | 514 | *Ocypode stimpsoni* Ortmann |
| 25 | *Nereis* sp. | 188 | *Atactodea striata* (Gmelin) | 353 | *Terebra* (*Noditerebra*) *dussumieri* Kiener | 515 | *Uca arcuata* (de Haan) |
| 26 | *Namalycastis albiuma* (Muller) | 189 | *Atactodea* sp. | 354 | *Tiberia* sp. | 516 | *Uca dussumieri* H. Milne-Edwards |
| 27 | *Neanthes glandicincta* (Southern) | 190 | *Coecella turgida* Deshayes | 355 | *Punctacteon yamamurae* Habe | 517 | *Uca marionis* Desmarest |
| 28 | *Neanthes japonica* (Izuka) | 191 | *Chion semigranosus* (Dunker) | 356 | *Radix auricularia* (Linnaeus) | 518 | *Uca nitidus* Desmarest |
| 29 | *Neanthes succinea* (Frey et Leuckart) | 192 | *Chion* sp. | 357 | *Bullacta exarata* (Philippi) | 519 | *Uca urvillei* H. Milne-Edwards |
| 30 | *Nectoneanthes oxypoda* (Marenzeller) | 193 | *Donax faba* (Gmelin) | 358 | *Melanoides tuberculata* (Muller) | 520 | *Uca lacteus* de Haan |

Annex 3 *cont.* List of Macrobenthos recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name | No. | Scientific name | No. | Scientific name |
|---|---|---|---|---|---|---|---|
| 31 | *Nectoneanthes* sp. | 194 | *Angulus vestalis* (Hanley) | 359 | *Melanoides* sp. | 521 | *Uca vocans*(Linnaeus) |
| 32 | *Ceratonereis* sp. | 195 | *Angulus* sp. | 360 | *Refusa borneensis* (A. Adams) | 522 | *Uca* (*celuca*) *annlipes* (H.Milne-Edwards) |
| 33 | *Perinereis aibuhitensis* Grube | 196 | *Merisca diaphana* (Deshayes) | 361 | *Pupa* sp. | 523 | *Macrophthalmus dilatum* (de Haan) |
| 34 | *Perinereis camiguinoides* Augener | 197 | *Arcopaginula* sp. | 362 | *Ellobium chinensis* (Pfeiffer) | 524 | *Macrophthalmus convexus* Stimpson |
| 35 | *Perinereis nuntia* (Savigny) | 198 | *Moerella culter* (Hanley) | 363 | *Ellobium aurismidae* (Linnaeus) | 525 | *Macrophthalmus crassipes* (H.Milne-Edwards) |
| 36 | *Tylonereis bogoyawleskyi* Fauvel | 199 | *Moerella iridescens* (Benson) | 364 | *Ellobium* sp. | 526 | *Macrophthalmus boteI* Tobagoe |
| 37 | *Tylorrhynchus heterochaetus* (Quatrefages) | 200 | *Moerella jedoensis* (Lischke) | 365 | *Melampus triticeus* (küster) | 527 | *Macrophthalmus japonicus* de Haan |
| 38 | *Lennates erythraeenis* Fauvel | 201 | *Moerella philippinurum* (Hanley) | 366 | *Melampus castaneus* | 528 | *Macrophthalmus pacificus* Dana |
| 39 | *Leonnates* sp. | 202 | *Moerella rutila* (Dunker) | 367 | *Auriculastra elongata* | 529 | *Macrophthalmus definitus* Adams et White |
| 40 | *Nicon sinica* Wu et Sun | 203 | *Nitidotellina iridella* (Martens) | 368 | *Laemodonta punctigera* (H.at A. Adams) | 530 | *Macrophthalmus erato* de Man |
| 41 | *Pareleonnates uschkovi* Chlebovitsch et Wu | 204 | *Nitidotellina minuta* (Lischke) | 369 | *Laemodonta* sp. | 531 | *Macrophthalmus catreillei* (Desmarest) |
| 42 | *Glycera chirori* Izuka | 205 | *Nitidotellina nitidula* (Dunker) | 370 | *Cassidula plecotrematoides* (Möllendorff) | 532 | *Macrophthalmus simdentatus* Shen |
| 43 | *Glycera rouxi* Audouin et M.-Edwards | 206 | *Fabulina tsichungyeni* Scarlato | 371 | *Pythia* sp. | 533 | *Macrophthalmus* sp. |
| 44 | *Glycera convolute* Keferstein | 207 | *Macoma* (*Psammacoma*) *luceria* (Hanley) | 372 | *Onchididum verruculatus* Cuvier | 534 | *Camptandrium elongatum* Rathbun |
| 45 | *Glycera subaenea* Grube | 208 | *Macoma nobilis* (Hanley) | | **CEPHALOPODA** | 535 | *Camptandrium aromaoum* Shen |
| 46 | *Glycera* sp. | 209 | *Macoma candida* (Lamarck) | 373 | *Sepiola birostrat* Sasaki | 536 | *Camptandrium sexdentatum* Stimpson |
| 47 | *Glycinde* sp. | 210 | *Macoma nipponica* | 374 | *Octopus variabilis* (Sasaki) | 537 | *Cleistostoma dilatatum* de Haan |
| 48 | *Goniada emerita* Audouin et M.-Edwards | 211 | *Apolymetis* sp. | 375 | *Octopus fusiformis* Brock | 538 | *Paracleistostoma cristatum* de Haan |
| 49 | *Goniada japonica* Izuka | 212 | *Pulvinus micans* (Hanley) | 376 | *Octopus* sp. | 539 | *Paracleistostoma depressum* de Man |
| 50 | *Goniada maculate* Oersted | 213 | *Theora lata* (Hinds) | | **ARTHROPODA** | 540 | *Ilyoplax dentimerosa* Shen |
| 51 | *Aglaophamus sinensis* (Fauvel) | 214 | *Gari reevei* Habe | | **Merostomata** | 541 | *Ilyoplax formosensis* Rathbun |
| 52 | *Aglaophamus dibranchis* Grube | 215 | *Gari* sp. | 377 | *Carcinoscorpius rotundicauda* (Latrelle) | 542 | *Ilyoplax tansuiensis* Sakai |
| 53 | *Inermonephtys inermis* (Ehlers) | 216 | *Hiatula diphos* (Linnaeus) | 378 | *Tachypleus tridentatus* Leach | 543 | *Ilyoplax serrata* Shen |
| 54 | *Nephtys californiensis* Haitman | 217 | *Soletellina atrata* Reeve | 379 | *Tachypleus* sp. | 544 | *Ilyoplax ningpoensis* Shen |
| 55 | *Nephtys ciliata* (Muller) | 218 | *Hiatula fogata* (Deshayes) | | **CRUSTACEA** | 545 | *Ilyoplax* sp. |
| 56 | *Nephtys oligobranchia* Southern | 219 | *Soletellina acuta* (Cai et Zhuang) | 380 | *Euraphia withersi* Pilsbry | 546 | *Tmethypocoelis ceratophora* (Koelbel) |
| 57 | *Nephtys capensis* Day | 220 | *Psammotaena elongata* (Lamarck) | 381 | *Chiromantis amarylis* (Darwin) | 547 | *Scapimera tuberculata* Stimpson |
| 58 | *Nephtys* sp. | 221 | *Psammotaena* sp. | 382 | *Chelonibia patula* (Ranzani) | 548 | *Scopimera bilympana* Shen |
| 59 | *Haploscoloplos elongatus* (Johnson) | 222 | *Solen grandis* Dunker | 383 | *Balanus albicostatus* Pilsbry | 549 | *Scopimera globosa* de Haan |
| 60 | *Haploscoloplos cf. fragilis* Webster | 223 | *Solen strictus* Gould | 384 | *Balanus amphitrite* Pilsbry | 550 | *Dotilla wichmanni* de Man |
| 61 | *Scoloplos rubra orientalis* Gallardo | 224 | *Solen dunkerianus* Clessin | 385 | *Balanus littoralis* Ren et Lin | 551 | *Metopograpsus frontalis* Miers |
| 62 | *Scoloplos gracilis* Pillai | 225 | *Cultellus attenuatus* Dunker | 386 | *Balanus reticulatus* Utinomi | 552 | *Metopograpsus quadridentatus* Stimpson |
| 63 | *Scoloplos dubia* Tebble | 226 | *Cultellus scalprum* (Gould) | 387 | *Balanus cimatus* Darwin | 553 | *Metopograpsus messor* (Forskal) |

Annex 3 *cont.* List of Macrobenthos recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name | No. | Scientific name | No. | Scientific name |
|---|---|---|---|---|---|---|---|
| 64 | *Scoloplos* sp. | 227 | *Siligua minima* (Gmelin) | 388 | *Balanus uliginosus* Utinomi | 554 | *Metopograpsus* sp. |
| 65 | *Aricidea* sp. | 228 | *Sinonovacula constricta* (Lamarck) | 389 | *Paranthura japonica* Richardson | 555 | *Pachygrapsus crassipes* Randall |
| 66 | *Cossura dimorpha* Hartman | 229 | *Pharella acutidens* (Broderip et Sowerby) | 390 | *Cirolana japonensis* (Richardson) | 556 | *Hemigrapsus longitarsis* (Miers) |
| 67 | *Laonice cirrata* (Sars) | 230 | *Trapezium liratum* (Reeve) | 391 | *Sphaeroma* sp. | 557 | *Hemigrapsus penicillatus* (de Haan) |
| 68 | *Paraprionospio pinnata* (Miers) | 231 | *Libitina japonica* (Pilsbry) | 392 | *Ligia exotica* (Roux) | 558 | *Varuna litterata* (Fabricius) |
| 69 | *Prionspil booki* | 232 | *Corbicula fluminea* (Muller) | 393 | *Porcellio* sp. | 559 | *Gaetice depressus* (de Haan) |
| 70 | *Prionspil malmgreni* Claparede | 233 | *Corbicula riters* (Philippi) | 394 | *Corophium* sp. | 560 | *Nanosesarma* (*N.*) *pontianacensis* (de Man) |
| 71 | *Magelona cincta* Ehlers | 234 | *Gelolina coaxans* (Gmelin) | 395 | *Gammarus gregoryi* Tattersall | 561 | *Nanosesarma* (*N.*) *minutum* (de Man) |
| 72 | *Cheetopterus* sp. | 235 | *Callista chinensis* (Hollen) | 396 | *Gammarus* sp. | 562 | *Sesarma* (*Holometopus*) *haematocheir* (de Haan) |
| 73 | *Poecilochaetus serpens* All | 236 | *Callista erycina* (Linnaeus) | 397 | *Amipithoe* sp. | 563 | *Sesarma dehaani* H. Milne-Edwards |
| 74 | *Poecilochaetus tropicus* Okuda | 237 | *Dosinia japonica* (Reeve) | 398 | *Caprella scaura* Templeton | 564 | *Sesarma* (*Parasesarma*) *pictum* (de Haan) |
| 75 | *Poecilochaetus Paratropicus* Gallardo | 238 | *Dosinia troscheli* Lisckke | 399 | *Atypopenaeus stenodactylus* (Stimpson) | 565 | *Sesarma plicata* (*Latreille*) |
| 76 | *Ciriformia tentaculata* (Montaau) | 239 | *Dosinia gibba* A.Adams | 400 | *Metapenaeopsis barbata* (de Haan) | 566 | *Sesarma bidens* (de Haan) |
| 77 | *Cirratulus* sp. | 240 | *Dosinia corrugata* (Reeve) | 401 | *Metapenaeus ensis* de Haan | 567 | *Sesarma* (*Sesarmops*) *sinensis* H.Milne-Edwards |
| 78 | *Barantolla sculpta* | 241 | *Meretrix meretrix* (Linnaeus) | 402 | *Metapenaeus joyneri* (Miers) | 568 | *Sesarma intermedia* (de Haan) |
| 79 | *Barantolla* sp.1 | 242 | *Meretrix lusoria* (Rumphius) | 403 | *Metapenaeus* sp. | 569 | *Sesarma picta* (de Haan) |
| 80 | *Herteromastus filiforms* (Claparede) | 243 | *Anomalocardia flexuosa* (Linnaeus) | 404 | *Myadiella podophthalmus* (Stimpson) | 570 | *Sesrama* sp. |
| 81 | *Herteromastus similis* Southern | 244 | *Anomalodiscus squamosus* (Linnaeus) | 405 | *Parapenaeopsis cultrirostris* (Alcock) | 571 | *Eriocheir sinensis* H. Milne-Edwards |
| 82 | *Herteromastus* sp. | 245 | *Clausinella calophylla* (Philippi) | 406 | *Parapenaeopsis hardwickii* (Miers) | 572 | *Helice tridens tientsinensis* Rathbun |
| 83 | *Notomastus latericeus* Sars | 246 | *Clausinella isabellina* (Philippi) | 407 | *Parapenaeopsis hungerfordi* Alcock | 573 | *Helice tridens* Wuana |
| 84 | *Notomastus aberans* Day | 247 | *Clausinella* sp. | 408 | *Parapenaeopsis comuta* (Kishinouye) | 574 | *Metaplax longipes* Stimpson |
| 85 | *Parheteromatus tenuis* Monro | 248 | *Gomphina aequilatera* (Sowerby) | 409 | *Parapenaeopsis tenella* (Bate) | 575 | *Metaplax elegans* de Man |
| 86 | *Euclymene annandalei* Southern | 249 | *Gomphina melanaegis* (Sowerby) | 410 | *Penaeus orientalis* Kishinouye | 576 | *Metaplax sheni* Gordon |
| 87 | *Euclymene* sp. | 250 | *Cyclina sinensis* (Gmelin) | 411 | *Penaeus merguiensis* De Man | 577 | *Metaplax* sp. |
| 88 | *Praxillella praetermissa* (Malmgren) | 251 | *Gafrarium divaricatum* (Gmelin) | 412 | *Penaeus* (*Fenneropenaeus*) *penicillatus* Alcock | 578 | *Clorida latreillei* (Eydoux et Souleyet) |
| 89 | *Armandia lanceolata* Willey | 252 | *Marcia nimularis* (Lamarck) | 413 | *Penaeus* (*Marsupenaeus*) *japonicus* Bate | 579 | *Cloridopsis scorpio* (Latreille) |
| 90 | *Armandia leptocirrus* Grube | 253 | *Marcia hiantina* (Lamarck) | 414 | *Penaeus* (*M.*) *latisulcatus* Kishinouye | 580 | *Lophosquilla costata* (de Haan) |
| 91 | *Armandia* sp. | 254 | *Marcia marmorata* (Lamarck) | 415 | *Penaeus monodon* Fabricius | 581 | *Oratosquilla interrupta* (Kemp) |
| 92 | *Ophelia acuminata* Oersted | 255 | *Tapes literata* (Linnaeus) | 416 | *Penaeus semisulcatus* De Haan | 582 | *Oratosquilla oratoria* (de Haan) |
| 93 | *Ophelia grandis* Pillai | 256 | *Paphia* (*Paratapes*) *undulata* (Born) | 417 | *Penaeus stylyorostris* | 583 | *Oratosquilla kempi* (Schmitt) |
| 94 | *Traoisia* sp. | 257 | *Ruditapes philippinarum* (Adams et Reeve) | 418 | *Trachypenaeus comuta* | 584 | *Oratosquilla nepa* (Latreille) |
| 95 | *Eurythoë parvecarunculata* Horst | 258 | *Ruditapes variegata* (Sowerby) | 419 | *Trachypenaeus sedili* Hall | | **BRACHIOPODA** |
| 96 | *Eurythoë* sp. | 259 | *Glauconme chinensis* (Gray) | 420 | *Acetes chinensis* Hansen | 585 | *Lingula anatina* Lamarck |
| 97 | *Chloeia parva* Baird | 260 | *Mya* sp. | 421 | *Acetes japonicus* Kishinouye | | **ECHINODERMATA** |

Annex 3 *cont.* List of Macrobenthos recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name | No. | Scientific name | No. | Scientific name |
|---|---|---|---|---|---|---|---|
| 98 | *Euphrosine* sp. | 261 | *Potamocorbula fasciata* (Reeve) | 422 | *Leptochela gracilis* Stimpson | 586 | *Leptopentacta imbricata* (Semper) |
| 99 | *Diopatra neapolitana* Della Chiaje | 262 | *Potamocorbula laevis* (Hinds) | 423 | *Leptochela pugnax* de Man | 587 | *Mensamaria intercedens* (Lampert) |
| 100 | *Diopatra sugokai* Izuka | 263 | *Bankia carinata* (Gray) | 424 | *Exopalaemon annandalei* (Kemp) | 588 | *Acaudina molpadioides* (Semper) |
| 101 | *Diopatra amboinesis* Audouin et Milne Edwards | 264 | *Bankia saulii* (Wright) | 425 | *Exopalaemon carinicauda* (Holthuis) | 589 | *Protankyra bidentata* (Woodward et Barrett) |
| 102 | *Diopatra* sp. | 265 | *Teredo manni* (Wright) | 426 | *Palaemon gravieri* (Yu) | 590 | *Protankyra* sp. |
| 103 | *Onuphis eremita* Audouinet M. – Edwards | 266 | *Teredo navalis* Linnaeus | 427 | *Palaemon macrodactylus* Rathbun | 591 | *Craspidaster hesperus* (Muller et Troschel) |
| 104 | *Marphysa sanguinea* (Montagu) | 267 | *Laternula* (*Exolaternula*) *manilina* (Reeve) | 428 | *Palaemon serrifer* (Stimpson) | 592 | *Astropecten monacanthus* Sladen |
| 105 | *Marphysa* sp. | 268 | *Laternula* (*E.*) *truncata* (Lamarck) | 429 | *Macrobrachium rosenbergii* (de Haan) | 593 | *Luidia quinaria* von Martens |
| 106 | *Eunphysa aculeata* Wesenberg Lund | 269 | *Laternula nanhaiensis* Zhuang et Cai | 430 | *Alpheus bisincisus* de Haan | 594 | *Astevina limboonkengi* G.A. Smith |
| 107 | *Lumbrineris heteropoda* (Marenzeller) | 270 | *Laternula anatina* Linnaeus | 431 | *Alpheus brevicristatus* de Haan | 595 | *Temnopleurus toreumaticus* (Leske) |
| 108 | *Lumbrineris inflata* (Moore) | 271 | *Laternula* sp. | 432 | *Alpheus distinguenus* de Haan | 596 | *Temnopleurus reevesii* (Gray) |
| 109 | *Lumbrineris latreilli* Audouinet M. – Edwards | 272 | *Trigonothracia jinxingae* Xu | 433 | *Alpheus hoplocheis* Coutiere | 597 | *Arachnoides placenta* (Linnaeus) |
| 110 | *L. brevicirra* (Schmarda) | | **GASTROPODA** | 434 | *Alpheus japonicus* Miers | 598 | *Trichaster acanthifer* Doderlein |
| 111 | *L. nagae* Gallardo | 273 | *Patelloida* sp. | 435 | *Alpheus lobidens* de Haan | 599 | *Amphioplus depressus* (Ljungman) |
| 112 | *Lumbrineris* sp. | 274 | *Trochus* sp. | 436 | *Alpheus stanleyi dearmarus* de Man | 600 | *Amphioplus impressus* (Ljungman) |
| 113 | *Drilonereis filum* (Claparede) | 275 | *Umbonium vestiarium* (Linne) | 437 | *Alpheus* sp. | 601 | *Amphioplus laevis* Lyman. |
| 114 | *Sternaspis sculata* (Renier) | 276 | *Turbo brunneum* Roding | 438 | *Ogyrides orientalis* (Stimpson) | 602 | *Amphioplus ancistrotus* (H.L. Clark) |
| 115 | *Owenia fusiformis* Delle Chiaje | 277 | *Lunella coronata granulata* (Gmelin) | 439 | *Ogyrides striaticauda* Kemp | 603 | *Amphioplus lucidus* |
| 116 | *Lygdamis indicus* Kinberg | 278 | *Nerita polita* Linnaeus | 440 | *Lysmata vittata* (Stimpson) | 604 | *Amphioplus duplicata* |
| 117 | *Pectinaria conchilega* Grube | 279 | *Nerita albicilla* Linnaeus | 441 | *Laomedia astacina* de Haan | 605 | *Amphioplus praestans* |
| 118 | *Pectinaria papillosa* Caullery | 280 | *Nerita striata* (Burrow) | 442 | *Upogebia wuhsienweni* YU | 606 | *Astrodendrum sagaminum* (Doderlein) |
| 119 | *Pectinaria aegyptia sensu* | 281 | *Nerita yoldi* Recluz | 443 | *Upogebia* sp. | 607 | *Amphiurap achybactra* Murakami |
| 120 | *Isolda pulchella* Muller | 282 | *Nerita achatina* (Reeve) | 444 | *Clibanarius clibanarius* (Herbst) | 608 | *Amphiura* sp. |
| 121 | *Melinna aberrans* | 283 | *Nerita japonica* (Dunker) | 445 | *Clibanarius infrasipinatus* Hilgendorf | 609 | *Ophiactis affinis* Duncan |
| 122 | *Melinna cristata* (Sars) | 284 | *Nerita* sp. | 446 | *Clibanarius* sp. | 610 | *Ophiothrix exigua* Lyman |
| 123 | *Paramphicteis* sp. | 285 | *Dostia violacea* (Gmelin) | 447 | *Diogenes avarus* Heller | 611 | *Placophiothrix plana* (Lyman) |
| 124 | *Terebellides stroemii* Sars | 286 | *Clithon oualaniensis* (Lesson) | 448 | *Diogenes edwardsii* (de Haan) | 612 | *Ophiochemis marmorata* (Lamarck) |
| 125 | *Loimia medusa* | 287 | *Littoraria articulata* (Philippi) | 449 | *Diogenes paracristimanus* Wang et Dong | | **UROCHORDATA** |
| 126 | *Pista cristata* (Muller) | 288 | *Littoraria melanostoma* Gray | 450 | *Diogenes rectimanus* Miers | 613 | *Oikopleura dioica* Fol |
| 127 | *Pista* sp. | 289 | *Nodilittorina* (*N.*) *radiata* (Eydoux et Souleyet) | 451 | *Diogenes tomentosus* Wang et Dong | 614 | *Styela plicata* (Lesueur) |
| 128 | *Streblosoma* sp. | 290 | *Littorina* (*Littoraria*) *coccinea* (Gmelin) | 452 | *Diogenes* sp. | 615 | *Microcosmus exasperatus* Heller |
| 129 | *Potamilla* sp. | 291 | *Stenothyra glabrata* A.Adams | 453 | *Pagurus dubius* (Ortmann) | | **CHORDATA** |
| 130 | *Pomatoleios* sp. | 292 | *Valvata* sp. | 454 | *Pagurus geminus* Melaughlin | 616 | *Chanos chanos* (Forskal) |
| 131 | *Sabellastarte zebuensis* Mcintosh | 293 | *Assiminea latericea* H.et A.Adams | 455 | *Pagurus* sp. | 617 | *Clupanodon punctatus* (Temminck et Schlegel) |
| 132 | *Tubifex* sp. | 294 | *Assiminea scalaris* Heude | 456 | *Pisidia serratifrons* (Stimpson) | 618 | *Anguilla japonica* Temminck et Schlegel |

Annex 3 *cont.* List of Macrobenthos recorded in Mangroves of China.

| No. | Scientific name | No. | Scientific name | No. | Scientific name | No. | Scientific name |
|---|---|---|---|---|---|---|---|
| | **SIPUNCULA** | 295 | *Assiminea violacea* Heude | 457 | *Raphidopus ciliatus* Stimpson | 619 | *Muraenichthys malabonensis* Harre |
| 133 | *Antillesoma antillarum* (Crube et Oersted) | 296 | *Assiminea brevicula* Pfeiffer | 458 | *Hippa adactyla* Fabricius | 620 | *Pisoodonophis boro* (Ham Buch) |
| 134 | *Phascolosoma esculenta* (Chen et Yeh) | 297 | *Assiminea lutea japonica* (A.Adams) | 459 | *Dorippe* (*Neodorippe*) *japonica* von Siebold | 621 | *Syngnathus cyanospilus* Bleeker |
| 135 | *Phascolosoma perlucens* Baird | 298 | *Assiminea nitida* | 460 | *Dorippe* (*Neodorippe*) *callida* (Fabricius) | 622 | *Mugil cephalus* Linnaeus |
| 136 | *Phascolosoma scolops* (Selenka, De Man et Bulow) | 299 | *Assiminea sculpta* | 461 | *Dorippe polita* Alcock et Anderson | 623 | *Epinephelus amblycephalus* (Blecker) |
| 137 | *Phascolosoma similes* (Grube et Oersted) | 300 | *Turritella terebra* (Linne) | 462 | *Nursia rhomboidalis* (Miers) | 624 | *Epinephelus laurina* |
| 138 | *Themiste spinulum* (Chen et Yeh) | 301 | *Turritella bacillum* Kiener | 463 | *Nursia sinica* Shen | 625 | *Lates calanfer* (Bloch) |
| 139 | *Siphonosoma australe* (Keferstein) | 302 | *Architectonica maxima* (Philippi) | 464 | *Philyra platycheira* de Haan | 626 | *Rhabdosargus sarba* (Forskal) |
| 140 | *Sipunculus mudus* Linneaus | 303 | *Architectonica perdix* (Hinds) | 465 | *Philyra biprotubera* Dai et Guan | 627 | *Sparus latus* Houttuyn |
| 141 | *Sipunculus angasoides* Chen et Yeh | 304 | *Cerithidea cingulata* (Gmelin) | 466 | *Philyra carinata* Bell | 628 | *Petroscirtes kallosoma* Bleeker |
| 142 | *Sipunculus* sp.1 | 305 | *Cerithidea microptera* (Kiener) | 467 | *Philyra pisum* de Haan | 629 | *Bostrichthys chinensis* (Lac) |
| | **ECHIURA** | 306 | *Cerithidea sinensis* (Philippi) | 468 | *Philyra olivaca* Rathbun | 630 | *Perecottus glehni* Dyboweki |
| 143 | *Para-arhynchite nexoronale* Chen | 307 | *Cerithidea Rhizophorarum* A. Adams | 469 | *Philyra minuta* Chen et Türkay | 631 | *Aboma lactipes* (Hilgendort) |
| 144 | *Listriolobus* sp. | 308 | *Cerithidea ornata* (A.Adams) | 470 | *Philyra scabra* ( Dai ) | 632 | *Amblyeleotris caninus* (Cuvier et Valenciennes) |
| 145 | *Ochetostoma erythrogrammon* Leuckart et Ruppell | 309 | *Cerithidea djadjamiensis* (K. Martin) | 471 | *Matuta planipes* Fabricius | 633 | *Amblyeleotris chlorostigmatoides* (Bleeker) |
| | **MOLLUSCA** | 310 | *Cerithidea largillierti* (Philippi) | 472 | *Matuta lunaris* Farskal | 634 | *Apocryptodon bleeken* (Day) |
| | **BIVALVIA** | 311 | *Cerithidea* sp. | 473 | *Matuta banksii* Leach | 635 | *Chaeturichthys hexanema* Bleeker |
| 146 | *Nucula tenuis* (Montagu) | 312 | *Terebralia sulcata* (Born) | 474 | *Onthyia sinica* Linnaeus | 636 | *Ctenogobius brevirostris* (Gunther) |
| 147 | *Nucula* sp. | 313 | *Batillaria zonalis* (Bruguiere) | 475 | *Elamenopsis* sp. | 637 | *Ctenogobius gymnauehen* (Bleeker) |
| 148 | *Arca birakayanensis* Faustino | 314 | *Batillaria cumingi* (Crosse) | 476 | *Phalangipus longipes* (Linnaeus) | 638 | *Gobius poecilichthy* Jord. & Snyd |
| 149 | *Barbatia decussata* Sowerby | 315 | *Cerithium citrinus* Sowerby | 477 | *Scylla serrata* (Forskal) | 639 | *Bathygobius fuscus* (Ruppell) |
| 150 | *Barbatia* sp. | 316 | *Cerithium pfefferi* | 478 | *Portunus trituberculatus* (Miers) | 640 | *Amoya brevirostris* (Gthr.) |
| 151 | *Scapharca cornea* (Reeve) | 317 | *Rhinoclavis sinensis* (Gmelin) | 479 | *Portunus pubescens* (Dana) | 641 | *Periophthalmus cantonensis* (Osbeck) |
| 152 | *Scapharca gubernaculum* (Reeve) | 318 | *Bittium* sp. | 480 | *Portunus hastatoides* (Fabricius) | 642 | *Boleuphthalmus pectinirostris* (Linnaeus) |
| 153 | *Scapharca anomala* (Reeve) | 319 | *Lunatica gilva* (Philippi) | 481 | *Portunus argentatus* (White) | 643 | *Scartelaos viridis* (Ham & Buch) |
| 154 | *Tegillaria granosa* (Linnaeus) | 320 | *Polinices mammata* (Roding) | 482 | *Portunus gracilimanus* (Stimpson) | 644 | *Odontamblyopus rubicundus* (Hanilton) |
| 155 | *Tegillaria nodifera* (Martens) | 321 | *Polinices macrostoma* (Philippi) | 483 | *Charybdis acuta* A. Milne-Edwards | 645 | *Trypauchen vegina* (Bloth et Schneider) |
| 156 | *Didimacar tenebrica* (Reeve) | 322 | *Sinum incisum* (Reeve) | 484 | *Charybdis affinis* Dana | | |
| 157 | *Brachidontes striatulus* (Hanley) | | | 485 | *Charybdis feriatus* (Linnaeus) | | |

Annex 4 List of Fishes recorded in Mangrove of China.

| **Elopidae** | **Lutjanidae** |
|---|---|
| 1. *Elops saurus* Linnaeus | 42. *Lutjanus johni* (Bloch) |
| **Clupeidae** | **Sparidae** |
| 2. *Kowala coval* (Cuvier) | 43. *Pagrosomus major* (Temminck et Schlegel) |
| 3. *Harenguta bulan* (Bleeker) | 44. *Sparus berda* Forskal |
| 4. *H. ovalis* (Bennett) | 45. *S. latus* Houttuyn |
| 5. *Sardinella richardsoni* Wongratana (Richardson) | **Pomadasyidae** |
| 6. *Clupanodon punctatus* (Temminck et Schlegel) | 46. *Pomadasys hasta* (Bloch) |
| 7. *Ilisha elongata* (Bennett) | **Theraponidae** |
| **Engraulidae** | 47. *Helotes sexlineatus* (Quoy et Gaimard) |
| 8. *Stolephorus chinensis* (Gunther) | 48. *Therapon jarbua* (Forskal) |
| 9. *S. tri* (Bleeker) | **Mullidae** |
| 10. *Thrissa hamiltonii* (Gray) | 49. *Mulloidichthys sunflamma* (Forskal) |
| **Chirocentridae** | **Drepanidae** |
| 11. *Chirocentrus dorab* (Forskal) | 50. *Drepane longimana* (Bloch et Schneider) |
| **Congridae** | **Scatophagidae** |
| 12. *Anago anago* (Temminck et Schlegel) | 51. *Scatophagus argus* (Linnaeus) |
| **Ophichthyidae** | **Siganidae** |
| 13. *Pisoodonophis boro* (Hamilton-Buchanan) | 52. *Siganus oramin* (Bloch et Valenciennes) |
| **Atherinidae** | 53. *S. fuscescens* (Houttuyn) |
| 14. *Atherina bleekeri* (Gunther) | **Trichiuridae** |
| **Belonidae** | 54. *Trichiurus haumela* (Forskal) |
| 15. *Tylosurus strongylurus* (Van Hasselt) | **Eleotridae** |
| **Hemiramphidae** | 55. *Bostrichthys sinensis* (Lacepede) |
| 16. *Hemirhamphus intermedius* Cantor | 56. *Butis butis* (Hamilton) |
| 17. *Hemirhamphus limbatus* (Cuvier et Valenciennes) | 57. *Brionobutis kollomatodon* (Bleeker) |
| 18. *Zenarchopterus buffoni* (Cuvier et Valenciennes) | **Gobiidae** |
| **Mugilidae** | 58. *Bathygobius fuscus* (Ruppell) |
| 19. *Osteomugil ophuyseni* (Bleeker) | 59. *Glossogobius giuris* (Hamilton) |
| 20. *O. strongylocephalus* (Richardson) | 60. *Acentrogobius viridipunctatus* (Cuvier et Valenciennes) |
| 21. *Valamugil seheli* (Forskal) | 61. *A. chlorostigmatoides* (Bleeker) |
| 22. *Liza carinatus* (Cuvier et Valenciennes) | 62. *Ctenogobius brevirostris* (Gunther) |
| 23. *L. haematochelia* (Temminck et Schlegel) | 63. *C. gymnauchen* (Bleeker) |
| **Ambassidae** | 64. *Synechogobius ommaturus* (Richardson) |
| 24. *Ambassis gymnocephalus* (Lacepede) | 65. *Apocryptodon malcolmi* Smith |
| **Latidae** | **Periophthalmidae** |
| 25. *Lates calcarifer* (Bloch) | 66. *Periophthalmus cantonensis* (Osbeck) |
| **Serranidae** | 67. *Boleophthalmus pectinirostris* (Linnaeus) |
| 26. *Lateolabrax japonicus* (Cuvier et Valenciennes) | 68. *Scartelaos viridis* (Hamilton- Buchanan) |
| **Sillaginidae** | **Taenioididae** |
| 27. *Sillago sihama* (Forskal) | 69. *Odontamblyopus rubicundus* (Hamilton-Buchanan) |
| **Carangidae** | 70. *Taenioides agutlaris* (Linnaeus) |
| 28. *Caranx* (*Carangoides*) *praeustus* Bennett | 71. *Trypauchen vagina* (Bloch et Schneider) |
| 29. *C.* (*Atule*) *kalla* Cuvier et Valenciennes | **Synancelidae** |
| 30. *C.* (*A.*) *mate* Cuvier et Valenciennes | 72. *Inimicus sinensis* (Valenciennes) |
| 31. *C.* (*A.*) *malam* (Bleeker) | **Platycephalidae** |
| 32. *Chorinemus hainanensis* Chu et Cheng | 73. *Platycephalus indicus* (Linnaeus) |
| **Sciaenidae** | **Soleidae** |
| 33. *Umbrina russelli* Cuvier et Valenciennes | 74. *Solea ovata* Richardson |
| **Leiognathidae** | **Cynoglossidae** |
| 34. *Leiognathus ruconius* (Hamilton-Buchanan) | 75. *Cynoglossus puncticeps* (Richardson) |
| 35. *L. elongatus* (Gunther) | 76. *C. sinicus* Wu |
| 36. *L. dussumieri* (Cuvier et Valenciennes) | **Triacanthidae** |
| 37. *L. rivulatus* (Temminck et Valenciennes) | 77. *Triacanthus brevirostris* Temminck et Schlegel |
| 38. *L. brevirostris* (Cuvier et Valenciennes) | **Tetraodotidae** |
| 39. *L. daura* (Cuvier) | 78.*Gastrophysus lunaris* (Bloch et Scheider) |
| **Gerridae** | 79. *Gastrophysus spadiceus* (Richardson) |
| 40. *Pentaroin longimanus* (Cantor) | 80. *Fugu alboplumbeus* (Richardson) |
| 41. *Gerreomorpha japonica* (Bleeker) | |

Annex 5 List of Mangrove Associated Birds in China.

| ■ GAVIIFORMES | (12) Turnicidae | 145. *Larus argentatus* | (42)Oriolidae |
|---|---|---|---|
| (1) Gaviidae | 72. *Turnix sylvatica* | 146. *Larus schistisagus* | 209. *Oriolus chinensis* |
| 1. *Gavia stellata* | 73. *Turnix tanki* | 147. *Larus ridibundus* | (43) Sturnidae |
| ■ PODICIPEDIFORMES | 74. *Turnix suscitator* | 148. *Larus saundersi* | 210. *Sturnus sericeus* |
| (2) Podicipedidae | (13) Gruidae | 149. *Childonias hybride* | 211. *Sturnus nigricollis* |
| 2. *Tachybaptus ruficollis* | 75. *Grus grus* | 150. *Childonias leucoptera* | 212. *Sturnus sinensis* |
| 3. *Podiceps cristatus* | (14) Rallidae | 151. *Hydroprogne caspia* | 213. *Acridotheres tristis* |
| ■ PELECANIFORMES | 76. *Rallus aquaticus* | 152. *Sterna dougalli* | 214. *Acridotheres cristatellus* |
| (3) Pelecanidae | 77. *Rallus striatus* | 153. *Sterna hirundo* | 215. *Sturnus cineraceus* |
| 4. *Pelecanus philippensis* | 78. *Rallina eurizonoides* | 154. *Thalasseus bergii* | (44) Corvidae |
| 5. *Pelecanus crispis* | 79. *Porzana pusilla* | (24) Columbidae | 216. *Pica pica* |
| (4) Phalacrocoracidae | 80. *Porzana fusca* | 155. *Streptopelia orientalis* | 217. *Dendrocitta formosae* |
| 6. *Phalacrocorax pelagicus* | 81. *Amaurornis akool* | 156. *Streptopelia chinensis* | 218. *Corvus torguatus* |
| 7. *Phalacrocorax carbo* | 82. *Amaurornis phoenicurus* | 157. *Oenopopelia tranquebarica* | 219. *Corvus macrorhynchos* |
| ■ CICONIIFORMES | 83. *Porzana paykulli* | 158. *Treron bicincta* | (45)Muscicapidae |
| (5) Ardeidae | 84. *Porzana bicolor* | ■ PSITTACIFORMES | 220. *Luscinia calliope* |
| 8. *Ardea cinerea* | 85. *Gallicrex cinerea* | (25) Psittacidae | 221. *Luscinia svecica* |
| 9. *Ardea purpurea* | 86. *Gallinula chloropus* | 159. *Psittacula krameri* | 222. *Luscinia cyane* |
| 10. *Butorides striatus* | 87. *Porphyrio porphyrio* | ■ CUCULIFORMES | 223. *Copsychus saularis* |
| 11. *Ardeola bacchus* | 88. *Fulica atra* | (26) Cuculidae | 224. *Tarsiger cyanurus* |
| 12. *Bubulcus ibis* | ■ CHARADRIIFORMES | 160. *Clamator coromandus* | 225. *Phoenicurus auroreus* |
| 13. *Egretta alba* | (15) Jacanidae | 161. *Cuculus sparverioides* | 226. *Saxicola torquata* |
| 14. *Egretta garzetta* | 89. *Metopidius indicus* | 162. *Cuculus micropterus* | 227. *Saxicola ferrea* |
| 15. *Egretta eulophotes* | 90. *Hydrophasianus chirurgus* | 163. *Cuculus merulinus* | 228. *Monticola cinclorhynchus* |
| 16. *Egretta sacra* | (16) Rostratulidae | 164. *Cuculus polocephalus* | 229. *Monticola solitarius* |
| 17. *Egretta intermedia* | 91. *Rostratula benghalensis* | 165. *Cuculus saturatus* | 230. *Myiophoneus caeruleus* |
| 18. *Nycticorax nycticorax* | (17) Haematopodidae | 166. *Eudynamys scolopacea* | 231. *Zoothera citrina* |
| 19. *Gorsachius goisagi* | 92. *Haematopus ostralegus* | 167. *Centropus sinensis* | 232. *Zoothera sibirica* |
| 20. *Gorsachius melanolophus* | (18) Charadriidae | 168. *Centropus toulou* | 233. *Zoothera dauma* |
| 21. *Ixobrychus sinensis* | 93. *Vanellus vanellus* | ■ STRIGIFORMES | 234. *Turdus cardis* |
| 22. *Ixobrychus eurhythmus* | 94. *Vanellus cinereus* | (27) Strigidae | 235. *Turdus menula* |
| 23. *Ixobrychus cinnamomeus* | 95. *Vanellus duvaucelii* | 169. *Otus scops* | 236. *Turdus hortulorum* |
| 24. *Ixobrychus flavicollis* | 96. *Pluvialis squatarola* | 170. *Otus bakkamoena* | 237. *Turdus pallidus* |
| 25. *Botaurus stellaris* | 97. *Pluvialis fulva* | 171. *Ninox scutulata* | 238. *Turdus naumanni* |
| (6) Ciconiidae | 98. *Pluvialis dominica* | ■ CAPRIMULGIFORMES | 239. *Pomatorhinus ruficollis* |
| 26. *Ciconia nigra* | 99. *Charadrius hiaticula* | (28) Caprimulgidae | 240. *Garrulax perspicillatus* |
| 27. *Ciconia boyciana* | 100. *Charadrius placidus* | 172. *Caprimulgus indicus* | 241. *Garrulax chinensis* |
| (7) Threskiornithidae | 101. *Charadrius dubius* | 173. *Caprimulgus affinis* | 242. *Garrulax canorus* |
| 28. *Threskiornis aethiopicus* | 102. *C.alexandrinus* | ■ APODIFORMES | 243. *Cettia diphone* |
| 29. *Platalea leucorodia* | 103. *Charadrius mongolus* | (29) Apodidae | 244. *Cettia robustipes* |
| 30. *Platalea minor* | 104. *Charadrius leschenaultii* | 174. *Apus pacificus* | 245. *Acrocephalus arundinaceus* |
| ■ ANSERIFORMES | 105. *Charadrius asiaticus* | 175. *Apus affinis* | 246. *Acrocephalus bistrigiceps* |
| (8) Anatidae | 106. *Charadrius veredus* | ■ CORACIIFORMES | 247. *Acrocephalus agricola* |
| 31. *Anser cygnoides* | (19) Scolopacidae | (30) Alcedinidae | 248. *Acrocephalus aedon* |
| 32. *Anser fabalis* | 107. *Numenius phaeopus* | 176. *Ceryle rudis* | 249. *Phylloscopus fuscatus* |
| 33. *Anser anser* | 108. *Numenius arquata* | 177. *Ceryle lugubris* | 250. *Phylloscopus proregulus* |
| 34. *Anser erythropus* | 109. *Numenius madagascariensis* | 178. *Alcedo atthis* | 251. *Phylloscopus borealis* |
| 35. *Dendrocygna javanica* | 110. *Numenius minutus* | 179. *Halcyon smyrnensis* | 252. *Phylloscopus inornatus* |
| 36. *Tadorna ferruginea* | 111. *Limosa limosa* | 180. *Halcyon pileata* | 253. *Phylloscopus trochiloides* |
| 37. *Tadorna tadorna* | 112. *Limosa lapponica* | (31) Meropidae | 254. *Cisticola juncidis* |
| 38. *Anas acuta* | 113. *Tringa erythropus* | 181. *Merops leschenaulti* | 255. *Orthotomus sutorius* |
| 39. *Anas crecca* | 114. *Tringa totanus* | 182. *Merops philippinus* | 256. *Prinia subflava* |
| 40. *Anas formosa* | 115. *Tringa stagnatilis* | (32) Coraciidae | 257. *Prinia flaviventris* |
| 41. *Anas falcata* | 116. *Tringa nebularia* | 183. *Eurystomus orientalis* | 258. *Ficedula narcissina* |
| 42. *Anas platyrhynchos* | 117. *Tringa glareola* | (33) Upupidae | 259. *Ficedula mugimaki* |
| 43. *Anas poecilorhyncha* | 118. *Tringa ochropus* | 184. *Upupa epops* | 260. *Ficedula parva* |
| 44. *Anas strepera* | 119. *Tringa hypoleucos* | ■ PICIFORMES | 261. *Ficedula strophiata* |
| 45. *Anas penelope* | 120. *Xenus cinereus* | (34)Picidae | 262. *Ficedula cyanomelana* |
| 46. *Anas querquedula* | 121. *Arenaria interpres* | 185. *Jynx torquilla* | 263. *Muscicapa sibirica* |
| 47. *Anas clypeata* | 122. *Heteroscelus brevipes* | ■ PASSERIFORMES | 264. *Muscicapa ferruginea* |
| 48. *Aythya ferina* | 123. *Limnodromus semipalmatus* | (35)Pittidae | 265. *Muscicapa muttui* |
| 49. *Aythya baeri* | 124. *Calidris acuminata* | 186. *Pitta nympha* | 266. *Muscicapa latirostris* |
| 50. *Aythya fuligula* | 125. *Philomachus pugnax* | (36)Hirundinidae | 267. *Muscicapa thalassina* |
| 51. *Nettapus coromandelianus* | 126. *Tringa guttifer* | 187. *Hirundo daurica* | 268. *Niltava hainana* |
| 52. *Mergus squamatus* | 127. *Gallinago stenura* | 188. *Delichon urbica* | 269. *Terpsiphone paradisi* |
| 53. *Mergus serrator* | 128. *Gallinago megala* | 189. *Hirundo rustica* | 270. *Terpsiphone atrocaudata* |
| 54. *Mergus albellus* | 129. *Gallinago gallinago* | (37) Motacillidae | (46)Paridae |
| 55. *Cygnus columbianus* | 130. *Scolopax rusticola* | 190. *Dendronanthus indicus* | 271. *Parus major* |
| ■ FALCONIFORMES | 131. *Calidris ruficollis* | 191. *Motacilla flava* | (47) Nectariniidae |
| (9) Accipitridae | 132. *Calidris subminuta* | 192. *Motacilla cinerea* | 272. *Nectarinia jugularis* |
| 56. *Milvus migrans* | 133. *Calidris temminckii* | 193. *Motacilla alba* | 273. *Aethopyga christinae* |
| 57. *Elanus caeruleus* | 134. *Calidris alpina* | 194. *Anthus hodgsoni* | (48) Zosteropidae |
| 58. *Accipiter soloensis* | 135. *Calidris tenuirostris* | 195. *Anthus novaeseelandiae* | 274. *Zosterops japonica* |
| 59. *Accipiter trivirgatus* | 136. *Calidris ferruginea* | 196. *Anthus cervinus* | (49) Ploceidae |

Annex 5 *cont.* List of Mangrove Associated Birds in China.

| | | | |
|---|---|---|---|
| **■ GAVIIFORMES** | **(12) Turnicidae** | 145. *Larus argentatus* | **(42)Oriolidae** |
| 60. *Accipter nisus* | 137. *Crocethia alba* | **(38)Campephagidae** | 275. *Passer montanus* |
| 61. *Accipter virgatus* | 138. *Limicola falcinellus* | 197. *Coracina melaschistos* | 276. *Lonchura striata* |
| 62. *Buteo buteo* | **(20)Recurvirostridae** | 198. *Pericrocotus roseus* | 277. *Lonchura punctulata* |
| 63. *Butastur indicus* | 139. *Himantopus himantopus* | 199. *Pericrocotus divaricatus* | **(50)Fringillidae** |
| 64. *Pandion haliaetus* | 140. *Recurvirostra avosetta* | **(39)Pycnonotidae** | 278. *Carduelis sinica* |
| 65. *Aquila heliaca* | **(21) Phalaropodidae** | 200. *Pycnonotus jocosus* | 279. *Ecphona migratoria* |
| 66. *Circus aeruginosus* | 141. *Phalaropus lobatus* | 201. *Pycnonotus sinensis* | 280. *Emberiza rutila* |
| 67. *Circus spilonotus* | **(22) Glareolidae** | 202. *Pycnonotus aurigaster* | 281. *Emberiza aureola* |
| **(10) FaLconidae** | 142. *Glareola maldivarum* | **(40)Laniidae** | 282. *Emberiza elegans* |
| 68. *Falco peregrinus* | **■ LARIFORMES** | 203. *Lanius cristatus* | 283. *Emberiza spodocephala* |
| 69. *Falco subbuteo* | **(23) Laridae** | 204. *Lanius collunoides* | 284. *Emberiza pusilla* |
| 70. *Falco tinnunculus* | 143. *Larus crassirostris* | 205. *Lanius schach* | 285. *Emberiza fucata* |
| **■ GALLIFORMES** | 144. *Larus canus* | **(41)Dicruridae** | 286. *Melophus lathami* |
| **(11) Phasianidae** | | 206. *Dicrurus macrocercus* | |
| 71. *Coturnix coturnix* | | 207. *Dicrurus leucophaeus* | |
| **■ GRUIFORMES** | | 208. *Dicrurus hottentottus* | |

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Global Environment Facility

**NATIONAL REPORT**

**on**

# Mangroves in the South China Sea

## INDONESIA

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# 1. INTRODUCTION

In Indonesia, 13 provinces has been identified bordering directly with the SCS viz. Riau, Jambi, South Sumatra, Bangka Belitung, Lampung, Banten, DKI Jakarta, West Java, Central Java, East Java, West Kalimantan, Central Kalimantan, and South Kalimantan. Data collected from all 13 provinces consists of secondary and primary data. The secondary data will includes distribution areas of mangroves, geographical information (position, topography, total area of region and mangrove forest, and land-uses), biological information (flora, fauna, and aquatic biota), utilisation, and socio-economic and socio-cultural aspects. Based on the evaluation of secondary data, primary data will be collected from selected provinces at the priority sites, e.g., West Kalimantan, DKI Jakarta and Bengkalis. Primary data will consist of biological, physical and socio-cultural information's, and utilisation.

Sources of secondary data will be collected from Faculty of Forestry, Faculty of Fisheries of the Bogor Agricultural University (BAU) Bogor, the Centre for Marine and Coastal Resources Studies, BAU Bogor, LPPM Bogor, Birdlife International, Wetland International-Indonesia program, LIPI, Department of Forestry, Department of Home Affairs, Department of Marine and Fisheries and State Ministry of Environment.

# 2. MANGROVE ECOSYSTEM IN 13 PROVINCES SURROUNDING THE SOUTH CHINA SEA

## 2.1 Extend of Mangrove Forest

Data on total area of mangrove forest in Indonesia are very varies from 3,177,700ha (Bina Programme Kehutanan, 1973), 3,707,100ha (UNESCO, 1979), 4,251,011ha (Bina programme Kehutanan, 1982) to 4,355,553ha (Intag Departemen Kehutanan, 1993). This is due to the facts that estimated value of mangrove forest are differentiated from one to another along with their different definition of the border zone they used. In 1989 to 1996, the Department of Forestry (1999) by using Landsat Imagery estimated that the total area of mangroves in Indonesia amounted to be 3,533,660ha, consisting of protected forests (424,800ha), Nature Reserve and Recreation Forest (674,600ha), Natural Forest Production (583,600ha), Production Forest (372,400ha), Production Forest for Conversion (928,900ha) and Other Forest Land-use (449,300ha).

Inventory of degraded mangrove forest conducted by the Department of Forestry (1999) shows that the mangrove forests in Indonesia covers an area of about 9,248,039ha, consisting of state forest land (3,720,187ha) and non-state forest land (5,527,852ha). From the above figure, about 5,579,116.53ha (60.32% of the total mangrove forest in Indonesia, and 1,877,605.51ha and 3,701,511.02ha belong to state and non-state forest areas, respectively) is found in the provinces at surrounding the South China Sea (SCS).

## 2.2 Mangrove Forests for Forestry Exploitation

The area of mangrove forest managed by Indonesian forest concessions (HPH, and HPHTI) at the surrounding SCS in 1982 amounted to be 226,000ha, and in 2000 it will be 172,143ha and managed by 9 companies. The mangrove forests managed by HPH used to be exploited for their wood as a raw material for chip industry. In some locations of West Kalimantan, the holders of HPH concession having less performance and their permission are terminated by the recent government policy (No log export regulation).

## 2.3 Mangrove Forest to be rehabilitated

Rehabilitation activity for mangrove forests commencing since the early of 1960 in Java and conducted by Perum Perhuani (The State Forestry Corporation). In connection with conserving of the mangrove forest and referring to needs of the people for agricultural lands, Perum Perhutani has developed a tambak tumpang sari system or tambak empang parit, call as silvo-fisheries. It was reported that about 20,000ha of degraded mangrove forests in the northern coast of Java have been rehabilitated successfully with *Rhizophora* spp. and *Avicennia* spp. For Segara Anakan, 105ha of degraded mangrove forests have been rehabilitated too, with *Rhizophora* sp. and *Bruguiera gymnorrhiza*. DitJen RLPS of the Department of Forestry have been rehabilitating the degraded mangrove forests in 12 provinces with a total area of 15,830ha.

Table 1 shows Extent, Distribution and Number of Changed Mangrove Forest Area in the South China Sea (at 13 provinces in Indonesia) during 1982-1999. Also, Figure 1 illustrates the Map of Mangrove Distribution in Indonesia.

Table 1 Extent, Distribution and Number of Changed Mangrove Forest Area in the South China Sea (at 13 provinces in Indonesia) in 1982–1999.

| No. | PROVINCE | EXTENT (ha) | | | | | | | MUMBER OF CHANGED 1982-1999 (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | STATE FOREST (SF) | | | | | | NON STATE FOREST (NSF) | | | |
| | | BIPRAN (1982) | PHPA-AWB (1987) | INTAG (1993) | RePPPRoT 1985-1989 | GIESEN (1993) | RLPS (1999) | RLPS (1999) | (3) – (5) | (5) – (8) | (3) – (8) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| 1. | Riau | 276,000 | 470,000 | 221,050 | 239,900 | 184,400 | 551,747.79 | 603,373.68 | -19.91 | +149.6 | +99.91 |
| 2. | Jambi | 65,000 | 50,000 | 13,450 | 18,00 | 4,050 | 36,703.50 | 226,645.51 | -79.31 | +172.9 | -43.53 |
| 3. | South Sumatera | 195,000* | 110,000* | 363,430* | 240,700* | 231,025* | 458,562.29 | 429,811.55 | +86.37 | +61.8 | +201.48 |
| 4. | Bangka Belitung | 0 | 0 | 0 | 0 | 0 | 129,317.42 | 29,205.23 | Tak hingga | Tak hingga | Tak hingga |
| 5. | Lampung | 17,000 | 3,000 | 49,440 | 31,800 | 11,000 | 10,762.07 | 7,607.91 | +190.82 | -78.2 | -36.69 |
| 6. | West Java and DKI Jakarta | 28,608** | 5,700** | 8,200** | 8,200** | 55,000** | 32,314.40 | 66,844.41 | -71.34 | +308.0 | +16.94 |
| 7. | Banten | 0 | 0 | 0 | 0 | 0 | 1,139.31 | 27,999.14 | Tak hingga | Tak hingga | Tak hingga |
| 8. | Central Java | 13,576 | 1,000 | 18,700 | 18,700 | 13,570 | 18,931.67 | 76,406.35 | +37.74 | +1.2 | +39.45 |
| 9. | East Java | 7,750 | 500 | 6,900 | 6,900 | 500 | 42.22 | 97,669.98 | -10.97 | -99.4 | -99.46 |
| 10. | West Kalimantan | 40,000 | 60,000 | 194,300 | 205,400 | 40,000 | 86,918.03 | 252,907.00 | +385.75 | -55.3 | +117.30 |
| 11. | Central Kalimantan | 10,000 | 20,000 | 48,740 | 28,700 | 20,000 | 474,999.90 | 1,750,586.90 | +387.40 | +874.6 | +4650.00 |
| 12. | South Kalimantan | 66,650 | 90,000 | 120,780 | 112,300 | 66,650 | 76,166.91 | 132,453.36 | +81.22 | -36.9 | +14.28 |
| Total | | 719,584 | 810,200 | 1,044,990 | 892,618 | 626,195 | 1,877,605.51 | 3,701,511.02 | | | |

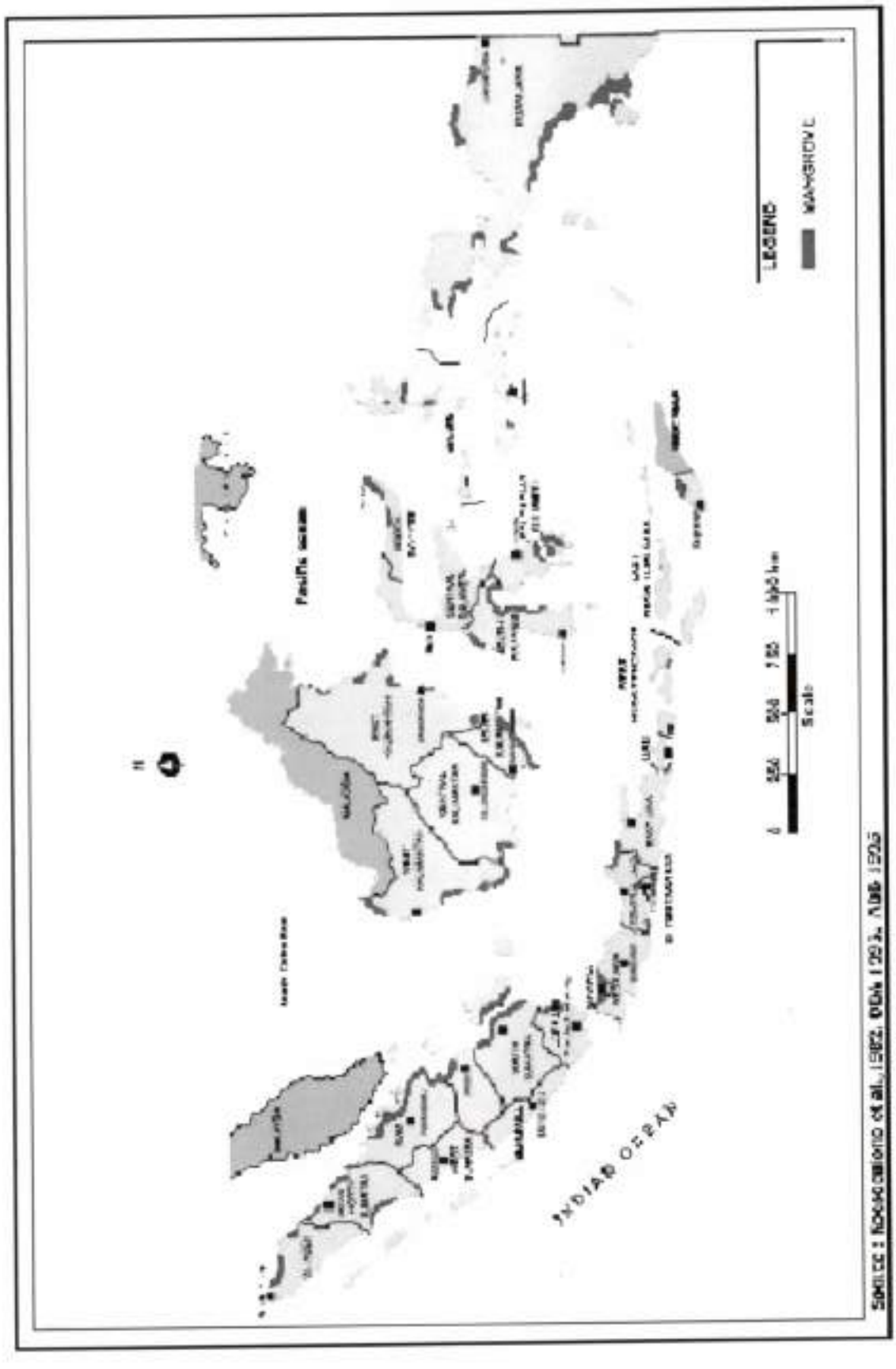


Figure 1 Map of Mangrove Distribution in Indonesia.

# 3. MANGROVE ECOSYSTEM CONDITION SURROUNDING THE SCS

## 3.1 Characteristics

### 3.1.1 Mangrove Zonation

In Indonesia the mangrove forests can be divided into two geographical zone, viz. Asia zone and Oceania zone. Both zones have highest plant, animal and micro-organism diversity than the other zones in the world. This is primarily due to the nature of the region that the islands have different characters with each other, even site by site in the same island. The harmonised system between mangrove forest resource and their specific substrate produce the life characters of heir species.

According to their substrates, mangrove species grow characteristically as zone by zone. And can be identified as follows: in the seaward edge as *Sonneratia* and *Avicennia* zone and followed by *Rhizophora, Bruguiera, Ceriops* and *Nypa* association zones at the inland-ward edge. All zones will be inundated by tides and at sea edge zone will receive strong wind and wave energies, and different salinity regimes than the other zones. At the areas in the sea edge zone with high salinity and soft mud substrate, *Sonneratia* spp. plays as pioneer species followed by *Avicennia* spp. as the substrate more compact. As the distance from the sea edge increased and the soil will be more compacted in the land ward areas, transition zone will be formed and the species of terrestrial forest occurs as a marginal species. The species configuration and changes at the sites examined are the response to the environmental gradients and usually call as succession. Species zonation in the mangrove forests therefore, is determined by change and period of inundation, soil salinity, sun shine intensity, tides and freshwater flows. It means that different location will have different zonation. For instance in Rambut island, 3 zones from sea edge to inland are identified as: *Rhizophora mucronata, R. stylosa*, and *Scyphyphora hydrophyllacea*, and *Lumnitzera racemosa.*

In Riau province, the mangrove forests usually zoned by *R. apiculata* and *R. mucronata* at the sea edge zone, and than mixed of *R. apiculata* and *Sonneratia alba* at the sand sediment substrates, and with *Avicennia marina* and *A. officinalis* at the muddy sediment.

At the upper rivers, *Nypa fruticans* will be abundance and sometimes associated with single of *S. caseolaris* trees. In the inland part of the zone, *Bruguiera cylindrica* and *Xylocarpus granatum* are found and will be followed by *B. gymnoorhiza, B. parviflora, X. moluccensis, Ceriops tagal, Heritiera littoralis, Lumnitzera littorea* and *Excoecaria agallocha* as the common species in the inland zone running to terrestrial zone, as the species of palm, *Oncosperma tigillaria* occurs if the area become freshwater swampy.

In Lampung province, the mangrove forests in the accretion area mostly dominated by both *Avicennia alba* and *A. marina*, and at the estuaries area will be by *E. agallocha*. Than at upper river by *Nypa fruticans, S. caseolaris*, and *X. granatum* as freshwater effect will more prominent. At the sandy habitat of the mangroves associated with coral reef, *R. stylosa* dominates. This is a common feature in the islands of Lampung Bay and along their coastline.

### 3.1.2 Habitats

As the transition zone between sea and terrestrial land, the mangrove ecosystems have shape environmental gradient. Tidal currents in the sites is one factor controlling the changes of water salinity and temperature, and as a result only the specific plant species and their animals who have tolerant to that regime will exist and growth and develop in the mangrove forest. Consequently, the biota's of mangrove have low diversity but have high in number of individual.

Although the mangrove habitat is specific, every marine biota will have an environmental range for their occurrences and niche. This will caused the form of mangrove community at different sites along with their species composition. Factors that are play essentially as ecological preference will consist of: (1) Soil type: hard or soft, sand and clay contents in different ratio, (2) Salinity: daily variation and average annual value roughly equal to the frequency, depth and period of flooding, (3) Ability of species cope with current and wave, and (4) Combination of germination and growth of seedling in related to ecological amplitudes of species in responding the above three factors.

In the following zones, *Bruguiera cylindrical* present mixed with *B. parviflora, Rhizophora apiculata* and *R. mucronata* and finally in landward side with *Xylocarpus granatum* (the canopy will reach up to 35-40m tall).

At the deep mud with soft characters, *Rhizophora* species distributed locally and *R. mucronata* is the typical species at the soft mud substrate and *R. stylosa* at the sandy and coral single substrate while

*R. apiculata* is the species at the transition between both substrates. Mangrove forests at the landward side, far from sea edge, usually form as pure stands.

There are close relationship with the tide factor, especially in the estuarine and lagoon areas. At the inland part of both estuarine and lagoon areas, *Rhizophora* will be replaced by *Lumnitzera*, a species of more less salty.

The effect of current velocity can be learned daily along the river, and at the side of river during the strong current, e.g., in the tributary, usually mangrove found typically mixed with a palm species, *Nypa fruticans*.

### 3.1.3 Physical Charatristics

**a. Soil**. In Indonesia, soil types in the mangrove forest can be classified into several land systems as follows:

**a.1-PRT Land System (Rotan island)**. The land system have a landform of coral islands and reefs with slope <2% and relief of <2m. The soils type is tropopsaments with their parent materials from young marine sediments, sand and gravel. Tropopsament soils at this land system have a sandy clay texture with consistency of clay at each layer. Drainage of the soil in this land system generally slightly buds with brown in colour of chroma 4, pH in $H_2O$ ranges from 6.0-7.0 and no pyrite at the <100cm depth can be found (Dephutbun and PT, 1998).

**a.2-KHY Land System (Kahayan)**. The land system have a landform of lower river dikes and alluvial slope of combination between estuarine and terrestrial areas. KHY system have a slope <2% and relief of 2-10m. The soil type is tropohemist with their parent material from peat of medium ripening (Dephutbun and PT, 1998). In the area free of mangrove forests, tropohemist soils have silty clay up to clay in texture with high consistency, bud drainage and blackly in colour at the chroma 2 and pH of 7-8. Pyrite potential in the amount of 0.19% and 0.85% can be found at a depth of 70-100cm and 100-120cm, respectively. And the decreasing of pH (in $H_2O$) up to 3 degree (with the oxidation of $H_2O_2$) is the form of their identity. The content of pyrite at the different depth layer was 0.23%, 0.75% and 0.41%, respectively (Dephutbun and PT, 1998).

**a.3-PTG Land System**. The soil type in this land system belong to tropoquents, with clay texture and have moderate consistency, bud drainage and grey in colour, pH (in $H_2O$) ranges from 5.0-8.0. Pyrite potential can be found in a depth of 30-50cm and 50-90cm, which indicated by their decreasing of pH (in $H_2O$) up to 3-4 degree with the oxidation by $H_2O_2$. The content of pyrite at the different depth layer was 1.395 and 1.90%, respectively (Dephutbun and PT, 1998).

**a.4-KJP Land System**. The soil type in this land system belongs to hydraquents, and found in the less density of mangrove stands. At that condition, the texture of the soil will be sandy clay up to clay with moderate consistency, bud drainage, grey in colour, pH 9 in $H_2O$) ranges from 6.0-7.0 and no pyrite can be found at a depth of less than 100cm (Dephutbun and PT, 1998). Hydraquent soils which found in the dense mangrove forests have a sandy clay up to silty clay in texture with high consistency, very bud drainage, grey in colour, pH (in $H_2O$) range from 6.0-6.5 and no pyrite can be found less than 100cm.

**a.5-MKS Land System**. The soil type in this land system belongs to fluvaquents with their parent materials from young marine alluvium sediments. The soil type have a silty clay in texture and moderate to high consistency, bud drainage, grey in colour, pH (in $H_2O$) ranges from 7.0-8.0. Pyrite potential can be found at a depth of 30-50cm, 50-70cm and 70-100cm with 0.03%, 0.06% and 0.05%, respectively (Dephutbun and PT, 1998).

**a.6-UPG Land System**. The soil type in this land system belongs to dystropepts with their parent materials from young marine alluvium sediment and coastal sand. The soil type have a silty clay and clay in texture, and moderate to high in consistency, bud drainage, grey-brown in colour, pH (in $H_2O$) ranges from 5.5-6.0 and no pyrite can be found at a depth of less than 100cm (Dephutbun and PT, 1998).

**b. Water**. The water quality of mangrove forests at the SCS region very varies, event up to their limiting layer for some parametre, e.g., in the Jakarta Bay DKI. The water quality at Muara Angke mangroves have been polluted by industrial waste and domestic waste. At the bottom sediment of tambak and their water canal, oil and heavy metals pollutant have been found, e.g., 6.176-10.882 ppm/g for Cu, 6.666-8.000ppm/g for Pb and 0.4000-0.450ppm/g for Hg.

Generally, the water quality in the Riau waters in October 2000 shown highest than the standard for marine biota both for mariculture and marine park, e.g., for Cu, Cd and Pb are less than the value of quality standard, but the degree Hg (minimum: <1mg/l) and Cr (minimum: <0.001mg/l) are higher than the quality standard. In the Riau islands, generally the waters are in good condition, especially for Batan island groups, Rempang and Batam islands, Senayang, Lingga and Singkep island groups, and surrounding Bintan Island. Temperature, salinity, pH and DO values indicated of their normal condition for tropical waters, even thus for upper and lower layers at different sites. At the western side of Riau islands, e.g., in the south and west parts of Karimun Island and Kundur Island, the waters condition are more turbid.

Based on the standard criteria of water quality for fishery culture (SK. Menteri Negara KLH No. 02/MENKLH, 19 Januari 1988), the water parameter in West Kalimantan waters such as temperature, turbidity, salinity, DLH, DO, $CO_2$ are in good condition to support the marine biota normally. But pH, DMA, COD and BOD are poorly in quality for that marine biota.

**c. Hidro-Oceanography**. In the SCS region, there are some rivers which affected the growth of mangrove, viz. Siak, Siak Kecil, Mandau rivers in the Riau province, Berbak and Batanghari rivers in the Jambi province, Mesuji, Lala, Banyuasin and Musi rivers in the South Sumatra province, Mesuji, Way Seputih, Way Sekampung and Tulang Bawang rivers in the Lampung province, Cisadane, Cidurian, Cibanten, Cidanau and Cipasuruan in the Banten province,Citarum and Cimanuk rivers in the West Java province, Brantas, Konto and Kali Madiun rivers in the East Java province, Kapuas river in West Kalimatan province, Mentaya, Katingan, Sebangau, Kahayan, Kapuas and Barito rivers in South Kalimantan province. It is therefore, the influence of tides for mangrove species distribution in Indonesia need to be studies in detail.

### 3.1.4 Environmental Classes of Mangrove Forest

Based on the environmental setting, the type of mangrove forests can be grouped into 4, viz. (a) Delta type: Formed in the estuaries of big river, and their sediment load in the river flow are deposited vastly formed as delta and generally their morphology are as tributary. Such a delta system can be found in Sumatra (e.g., Musi river delta, Tembilahan delta, Siak river delta). (b) Mudflat. Mudflats are found in the sea shores, generally typified by vast river flow, high tidal current and distributed sediments which become terrestrial lands. Widest sedimentation along with the tidal current and river erosion will threat the mangrove forests. (c) Terrestrial islands. The small island and their substrates consist of terrestrial sediment and marine carbonate sediment, and usually occupied by water during high tides. At low tides, the island represent of unique habitat for mangroves, e.g., Seribu islands. (d) Terrestrial shores. The habitat formed as a narrow strip in the shores, and mostly consists of sand, coral single and sandy mud. Here, the mangrove growth as a fringing mangrove community, e.g., in east shore of Lampung and South Sumatra and northern coast of West Java.

## 3.2 Biodiversity

### 3.2.1 Flora

70 species of mangrove plants are identified in the world, and 40 species of which are found in SE. Asia, 15 species in Africa and 10 species in America. It was reported that 15 families along with 18 genera and 41 species, and 116 associated species are to be found in the mangrove ecosystem in Indonesia. At present, many reports claim that at least 101 species of mangrove plants can be identified and belonging to several families and life-forms such as, trees (47 species), scrubs (5 species), herbs and grasses (9 species), liana (9 species), epiphytes (29 species) and parasites (2 species). While at the 13 provinces of the SCS region, there will be 36 species of true mangroves, 11 species of associated and 38 species of marginal plants.

Based on the dominant tree species, the mangrove communities found in the SCS region can be formed as stand associations. Five associations can be identified as *Avicennia, Rhizophora, Sonneratia, Bruguiera* and *Nypa consocies*. Generally, the *Bruguiera – Rhizophora* associations are commonly found in Indonesia. From biodiversity point of view, at the transition zone between mangroves and fresh water swamps, there will be more species to be found.

### 3.2.2 Fauna

In the 13 provinces of the SCS region, there will be 48 species of mammals, 27 species of reptiles, and 333 species of birds. Marine fauna reported to be 522 species of fish, 116 species of crustaceans, 275 species of gastropods, and 162 species of bivalves.

### 3.3 Socio-economic of Societies

The total area of 13 provinces to be 1,011,148km$^2$ (or 53.48% of the total area of Indonesia) and only 48 districts can be included with a total area of 312,703.25km$^2$ (or 16.54% of the total area of Indonesia). The population of 13 provinces was 152,244,395 peoples (or 73.81% of the Indonesian population), and for the 48 district amounted to be 88,475,396 peoples (or 42.89% of the Indonesian population). The number of district closed to the SCS region amounted only 16.54% with a total population of 42.89%. This means that most population living in the coastal zone, and represent as threats for the mangrove forests.

### 3.4 Utilisation of Mangrove Forests

#### a. Charcoal

In both provinces of Riau and West Kalimantan, mangrove charcoal produced based on the HPHH permission. This traditional production called as panglong system with Chinese technology, popularised of about hundreds years ago. The mangrove plants used as the best species for charcoal materials were *Rhizophoraceae* (*Rhizophora apiculata, R. mucronata* and *Bruguiera gymnorrhiza*). The production of mangrove charcoal in 1998 was 330,000 tonnes, and mostly exported to Japan and Taiwan through Malaysia and Singapore. The FOB export price of charcoal was US$1,000.00/10 tonnes, and at the local markets will be varies from Rp350 to Rp950/kg (Batu ampar, West Kalimantan). The total amount of exported charcoal in 1993 was 83,000,000kg worth at about US$13,000,000 (Rp105,214,000).

#### b. Firewood

The mangrove species having a good quality for firewood and produced high heating and permanent, except for *Avicennia* spp. and *Sonneratia* spp. the market price of firewood in the villages in East Java reach up to Rp13,000/m$^3$. Every cubic meter of firewood of mangrove plants can be used for cooking for one month/family (with 3 children's). One peace of firewood pole with 8cm diameter and 50cm length are enough for cooking rice for 5 persons of one family.

#### c. Construction materials.

The mangrove species suitable for construction materials are *Rhizophora apiculata, R. mucronata* and *Bruguiera gymnorrhiza*, usually for kaso, pole, and wood plane. The price for kaso with 4-5cm diameter and 3-4m length is Rp 1,500/pole.

#### d. Chip

Generally, the mangrove forest allocated for producing chip will be managed under the HPH concession. Silviculture system adopted for exploiting the mangrove forests for chip was KS. DirJen Kehutanan No. 60/Kpts/DJ/I/1978: selecting cutting system, 30 years rotation, tree cutting with diameter >10cm, and 40 trees/ha for mother trees (diameter >20cm), planting system in the abandoned logging areas, green belt protection along the riverbank/coastlines.

In 1998, the total amount of chip production in Indonesia was 250,000 tonnes, and mostly exported to Japan and Korea. The production area of chip distributed in the provinces of Riau, West Kalimantan, East Kalimantan and Irian Jaya. The price of chip in international markets was US$40/tonnes. The mangrove chips are very comparable to the other chip (*Acassia mangium*) in the level of price and quality including the transportation fee (using water transportation facility). For producing chip sustain, the sizeable of mangrove forests with their good potential of wood are needed.

#### e. Tannin

Tanning can be produced from the bark of the mangrove species, such as *Rhizophora Apiculata, R. mucronata* and *Xylocarpus granatum*. The liquid concentration of extract called as catch are exported in the high amount and used for colouring the skin products (bags, shoes etc.). This material are no longer exported and replaced by chemical synthetic products. In the fishermen community in Indonesia, mangrove tannin is still useful for colouring the fishing nets.

#### f. Nipa

Nipa palm (*Nypa fruticans*) are one of mangrove plants commonly used by local peoples for traditional materials such as leaf for thatching materials (5 years life), cigarette wrappers, and the young fruits are for foods (es, manisan, table fruit, wajid), and their nira are source for sugar production. The atap (shingle) of nipa in Riau markets are Rp200/peace, and the sugar in Cilacap reach up to Rp2,000/kg (in November 1999).

**g. Medicinal plants**

The mangrove plants are source of medicinal materials at the traditional level. The decoction of *R. apiculata* is used as astringent, and bark of *R. mucronata* are useful for blood purification. The decoction of *Ceriops tagal* is useful as antiseptic treatments, and *Acanthus ilicifolius* for diabetes, and *Xylocarpus granatum* fruits mixed with rice powder are for skin repellence and against skin diseases.

**h. Fishery**

One of the important utilisation of mangrove ecosystem in term of fishery is their habitat for supporting the life of marine biota through producing biomass (litterfall: leaf, branch and twig). The decomposition of their litter by microorganisms will finally produced detritus suitable for many planktonic organisms, and will be a source of food for fishes, crabs and shrimp.

Roots systems of the mangrove forest represent a shelter for protecting the marine biota. Those conditions determine the mangrove forests as a habitat for catching shrimp, fish and crab.

Milkfish culture in the brackish water has been practiced in Indonesia for more than 300 years. President Decree No. 39/1980 issued by the government is concern with the bund of pukat harimau. Since the time of that effective, tambak develop vastly in the coastal zone along with their high international demand and increasing price in the market. In 1975, the total area of tambak in Indonesia was 180,000ha with their production amounted to be 9,600 tonnes, and in 1991 increased to 290,000ha with production of 140,000 tonnes. The tambak distributed in Java (45%), Sulawesi (35%), Sumatra (17%) and the rest are found in scattered areas in Kalimantan, Maluku and Irian Jaya.

The productivity of tambak with extensive technology will be up to 3-5 years, and with traditional technology or extensive can be up to 300 years. The extensive tambak consists of silvofisheries (leads by Perum Perhutani) and tambak traditional. Tambak traditional have been managed by people with mangrove tree cultured at the dikes, e.g., in Curah Sawo Probolinggo.

There are some of tambak development friendly environment developed in Indonesia, namely: **(a) Empang Parit**. This model used by government for rehabilitation programme. This is moderate system of silvofishery or wanamina with their tidal creeks surrounding the *Rhizophora* stands. At the 8-10 years old, the thinning production can be harvested as a pole, and the final product will be at 20-30 years as wood product. The additional product can be found such as shrimp, fish and crabs from the keramba culture. The area development of mangrove hopefully will be produced shrimp as feeding grounds. At the design of this model, water canals will be narrow and consequently the tannin content will be increased and the water volume will be lower for fish and the water will shade by the canopy. The model recommended as much as 10ha in size per unit with 2ha of tambak in centre and surrounded by 8ha of *Rhizophora* plantation. **(b) Silvofishery**. The model will be used for industrial fishery with small scale productivity for supporting the mangrove conservation. The goal of the model was to produce fish, shrimp and to protect the mangrove plantation as vegetation, and no cutting will be allowed. The ration between tambak and mangrove land will be 20%: 80% up to 50%: 50%. Along the line of 5-10m wide in the riverbank and/or creeks and in the coastline will be protected as silvofishery areas. Due to their wide is more than empang parit system, the water supply will much better for the growth of mangrove plants and so the negative impact of tannin content will be reduced. The model has been implemented in Subang district by the Perum Perhutani (The State Forestry Corporation). **(c) Wanamina wood model**. The model has attractive capacity as the above model, and practiced for producing wood for firewood, and managed as the surrounding area for tambak. The smaller unit of land for the model will be 25ha, and zone with 5-10m wide along the coastline, river bank and small river will left as protection area. The 0.5ha tambak for fish will separated 100m away from the mangrove stands. The ration of tambak and mangrove land will 20-80% and the minimum unit for tambak will be 5ha and 20ha for mangrove plants. The mangrove plantation will managed for wood at the 20 years rotation. **(d) Integrated mangrove culture**. The model implemented for supporting the daily life of people with the diversity product of fish along with their agricultural crops. At the model, mangrove plays an important role as protected agent, firewood source, foliages for animals and shading plant for crops. **(e) Tambak extensive model with mangrove plants**. The management of tambak extensive has been practiced since a memorial, and technically as a mangrove-friendly aquaculture. The owner of tambak will planting the mangrove along their dikes, And usually they used *Rhiozophora* spp. and *Avicennia* spp. with 5-10m distance. The mangrove with high canopy and dense of stands will reduced the sunshine for tambak and finally will affect the growth of shrimps. Based on those facts, the recommended will be cutting and replanting rotation of 20 years period.

### i. Agriculture

The fruits of Nipa (*N. fruticans*) and pedada (*S. caseolaris*) are source of edible mangrove plants, and very often consumed by people for traditional cake. The fruits of tumu (*B. gymnorrhiza*), api-api (*Avicennia* spp.) and bakau (*Rhizophora* spp.) can be eaten too, but must be processed and cooking for safely food. The foods recipes of mangrove plants are available at the LPP Mangrove Bogor (26 recipes), and need for further socialisation. Honey beetle are common in mangrove forests, and Pidada flowers (*Sonneratia caseolaris*) are the plants suitable for producing honey. This is another minor product from mangrove forests and potentially need to be improved. The mangrove forests play an important role for wind breaking, protection from erosion and abrasion, and finally very important barrier for protecting the agricultural land and their settlements. It is therefore, the conversion of mangrove forest into another land use types such as coconut and oil palm plantations, sawah (rice field) will adversely affected the coastal zone itself due to salinity and sulfates contexts.

## 3.5 Problems

Mangroves growth and developed under the optimal condition of inundation and continued water circulation in the upper layer. The fixed circulation of the tides will increase the input of nutrient and oxygen for the respiration and production activity of plants. The waters with low salinity will reduce salt and alkaline materials. It is remembered that salty waters can neutralised the soil acidity. Generally, mangrove ecosystem has a resistance to the kinds of threats and environmental stress. Unfortunately, the mangroves are vulnerable to the sedimentation and sediments character, and finally can alter the oxygen content for respiration, and can cause the mangrove mortality. The change of thus factors controlled to the salinity pattern in the substrate can cause the species composition, and salinity over than 90ppt can damaging the mortality of biota in number of amount. The salinity change can be happen due to the change of hydrological cycle, freshwater flow and leaching by the damp, and others activity of water treatment. The main problems of digging or stress to the mangrove ecosystem originally come from the human needs for conversing the mangrove forest into the other areal for housing, commercial purposes (industrial area, harbours, tambaks) and agricultural lands. On the otherhand, the increasing demands for wood products cause the over-exploitation of mangrove forests.

Since 1992, Spatial Land-use Planning for provincial and district levels implemented for appropriate mangrove management status at the some sites. Based on the Spatial Land Use, the mangrove forests included in both the Protected Area and Culture Area (Forestry culture, Fishery and Agricultural cultures). At the some sites, the mangrove forest areas included in the protected areas, so that the position will be debating controversially against the previous policy.

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Annex 1 List Species of Mangrove of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | |
| 1 | Jeruju putih | *Acanthus ebracteatus* | Acanthaceae | | | + | | | | | | | | | | | |
| 2 | Jeruju hitam | *Acanthus ilicifolius* | Acanthaceae | + | | + | + | | | | | | | | + | + | |
| 3 | Piai raya | *Acrostichum aureum* | Pteridaceae | + | | + | + | | | | | | | + | + | + | |
| 4 | Piai lasa | *Acrostichum speciosum* | Pteridaceae | | | | + | | | | | | | | | | |
| 5 | Teruntun | *Aegiceras corniculatum* | Myrsinaceae | + | + | + | + | | | | | | | + | | | |
| 6 | Teruntun | *Aegiceras marina* | Myrsinaceae | | | | | | | | | | | | | + | |
| 7 | Api-api | *Avicennia aecalyptifolia* | Avicenniaceae | | | | | | | + | + | | | | | | |
| 8 | Api-api | *Avicennia alba* | Avicenniaceae | | + | + | + | | + | + | | + | + | + | | | |
| 9 | Api-api | *Avicennia lanata* | Avicenniaceae | | | | | | | | | | | + | | | |
| 10 | Api-api | *Avicennia marina* | Avicenniaceae | + | + | + | + | + | + | + | + | | + | + | + | | |
| 11 | Api-api daun lebar | *Avicennia officinalis* | Avicenniaceae | | | + | | | + | + | + | + | + | + | | | |
| 12 | Lenggadai | *Bruguiera cylindrica* | Rhizophoraceae | | + | + | + | | + | | | + | + | + | | + | |
| 13 | Tancang merah | *Bruguiera gymnorrhiza* | Rhizophoraceae | + | + | | + | + | + | + | | + | + | + | + | + | |
| 14 | Langgade | *Bruguiera parviflora* | Rhizophoraceae | | + | + | | | | | | + | + | + | | | |
| 15 | Tancang sukun | *Bruguiera sexangula* | Rhizophoraceae | | | + | | | | + | + | + | + | + | | | |
| 16 | Tengal | *Ceriops decandra* | Rhizophoraceae | + | + | + | | + | | | | | + | | | | |
| 17 | Wanggo | *Ceriops tagal* | Rhizophoraceae | | + | + | | + | | | | | + | | | + | |
| 18 | Buta-buta | *Excoecaria agallocha* | Euphorbiaceae | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| 19 | Bayur laut | *Heritiera littoralis* | Sterculiaceae | | | + | | + | | | | | + | + | | | |
| 20 | Teruntum | *Lumnitzera littorea* | Combretaceae | + | + | + | | + | | | | | + | + | | | |
| 21 | Api- api balah | *Lumnitzera racemosa* | Combretaceae | | | + | + | | | | | | + | | | | |
| 22 | Nipah | *Nypa fruticans* | Arecaceae | + | | + | + | + | + | + | + | + | + | + | + | + | |
| 23 | Cantigi | *Pemphis acidula* | Lythraceae | | | | | + | | | | | | | + | | |
| 24 | Bakau minyak | *Rhizophora apiculata* | Rhizophoraceae | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| 25 | Bakau merah | *Rhizophora mucronata* | Rhizophoraceae | + | + | + | + | + | + | + | + | + | + | + | | | |
| 26 | Bakau | *Rhizophora stylosa* | Rhizophoraceae | + | + | + | + | + | + | + | | | + | + | | | |
| 27 | Cingam | *Scyphiphora hydrophyllacea* | Rubiaceae | | | | + | + | | | | | + | | | | |
| 28 | Pedada | *Sonneratia acida* | Sonneratiaceae | | | + | | | | | | | | | | | |
| 29 | Pedada | *Sonneratia alba* | Sonneratiaceae | + | + | + | | + | | + | | + | + | + | | + | |
| 30 | Pedada | *Sonneratia caseolaris* | Sonneratiaceae | + | + | + | + | + | + | + | + | + | + | + | + | | |
| 31 | Pedada | *Sonneratia griffithi* | Sonneratiaceae | | | | | | | | | | | + | | | |
| 32 | Kedabu | *Sonneratia ovata* | Sonneratiaceae | | | | | | | | | + | + | | | | |
| 33 | Nyirih | *Xylocarpus granatum* | Meliaceae | + | + | | | + | + | + | + | + | + | + | + | | |
| 34 | Nyirih batu | *Xylocarpus moluccensis* | Meliaceae | + | + | + | | + | | | | + | + | + | + | | |
| 35 | Nyirih | *Xylocarpus rumphii* | Meliaceae | | | | | | | + | + | | | | | | |

Annex 1 *cont.* List Species of Mangrove of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | |
| **Associate Mangrove Species** | | | | | | | | | | | | | | | | | |
| 1 | Bogem | *Barringtonia asiatica* | Lecythidaceae | | | | | | | | | | + | | | | |
| 2 | Nyamplung | *Callophyllum inophyllum* | Guttiferae | | + | | | + | + | + | | + | + | + | | | |
| 3 | Biduri | *Calotropis gigantea* | Aselepiadaceae | | | | | | | | | | + | | | | |
| 4 | | *Camptostemon philippensis* | Bombaceae | | | | | | | + | | + | | | | | |
| 5 | Cemara laut | *Casuarina equisetifolia* | Casuarinaceae | | | | | | | | | | + | | | | |
| 6 | Bintan | *Cerbera manghas* | Apocynaceae | | + | + | | | + | + | + | + | + | + | | | |
| 7 | Bintan | *Cerbera adollan* | Apocynaceae | | + | | | | + | | | | + | | | + | |
| 8 | Dadap laut | *Clerodendrum inerme* | Verbenaceae | | | | | | | | | | + | | | | |
| 9 | | *Combretocarpus fagifer* | | | | | | | | | | | + | | | | |
| 10 | | *Cyperus malaccensis* | Cypuaceae | | | | + | | | | | | | | | + | |
| 11 | | *Cyperus javanicus* | Cypuaceae | | | | + | | | | | | | | | | |
| 12 | Teki Laut | *Cyperus maritima* | Cypuaceae | | | + | + | | | | | | | | | | |
| 13 | | *Cyperus portulacastrum* | Cypuaceae | | | + | | | | | | | | | | | |
| 14 | | *Cyperus sp* | Cypuaceae | | | + | | | | | | | | | | | |
| 15 | Ambungan | *Derris heptophylla* | Leguminosae | | | + | + | | + | + | | + | | | | | |
| 16 | Ambungan | *Derris trifoliata* | Leguminosae | | | | + | | + | + | | + | + | | + | | |
| 17 | | *Dolichondrone spathacea* | Bignoniaceae | | | | | | | | | | + | + | | | |
| 18 | | *Flacourtia rukam* | | | | | | | | | | | + | | | | |
| 19 | Waru laut | *Hibiscus tiliaceus* | Malvaceae | + | + | | + | + | | + | | + | + | + | | + | |
| 20 | Batata pantai | *Ipomomea pes-capre* | Convolvulaceae | | | | | | | | | | + | | | | |
| 21 | | *Oncosperma tigillarium* | | | | | | | + | | | | + | | | | |
| 22 | Pandan | *Pandanus odoratissima* | Pandanaceae | | | | | | | | | | + | | | | |
| 23 | Pandan | *Pandanus tectorius* | Pandanaceae | | | | | | | | | | + | | | | |
| 24 | Bangkong | *Pongamia pinnata* | Leguminosae | | | | | | | | | | + | | | | |
| 25 | | *Saccharum spontaneum* | | | | | | + | + | + | | + | | | | | |
| 26 | | *Sapium indicum* | | | | | | | | | | | | | + | | |
| 27 | | *Scyrpus grossus* | | + | | | | | | | | | | | | | |
| 28 | | *Sesuvium portulacastrum* | Aizoaceae | | | | | | | | | | + | | | | |
| 29 | Ketapang | *Terminalia catappa* | Combretaceae | + | + | | | + | + | + | | + | + | + | | | |
| 30 | Waru lot | *Thepesia populnea* | Malvaceae | | | | | | | | | | + | | | | |

Annex 1 *cont.* List Species of Mangrove of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | |
| **Other Species** | | | | | | | | | | | | | | | | | |
| 1 | Akasia laut | *Acacia auriculiformis* | Leguminosae | + | | | | + | | | | | | + | | | |
| 2 | Saga pohon | *Adenanthera microsperma* | | | | | | + | | | | | | + | | | |
| 3 | | *Andropogon nardus* | | | | | | + | | | | | | + | | | |
| 4 | | *Cryptocoryne ciliata* | Araceae | | | | + | | | | | | | | | | |
| 5 | | *Cynodon dactylon* | Poaceae | | | | + | | | | | | | | | | |
| 6 | Kayu hitam | *Dyospiros maritime* | | | | | | + | | | | | | + | | | |
| 7 | Kedoya | *Dysoxylum amocroides* | | | | | | + | | | | | | + | | | |
| 8 | | *Eichornia crassipes* | | | | | | + | | | | | | + | | | |
| 9 | Beringin | *Ficus* sp. | Moraceae | | | | | + | | | | | | | | | |
| 10 | | *Fimbristylis ferruginea* | Cyperaceae | + | | | | | | | | | | | | | |
| 11 | | *Fimbristylis scathacea* | Cyperaceae | | | + | | | | | | | | | | | |
| 12 | | *Fimbristylus globulosa* | Cyperaceae | | | + | | | | | | | | | | | |
| 13 | | *Imperata cylindrica* | | | | | | + | | | | | | + | | | |
| 14 | Jambu-jambu | *Ixora javanica* | | | | | | + | | | | | | + | | | |
| 15 | Rumput rawa | *Laersia hexandra Swartz* | | + | | | | | | | | | | | | | |
| 16 | Lebar daun | *Macaranga* sp. | | | | | | + | | | | | | + | | | |
| 17 | Mangga | *Mangifera indica* | | + | | | | | | | | | | | | | |
| 18 | Gelam | *Melaleuca* sp. | Myrtaceae | | | | | | | | + | | | | | | |
| 19 | Mengkudu | *Morinda citrifolia* | | | | | | + | | | | | | + | | | |
| 20 | Pisang | *Musa* sp. | | + | | | | | | | | | | | | | |
| 21 | Sengon | *Paraserianthes falcataria* | Malvaceae | | | | | + | | | | | | + | | | |
| 22 | | *Plucea indica* | Comporitae | | | + | | | | | | | | | | | |
| 23 | Kesambi | *Schleichera oleosa* | | | | | | + | | | | | | + | | | |
| 24 | | *Sesuvium portulacastrum* | Portulaceae | | | + | | | | | | | | | | | |
| 25 | Kepuh | *Sterculia feotida* | | | | | | + | | | | | | + | | | |
| 26 | | *Thespesia populnea* | Malvaceae | | | + | | + | | | | | | + | | | |
| 27 | Seruni | *Widelia biflora* | | | | + | | | | | | | | | | | |

Annex 2 List Species of Mammals in Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 1 | Sero Ambrang | *Aonyx cinnerea* | Oriental Small-clawed Otter | Mustelidae | | | | | + | | | | | | + | | | A, F | - | - | II | |
| 2 | Banteng | *Bos javanicus* | | | | | | | | | | | | | | + | | - | - | - | - | |
| 3 | Bajing Kinabalu | *Callosciurus baluensis* | Kinabalu Squirrel | Sciuridae | | | | | | | | | | | + | | | - | - | - | - | |
| 4 | Bajing Kelapa | *Callosciurus notatus* | Plantain Squirrel | Sciuridae | | | | | | | | | | | + | | + | - | - | - | - | |
| 5 | Rusa Timor | *Cervus timorensis* | Javan Rusa | Cervidae | | | | | | | | | | + | | | | A, F | - | - | - | |
| 6 | Rusa Sambar | *Cervus unicolor* | Sambar Deer | Cervidae | | | | + | | + | | + | + | | + | | | A, F | - | - | - | |
| 7 | | *Conilurus* sp. | | | | | | + | | | | | | | | | | - | - | - | - | |
| 8 | Curucut Gigi Putih | *Crocidura fuliginosa* | Southeast Asian White-toothed Shrew | Soricidae | | | | | | | | | | | + | | | - | - | - | - | |
| 9 | Cerucut Kecil | *Crocidura monticula* | Sunda Shrew | Soricidae | | | | | | | | | | | + | | | - | - | - | - | |
| 10 | Musang Air | *Cynogale bennetti* | Otter-Civet | Viverridae | | | | | | | | | | + | + | | | C, F | - | E | II | |
| 11 | Kelelawar Ekor Trubus Kecil | *Emballonura monticola* | Lesser Sheath-tailed Bat | Emballonuridae | | | | | | | | | | | + | | | - | - | - | - | |
| 12 | Kucing Hutan | *Felis bengalensis* | Leopard Cat | Felidae | | | + | | | | | | | | + | | | F, G | - | - | I, II | |
| 13 | Kucing Bakau | *Felis viverrinus* | Fishing Cat | Felidae | | | + | + | | | | | | | + | | | D, F | - | IK | II | |
| 14 | | *Gemus* sp. | | | | | | | | | | | | | | | + | - | - | - | - | |
| 15 | Beruang Madu | *Helarctos malayanus* | Sun Bear | Ursidae | | | | | | + | | | + | | + | + | + | A, F | - | V | I | |
| 16 | Garangan Jawa | *Herpestes javanicus* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 17 | Barong Dayak | *Hipposideros dyacorum* | Dayak Roundleaf Bat | Hipposideridae | | | | | | | | | | | + | | | - | - | - | - | |
| 18 | | *Hydromys chrysogaster* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 19 | | *Isodon* sp. | | | | | | + | | | | | | | | | | - | - | - | - | |
| 20 | Berang-berang Pantai | *Lutra-lutra* | Eurasian Otter | Mustelidae | | | + | + | | + | + | | | | + | | | - | V | - | I | |
| 21 | Monyet Ekor Panjang | *Macaca fascicularis* | Long-tailed Macaque | Cercopithecidae | | | | | | | | | | | | | | - | - | - | II | |
| 22 | Monyet Ekor Panjang | *Macaca fascicularis* | Long-tailed Macaque | Cercopithecidae | + | | | + | + | + | + | | + | + | + | | + | - | - | - | - | |
| 23 | Kera Abu-abu | *Macaca irus* | | Cercopithecidae | | | | | | | | | | | + | | + | - | - | - | - | |
| 24 | Beruk | *Macaca nemestrina* | Pig-tailed Macaque | Cercopithecidae | | | | + | | + | + | + | | + | + | | + | - | - | - | II | |
| 25 | | *Macroglossus lagochilus* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 26 | Codot madu kecil | *Macroglossus minisus* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 27 | Trenggiling Perusing | *Manis javanica* | Pangolin | Manidae | | | | | | | | + | | + | | | + | A, F | - | - | II | |
| 28 | | *Melomys* sp. | | | | | | + | | | | | | | | | | - | - | - | - | |
| 29 | | *Mesembriomys* sp. | | | | | | + | | | | | | | | | | - | - | - | - | |
| 30 | Kijang | *Muntiacus muntjak* | Red muntjak | Cervidae | | | | | | + | | | | + | | | + | A, F | - | - | - | |
| 31 | | *Mus musculus* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 32 | Musang Kepala Putih | *Mustela Nudipes* | Malay Weasel | Mustelidae | | | | | | | | | | | + | | | - | - | - | - | |

Annex 2 *cont.* List Species of Mammals in Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 33 | Bekantan | *Nasalis larvatus* | Proboscis Monkey | Cercopithecidae | | | | | | | | | | | + | + | + | A, F | - | V | I | |
| 34 | Macan dahan | *Neofelis nebulosa* | Clouded Leopard | Felidae | | | | | | | | | | + | | + | | D, F | V | V | I | |
| 35 | Harimau Sumatera | *Panthera tigris sumatrana* | Sumatran Tiger | Felidae | | | | | | | + | | | + | | | | C, F | E | E | I | |
| 36 | Musang Luwak | *Paradoxurus hermaphroditus* | Common Palm Civet | Viverridae | | | | + | | | | + | | | + | | + | - | - | - | III IN | |
| 37 | | *Paramelas* sp. | | | | | | + | | | | | | | | | | - | - | - | - | |
| 38 | Lutung Kelabu | *Presbytis cristata* | Silvered Langur | Cercopithecidae | | | + | + | | + | | | + | + | | | | - | - | - | - | |
| 39 | Lutung Simpai | *Presbytis femoralis* | Banded Langur | Cercopithecidae | | | | | | | | | | | + | | | - | - | - | II | |
| 40 | Lutung Merah | *Presbytis rubicunda* | Red Leaf Monkey | Cercopithecidae | | | | | | | | | | | + | | | - | - | - | - | |
| 41 | | *Pteropus alecto* | | Pteropidae | | | | + | | | | | | | | | | - | - | - | - | |
| 42 | | *Pteropus conspicillatus* | | Pteropidae | | | | + | | | | | | | | | | - | - | - | - | |
| 43 | Kalong Kecil | *Pteropus hypomelanus* | Island flying Fox | Pteropidae | | | | + | | | | | | | + | | | - | - | - | - | |
| 44 | | *Pteropus poliocephalus* | | Pteropidae | | | | + | | | | | | | | | | - | - | - | - | |
| 45 | Kalong Besar | *Pteropus vampyrus* | Large flying Fox | Pteropidae | | | | + | + | | | + | | + | + | | | - | - | - | II | |
| 46 | Tikus Sawah | *Rattus argentiventer* | Ricefield Rat | Muridae | | | + | | | | | | | | + | | | - | - | - | - | |
| 47 | | *Rattus rattus diardi* | | Muridae | | | + | | | | | | | | + | | | - | - | - | - | |
| 48 | | *Rattus sordidus* | | Muridae | | | | + | | | | | | | | | | - | - | - | - | |
| 49 | Tikus Belukar | *Rattus tiomanicus* | Malaysian Wood Rat | Muridae | + | | + | + | + | | | | | | + | | | - | - | - | - | |
| 50 | Tikus Riul | *Ratus norvegicus* | Norway Rat | Muridae | | | | | | | | | | | + | | | - | - | - | - | |
| 51 | Tikus | *Ratus ratus* | | Muridae | | | | | | | | | | | | | + | - | - | - | - | |
| 52 | Kelelawar Ladam Lapet Kecil | *Rhinolopus sedulus* | Lesser Woolly Horseshoe Bat | Rhinolophidae | | | | | | | | | | | + | | | - | - | - | - | |
| 53 | Kelelawar Rumah Kuning Kecil | *Scotophilus temminckii* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 54 | Lumba-lumba | *Stenella* sp. | | Stonidae | | | | | | | | | | | + | | | F | - | - | - | |
| 55 | Munggis Rumah | *Suncus murinus* | House Shrew | Soricidae | | | + | | | | | | | | + | | | - | - | - | - | |
| 56 | Tikus Besar Lembah | *Sundamys muelleri* | Muller's Rat | Muridae | | | | | | | | | | | + | | | - | - | - | - | |
| 57 | Babi hutan | *Sus barbatus* | Bearded Pig | Suidae | | | | | | + | | | + | + | + | | | - | V | - | - | |
| 58 | Babi hutan | *Sus scrofa* | Domestic Pig | Suidae | | | | | | | | + | | | + | | + | - | - | - | - | |
| 59 | | *Tidanida planiceps* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 60 | Pelanduk Kancil | *Tragulus javanicus* | Lesser Mouse Deer | Tragulidae | | | | | | + | | | | | + | | + | - | - | - | - | |
| 61 | Napu | *Tragulus* sp. | | Tragulidae | | | | | | + | | | | | | | | - | - | - | - | |
| 62 | | *Trichosurus arnhemensis* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 63 | Tupai Bergaris | *Tupaia dorsalis* | Striped Treeshrew | Tupaiidae | | | | | | | | | | | + | | | - | - | - | II | |
| 64 | Tupai Akar | *Tupaia glis* | Common Treeshrew | Tupaiidae | | | | | | | | | | | + | | | - | - | - | - | |
| 65 | Tupai Tana | *Tupaia tana* | Large Treeshrew | Tupaiidae | | | | | | | | | | | + | | | - | - | - | II | |
| 66 | | *Ursus malayanus* | | Ursidae | | | | | | | | | | | + | | | - | - | - | - | |
| 67 | | *Wallabia bicolor* | | | | | | + | | | | | | | | | | - | - | - | - | |

Annex 3 List Species of Reptile of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 1 | Ular Kadut | *Acrochordus granulatus* | File Snake | Acrochordidae | | | + | + | + | | | | | | | | | - | - | - | - | |
| 2 | | *Ajaysunus aydouxi* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 3 | Kura-kura | *Batagur baska* | Mangrove Terrapin | Bataguridae | | | | | | | | | | | + | | | - | - | - | - | |
| 4 | Ular Cincin Mas | *Boiga dendrophila* | Mangrove Sanke | Colubridae | | | | + | + | | + | | | | | | | - | - | - | - | |
| 5 | Ular Cincin Mas | *Boiga dendrophila* | Mangrove Sanke | Colubridae | | | | | | | | | | + | | | + | - | - | - | - | |
| 6 | Kodok | *Bufo bipurcatus* | | Bufonidae | | | | | | | | | | | | | + | - | - | - | - | |
| 7 | Ular Welang | *Bungarus fasciatus* | Banded Krait | Elapidae | | | | | + | | + | | | | | | | - | - | - | - | |
| 8 | Penyu Muara | *Callagur borneoensis* | Red-headed Terrapin | Bataguridae | | | | | | | | | | | + | | | - | E | - | - | |
| 9 | Ular Tambak | *Cerberus rynchops* | Dog-faced Water Snake | Colubridae | | | + | | | | + | | | + | | | | - | - | - | III IN | |
| 10 | Penyu hijau | *Chelonia mydas* | Green Turtle | Chelonidae | | | | | | | | | | | + | + | | F | E | E | III IN | |
| 11 | Buaya Muara | *Crocodilus porosus* | Saltwater | Crocodylidae | | | | | | + | + | + | + | + | + | + | + | F | V | V | I, II | |
| 12 | | *Crocodylus siainensis* | | Crocodylidae | | | | | | | | | | | | | + | - | - | - | - | |
| 13 | Penyu Belimbing | *Dermochelys coriacea* | Leatherback Turtle | Dermochelyidae | | | | | | | | + | | | + | | | F | E | E | I | |
| 14 | Bunglon | *Draco volans* | Blanford's Gliding Lizard | Agamidae | + | | | | | | | | | | | | + | - | - | - | - | |
| 15 | Ular Daun | *Dryophiops rubescens* | Keel-bellied | Colubridae | | | | | + | | + | | | | | | + | - | - | - | - | |
| 16 | Ular Sapi | *Elaphe radiata* | Radiated Rat Snake | Colubridae | | | + | | | | | | | | | | | - | - | - | - | |
| 17 | | *Enhydris punctata* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 18 | | *Ephalophis greyi* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 19 | | *Ephalophis mertoni* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 20 | Penyu sisik | *Eretmochelys imbricata* | Hawwksbill Turtle | Chelonidae | | | | | | | | + | | | + | + | | F | E | E | I | |
| 21 | Ular Bakau | *Fardonia leucobalia* | Whitebelly Mangrove Snake | Colubridae | | | | + | | | + | | + | | + | | | - | - | - | - | |
| 22 | | *Hydrophis elegans* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 23 | Penyu lekang | *Lepidochelys olivacea* | Olive Ridley Turtle | Chelonidae | | | | | | | | | | | + | | | F | E | E | I | |
| 24 | Ular pyton | *Liasis fuscus* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 25 | Ular pyton | *Liasis olivaceus* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 26 | | *Lophognathus temporalis* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 27 | Kadal | *Mabouya multifasciata* | Many-lined Sun Skink | Scincidae | + | | + | + | + | | + | + | | + | + | | + | - | - | - | - | |
| 28 | | *Morelia spilotes* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 29 | | *Myron richardsonii* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 30 | Ular Kobra | *Naja sputatrix* | | Elapidae | | | | + | + | | | + | | | | | | - | - | - | II | |
| 31 | Ular Tedung | *Ophiophagus hannah* | King Cobra | Elapidae | | | | | | | + | | | | | | + | - | - | - | II | |
| 32 | | *Phyton malanis* | | Boidae | | | | | | | | | | | | | + | - | - | - | - | |
| 33 | Ular Sawah | *Phyton reticulatus* | Reticulated python | Boidae | | | + | | + | | + | + | + | + | | | + | - | - | - | II | |
| 34 | Katak Sawah | *Rana cancrivora* | | | | | | + | | | | | | | | | | - | - | - | - | |
| 35 | Buaya ikan | *Tomistoma schelegli* | Sunda Gharial | Crocodylidae | | | | | | + | | | | + | | + | | F | E | E | I | |
| 36 | Labi-labi | *Trionhyx cartilagineus* | Southeast Asian Soft-shelled Turtle | Trionychidae | | | | | | | + | | | | + | | | - | - | - | - | |
| 37 | Biawak | *Varanus salvator* | Water Monitor | Varanidae | | | + | + | + | + | + | + | + | + | + | | + | - | - | - | II | |
| 38 | Buaya Rawa | | | Crocodylidae | | | | | | | | | + | | | | | - | - | - | - | |
| 39 | Buaya Sungai | | | Crocodylidae | | | | | | | | | + | | | | | - | - | - | - | |
| 40 | Katak Rawa | | | | + | | + | | | | | | | | | | | - | - | - | - | |
| 41 | Ular Laut | | | | + | | | | | | | | | | | | | - | - | - | - | |
| 42 | ular sanca | | | | | | | | | | | + | | | | | | | | | | |

Annex 4 List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 1 | Julang Emas | *Aceros undulatus* | Wrinkled Hornbill | Bucerotidae | | | | | | | | | | + | + | | | - | - | - | II | Migrant |
| 2 | Jalak Ungu | *Acridotheres javanicus* | Javan Myna | Sturnidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 3 | Kerakbasi | *Acrocephalus stentoreus* | Clamorous Reed-warbler | Silvidae | | | + | + | + | | | | | | | | | - | - | - | - | Resident |
| 4 | Trinil Pantai | *Actitis hypoleucos* | Common Sandpiper | Scolopocidae | | | + | + | + | | + | | | + | + | | + | - | - | - | - | Migrant |
| 5 | Cipoh Kacat | *Aegithina tiphia* | Common Iora | Chloropseidae | | | + | + | + | | | | | | + | | | - | - | - | - | Resident |
| 6 | Cipoh Jantung | *Aegithina viridissima* | Green Iora | Chloropseidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 7 | Burung Madu Sepah Raja | *Aethopyga siparaja* | Crimson Sunbird | Nectariniidae | | | | | | | | | | | + | | + | A, F | - | - | - | Migrant |
| 8 | Burung Madu Ekor Merah | *Aethopyga temminckii* | Temmick's Sunbirds | Nectariniidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 9 | Raja Udang Erasia | *Alcedo atthis* | Common Kingfisher | Acledinidae | | | | | | | | | | + | | | | A, F | - | - | - | Migrant |
| 10 | Raja Udang | *Alcedo caerulescens* | Blue Kingfisher | Acledinidae | | | + | + | + | | | | | | + | | | A, F | - | - | - | Resident |
| 11 | Raja Udang Meninting | *Alcedo meninting* | Blue-eared Kingfisher | Acledinidae | | | + | | + | | | | | + | + | | | A, F | - | - | - | Migrant |
| 12 | Burung Wergan Coklat | *Alcippe brunneicauda* | Brown Fulwatta | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 13 | Kareo | *Amaurornis phoenicurus* | White breaste waterhen | Rallidae | | | + | + | + | | | | | | + | | | - | - | - | - | Migrant |
| 14 | Itik Benjut | *Anas gibberifrons* | Sunda Teal | Anatidae | | | + | + | | | | | | | | | | - | - | - | - | Resident |
| 15 | | *Anhinga glareola* | | Phalacrocoracidae | | | | + | | | | | | | | | | - | - | - | - | n. i. |
| 16 | Pecuk Ular Asia | *Anhinga melanogaster* | Oriental Darter | Anhingidae | | | + | + | + | + | + | | | | + | + | | D, F | - | - | - | Resident |
| 17 | | *Anhinga nebularia* | | Phalacrocoracidae | | | | + | | | | | | | | | | - | - | - | - | n. i. |
| 18 | | *Anhinga stagnatilis* | | Phalacrocoracidae | | | | + | | | | | | | | | | - | - | - | - | n. i. |
| 19 | | *Anhinga totanus* | | Phalacrocoracidae | | | | + | | | | | | | | | | - | - | - | - | n. i. |
| 20 | | *Amnideeheres javanicus* | | | | | + | | | | | | | | | | | - | - | - | - | n. i. |
| 21 | Burung Enggan Klihingan | *Anorrhinus galeritus* | Bushy-crested Hornbill | Bucerotidae | | | | | | | | | | | + | | | - | - | - | II | Migrant |
| 22 | Kangkareng Perut Putih | *Anthracoceros albirostris* | Oriental Pied Hornbill | Bucerotidae | | | | | | | | | | | + | | | - | - | - | II | Migrant |
| 23 | Kangkareng Hitan | *Anthracoceros malayanus* | Asian Black Hornbill | Bucerotidae | | | | | | | | | | | + | | | - | - | - | II | Migrant |
| 24 | Burung Madu Kelapa | *Anthreptes malacensis* | Plain-throated Sunbieds | Nectariniidae | | | | + | + | | | | | | + | | | A, F | - | - | - | Resident |
| 25 | Burung Madu Polos | *Anthreptes simplex* | Plain Sunbirds | Nectariniidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 26 | Burung Madu Belukar | *Anthreptes singalensis* | Ruby-Cheeked Sunbirds | Nectariniidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 27 | Perling Kumbang | *Aplonis panayensis* | Asian Glossy Starling | Sturnidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 28 | Kapinis rumah | *Apus affinis* | Little Swift | Apodidae | | | + | | | | | | | | + | | | - | - | - | - | Resdinet |
| 29 | Pijantung Gunung | *Arachnothera affinis* | Grey Breasted Spiderhunter | Nectariniidae | | | | | + | | | | | | + | | | - | - | - | - | Migrant |
| 30 | Pijantung Telinga Kuning | *Arachnothera chrysogenys* | Yellow-eared Spiderhunter | Nectariniidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 31 | Pijantung Tesmak | *Arachnothera flavigaster* | Spectacled Spiderhunter | Nectariniidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 32 | Pijantung Kecil | *Arachnothera longirostra* | Little Spiderhunter | Nectariniidae | | | | + | | | | | | | + | | | - | - | - | - | Migrant |
| 33 | Pijangtung Besar | *Arachnothera robusta* | Long-billed Spiderhunter | Nectariniidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 34 | Cangak Abu | *Ardea cinerea* | Grey Heron | Ardeidae | | | + | + | + | | + | | + | + | + | | | A, F | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 35 | Cangak merah | *Ardea purpurea* | Purple Heron | Ardeidae | | | + | + | + | | | | | | + | + | | A, F | - | - | - | Migrant |
| 36 | Cangak Laut | *Ardea sumatrana* | Giant Heron | Ardeidae | | | + | + | | | + | | | | + | | | A, F | - | - | - | Resident |
| 37 | Blekok Sawah | *Ardeola speciosa* | Javan Pond Heron | Ardeidae | | | + | + | + | + | | | | | + | | + | A, F | - | - | - | n. i. |
| 38 | Trinil Pembalik Batu | *Arenaria interpres* | Ruddy Turnstone | Scolopocidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 39 | Kuau Raja | *Argusianus argus* | Great Argus | Phasianidae | | | | | | + | | | | | + | | | B, F | - | - | II | Migrant |
| 40 | | *Artamus contra* | | Artamidae | | | | + | | | | | | | | | | - | - | - | - | n. i. |
| 41 | Kekep Babi | *Artamus leucorhynchus* | White-breasted Wood-swallow | Artamidae | | | + | + | + | | | | | | + | | | - | - | - | - | Migrant |
| 42 | | *Artamus melanopterus* | | Artamidae | | | | + | | | | | | | | | | - | - | - | - | n. i. |
| 43 | | *Artamus sturminus* | | Artamidae | | | | + | | | | | | | | | | - | - | - | - | n. i. |
| 44 | Burung Baza Jerdon | *Aviceda jerdoni* | Jerdon's Baza | Accipitridae | | | | | | | | | | | + | | | B, F | - | - | II | Migrant |
| 45 | Pelatuk Pangkas | *Blythipicus rubiginosus* | Maroon Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 46 | Beluk Jempuk | *Bubo sumatranus* | Barred Eagle-owl | Strigidae | | | | | | | | | | | + | | | - | - | - | II | Migrant |
| 47 | Kuntul Kerbau | *Bubulcus ibis* | Cattle Egret | Ardeidae | | | + | + | + | | | | | | + | | | - | - | - | III GH | Migrant |
| 48 | Rangkong Papan | *Buceros bicornis* | Great Hornbill | Bucerotidae | | | | | | + | | | | + | | | | A | - | - | I | Migrant |
| 49 | Rangkong Badak | *Buceros rhinoceros* | Rhinoceros Hornbill | Bucerotidae | | | | | | | | | | | + | | | A, F | - | - | II | Migrant |
| 50 | Kokokan Laut | *Butorides striatus* | Striated Heron | Ardeidae | | | + | + | + | + | + | | | + | + | | | - | - | - | - | Resident |
| 51 | Kakatua Jambul | *Cacatua galerita* | Sulphur-crested Cockloo | Psittacidae | | | | | | | | | | | | | + | B, E, F | - | - | II | Migrant |
| 52 | Wiwik Lurik | *Cacomantis sonneratii* | Banded Bay Cuckoo | Cuculidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 53 | Kedidi Golgol | *Calidris ferruginea* | Curlew Sandpiper | Sclolopacidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 54 | Kedidi Leher Merah | *Calidris ruficollis* | Rufous-necked Stint | Sclolopacidae | | | + | + | | | | | | | | | | - | - | - | - | Migrant |
| 55 | Kedidi Kedidi Panjang | *Calidris subminuta* | Long-toed Stint | Sclolopacidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 56 | Burung Takur Ampis | *Calorhamphus fuliginosus* | Brown Barbet | Capitonidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 57 | Burung Madi Hijau Kecil | *Calyptomena viridis* | Green Boradbill | Eurylaimidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 58 | Burung Cabak Kota | *Caprimulgus affinis* | Savannah Nightjar | Caprimulgidae | | | + | + | + | | | | | | + | | + | - | - | - | - | Migrant |
| 59 | | *Casmerodius albus* | | | | | | + | | | | | | | | | | | | | | |
| 60 | Bubut alang-alang | *Centropus bengalensis* | Lesser Coucal | Cuculidae | | | + | | + | | + | | | | + | | + | - | - | - | - | Migrant |
| 61 | Bubut Jawa | *Centropus nigrorufus* | Sunda Coucal | Cuculidae | | | + | | + | | | | | | | | + | - | V | - | - | Resident |
| 62 | Bubut | *Centropus rectunguis* | | Cuculidae | | | | | | | | | | | | + | | | | | | |
| 63 | Bubut Besar | *Centropus sinensis* | Greater Coucal | Cuculidae | | | | | | | + | | | | + | | + | - | - | - | - | Migrant |
| 64 | Delimukan Zamrud | *Chalcophaps indica* | Zebra-Dove | Columbidae | | | | | | | | | | | + | | + | - | - | - | - | Migrant |
| 65 | Cerek Tilil | *Charadrius alexandrinus* | Kentish Plover | Charadriidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |
| 66 | Cerek Kalung Kecil | *Charadrius dubius* | Little Ringed Plover | Charadriidae | | | + | + | | | | | | | | | | - | - | - | - | Migrant |
| 67 | Cerek Pasir Besar | *Charadrius leschenaultii* | Greater Sand-plover | Charadriidae | | | | + | | | | | | | + | | | - | - | - | - | Migrant |
| 68 | Cerek Pasir Mongolia | *Charadrius mongolus* | Mongolian Plover | Charadriidae | | | | + | | | | | | + | | | | - | - | - | - | Migrant |
| 69 | Cerek Melayu | *Charadrius peronii* | Malaysian Plover | Charadriidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 70 | Cerek Asia | *Charadrius veredus* | Oriental Plover | Charadriidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 71 | Cerek Besar | *Charadus mongolus* | | Charadriidae | | | + | | | | | | | + | | | | | | | | |
| 72 | Dara Laut Kumis | *Childonias hybridus* | Whiskered Tern | Sternidae | | | | + | | | | | | + | | | | A, F | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 73 | Dara Laut Sayap Putih | *Chlidonias leucopterus* | White-winged Tern | Sternidae | | | + | + | | | | | | | | | | - | - | - | - | Migrant |
| 74 | Burung Cica Daun Kecil | *Chloropsis cyanopogon* | Lesser Green Leafbird | Chloropseidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 75 | Burung Cica Daun Besar | *Chloropsis sonnerati* | Greater Green Leafbird | Chloropseidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 76 | Burung Kedasi Ungu | *Chrysococcyx xanthorhynchus* | Violet Cuckoo | Cuculidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 77 | Pelatuk Tunggir Emas | *Chrysocolaptes lucidus* | Greater Goldenback | Picidae | | | | | | | | | | + | | | | - | - | - | - | Migrant |
| 78 | Bangau Sandang Lawe | *Ciconia episcopus* | Woolly-necked Stork | Ciconiidae | | | | | | + | | | | | | | | A, F | - | - | - | Migrant |
| 79 | Bangau Storm | *Ciconia stormi* | Storm's Stork | Ciconiidae | | | | | | + | | | | | + | + | | A, F | R | - | - | Migrant |
| 80 | Burung Cici Padi | *Cisticola juncidis* | Zitting Cisticola | Silvidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 81 | Saeran Gila | *Clypsirina temia* | | Silvidae | | | + | | | | | | | | | | | | | | | |
| 82 | Bubut Pacar Jambul | *Clamator coromandus* | Chesnut-winged Cuckoo | Cuculidae | | | | | + | | | | | | | | | - | - | - | - | Resident |
| 83 | Walet Sapi | *Collocalia esculenta* | Glossy Swiftlet | Apodidae | + | | + | + | + | | | | | | + | | | - | - | - | - | n. i. |
| 84 | Walet sarang putih | *Collocalia fuchipaga* | Edible-nest Swiftlet | Apodidae | | | | | + | | | | | | | | | - | - | - | - | Resident |
| 85 | Kucica Hutan | *Copsychus malabaricus* | White-rumped Shama | Turdidae | | | | | + | | | | | | + | | | - | - | - | - | Migrant |
| 86 | | *Copsychus pyrropygus* | | Turdidae | | | | | | | | | | | + | | | - | - | - | - | n. i. |
| 87 | Kucica Kampung | *Copsychus saularis* | Magpie Robin | Turdidae | | | | + | + | | | | | | + | | | - | - | - | - | Migrant |
| 88 | Gagak Hutan | *Corvus enca* | Slender-billed Crow | Corvidae | | | | | + | | | | | | + | | | - | - | - | - | Migrant |
| 89 | Gagak Kampung | *Corvus macrorhynchos* | Large-billed Crow | Corvidae | | | + | + | | | | | | | | | + | - | - | - | - | Migrant |
| 90 | Burung Madi Kelam | *Corydon sumatranus* | Dusky Broadbill | Eurylaimidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 91 | Puyuh Batu | *Coturnix chinensis* | Blue-breasted Quail | Phasianidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 92 | Burung Janggut | *Criniger bres* | Grey-cheeked Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 93 | Empuloh Leher-Kuning | *Criniger finschii* | Finsch's Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 94 | | *Criniger phaeocephalus* | | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | n. i. |
| 95 | Tangkar Centrong | *Crypsirina temia* | Racket-tailed Treepie | Corvidae | | | | | + | | | | | | | | | - | - | - | - | Migrant |
| 96 | Kangkok Melayu | *Cuculus fugax* | Hodgson's Hawk-Cuckoo | Cuculidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 97 | Kangkok India | *Cuculus micropterus* | Indian Cuckoo | Cuculidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 98 | Burung Unclung | *Cuculus saepulchralis* | | Cuculidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 99 | Sikatan Kelapa-Abu | *Culicicapa ceylonensis* | Grey-headed Flycatcher | Muscicapidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 100 | Sempur-Hujan Sungai | *Cymbirhynchus macrorhynchos* | Black-and-red Broadbill | Eurylaimidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 101 | Sikatan bakau | *Cyornis ruficastra* | Mangrove Blue-flycatcher | Muscicapidae | | | | | + | | | | | | | | | - | - | - | - | Resident |
| 102 | Layang-layang Rumah | *Delichon dasypus* | Asian House-martin | Hirundinidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 103 | Belibis Kembang | *Dendrocygna arcuata* | Wandering Whistling-Duck | Anatidae | | | | | + | + | | | | | | | | - | - | - | - | Resident |
| 104 | Belibis Batu | *Dendrocygna javanica* | Lesser Whistling-Duck | Anatidae | | | + | | | | | | | | + | | + | - | - | - | - | Migrant |
| 105 | Burung Cabai Rimba | *Dicaeum chrysorrheum* | Yellow-vented Flowerpecker | Dicaeidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 106 | Burung Cabai Polos | *Dicaeum concolor* | Plain Flowerpecker | Dicaeidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 107 | Burung Cabai Bunga-Api | *Dicaeum trigonostigma* | Orange-billied Flowerpecker | Dicaeidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 108 | Cabai jawa | *Dicaeum trochileum* | Scarlet-headed Flowerpecker | Dicaeidae | | | | + | + | | | | | | + | | | - | - | - | - | Resident |
| 109 | Srigunting Gagak | *Dicrucus annectans* | Crow-billed Drongo | Dicruridae | | | | | | | | | | | | | | - | - | - | - | Migrant |
| 110 | Srigunting Hitam | *Dicrucus macrocercus* | Black Drongo | Dicruridae | + | | + | | + | | | | | | + | | + | - | - | - | - | Resident |
| 111 | Srigunting Batu | *Dicrurus paradiseus* | Greater Racket-tailed Drongo | Dicruridae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 112 | Pelatuk Raffles | *Dinopium rafflesii* | Olive-backed Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 113 | Pelatuk Ayam | *Dryocopus javensis* | White-bellied Woodpecker | Picidae | | | | | | | | | | | + | | + | - | - | - | I | Migrant |
| 114 | Pergam Hijau | *Ducula aenea* | Green Imperial-Pigeon | Columbidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 115 | Pergam Laut | *Ducula bicolor* | Pied Imperial-Pigeon | Columbidae | | | | | + | | | | | | + | | | - | - | - | - | Resident |
| 116 | Kuntul Besar | *Egretta alba* | Great Egret | Ardeidae | + | | + | + | + | + | | | | + | + | + | + | A, F | - | - | III GH | Migrant |
| 117 | Kuntul Kecil | *Egretta garzetta* | Little Egret | Ardeidae | | | + | + | + | | | | | + | + | + | | A, F | - | - | III GH | Migrant |
| 118 | Kuntul Perak | *Egretta intermedia* | Intermediate Egret | Ardeidae | | | | + | + | | | | | | | | | A, F | - | - | - | Resident |
| 119 | Kuntul Karang | *Egretta sacra* | Pacific Reef-egret | Ardeidae | | | + | + | + | | | | | + | + | | | A, F | - | - | - | Resident |
| 120 | Elang Tikus | *Elanus caeruleus* | Black-winged Kite | Accipitridae | | | + | | | | | | | | + | | + | A, B | - | - | II | Resident |
| 121 | Emberiza Pundak Putih | *Emberiza aureola* | Yellow-breasted Bunting | Emberitidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |
| 122 | Burung Meninting Besar | *Enicurus leschenaulti* | White-crowned Forktail | Turdidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 123 | Burung Meninting Cegar | *Enicurus ruficapillus* | Chesnut-naped Forktail | Turdidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 124 | Tuwur Asia | *Eudynamys scolopacea* | Asian Koel | Coculidae | | | | | + | | + | | | | | | | - | - | - | - | Migrant |
| 125 | Sipinjur Melayu | *Eupetes macrocerus* | Malaysian Rail-babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 126 | Taktarau Melayu | *Eurostopodus temminckii* | Malaysian Eared-nightjar | Caprimulgidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 127 | Sempur-Hujan Rimba | *Eurylaimus javanicus* | Banded Broadbill | Eurylaimidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 128 | Sempur-Hujan darat | *Eurylaimus ochromalus* | Balck-and-Yellow Broadbill | Eurylaimidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 129 | Tiong Lampu Biasa | *Eurystomus orientalis* | Dollarbird | Meropidae | | | | | | | | | | + | + | | | - | - | - | - | Migrant |
| 130 | Alap-alap Kawah | *Falco peregrinus* | Peregrine falcon | Falconidae | | | | + | | | | | | | | | | - | - | - | I | Migrant |
| 131 | Sikatan Emas | *Ficedula zanthopygia* | Yellow-Rumped Flycatcher | Muscicapidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 132 | Cikalang Christmas | *Fregata andrewsi* | Christmas Frigatebird | Fregatidae | | | | + | | | | | | | | | | - | - | V | I | Migrant |
| 133 | Cikalang Kecil | *Fregata ariel* | Lesser Frigatebird | Fregatidae | | | + | | + | | | | | | | | | - | E | - | - | Migrant |
| 134 | Mandar Bontod | *Gallicrex cinerea* | Watercock | Rallidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 135 | Mandar Batu | *Gallinula chloropus* | Common Moorhen | Rallidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 136 | Mandar Padi Sintar | *Gallirallus striatus* | Slaty-breasted | Rallidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 137 | Perkutut Jawa | *Geopelia striata* | Zebra-Dove | Columbidae | | | | + | | | | | | | | | + | - | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 138 | Remetuk Laut | *Gerygone sulphurea* | Golden-bellied Gerygone | Muscicapidae | | | + | + | + | | | | | | + | | | - | - | - | - | Migrant |
| 139 | Terik Asia | *Glareola maldivarum* | Oriental Pratincole | Glareolidae | | | + | + | | | | | | | | | | - | - | - | - | Migrant |
| 140 | Tiong Emas | *Gracula religiosa* | Hill Myna | Sturnidae | | | | | | | | | | | + | | | B, F | - | - | III TH | Migrant |
| 141 | Jenjang | *Grus antigone* | | Grusdae | | | | | | | | | | | | | + | F, H | - | - | II | n. i. |
| 142 | Raja Udang | *Halcyon capensis* | Stork-billed Kingfisher | Alcedinidae | | | | | | | | | | + | | | | | | | | |
| 143 | Cekakak | *Halcyon chloris* | White-collared Kingfisher | Alcedinidae | | | + | + | + | | | | | + | + | | + | A, F | - | - | - | Resident |
| 144 | Cekakak Merah | *Halcyon coromanda* | Ruddy Kingfisher | Alcedinidae | | | | | | | | | | | + | | | A, F | - | - | - | Resident |
| 145 | Raja Udang | *Halcyon funebris* | | Alcedinidae | | | | | | + | | | | | | | | A, F | - | - | - | Migrant |
| 146 | Cekakak Cina | *Halcyon pileata* | Black-capped Kingfisher | Alcedinidae | | | | | | | | | | | + | | + | A, F | - | - | - | Migrant |
| 147 | Cekakak Suci | *Halcyon sancta* | Scared Kingfisher | Alcedinidae | | | + | + | + | + | | | | | + | | | A, F | - | - | - | Migrant |
| 148 | Elang Laut Perut Putih | *Haliaeetus leucogaster* | White-billed Fish Eagle | Accipitridae | | | | + | + | | + | | + | + | + | | + | B, F | - | - | II | Resident |
| 149 | Elang Bondol | *Haliastur indus* | Brahminy Kite | Accipitridae | | | | + | + | + | + | | | + | + | | + | B, F | - | - | II | Resident |
| 150 | Burung Luntur Diard | *Harpactes diardi* | Diad's Trogon | Trogonidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 151 | Burung Luntur Putri | *Harpactes duvaucelii* | Scarlet-rumphed Trogon | Trogonidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 152 | Burung Luntur Kasumba | *Harpactes kasumba* | Red-naped Trogon | Trogonidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 153 | Caladi Tikotok | *Hemicircus concretus* | Grey-and-buffWoodpecker | Pecidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 154 | Tepekong Jambul | *Hemiprocne longipennis* | Grey-rumped Treeswift | Hemiprocnidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |
| 155 | Jinjing batu | *Hemipus hirundinaceus* | Black-winged Flycatcher-shrike | Campephagidae | | | | | + | | | | | | | | | - | - | - | - | Migrant |
| 156 | Kapinis Jarum Gendang | *Hirundapus giganteus* | Brown-backed Needletail | Apodidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 157 | Layang-layang Api | *Hirundo rustica* | Barn Swallow | Hirundinidae | | | + | + | + | | | | | | + | | | - | - | - | - | Migrant |
| 158 | Layang-layang Batu | *Hirundo tahitica* | Pacific Swallow | Hirundinidae | | | + | + | + | | | | | | + | | + | - | - | - | - | Migrant |
| 159 | Burung Madu Rimba | *Hypogramma hypogrammicum* | Purpl-naped Sunbird | Nectariniidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 160 | Burung Kehicap Ranting | *Hypothymis azurea* | Black-naped Monarch | Muscicapidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 161 | | *Hypsipetes criniger* | | Pygnonotidae | | | | | | | | | | | + | | | - | - | - | - | n. i. |
| 162 | | *Hypsipetes malaccensis* | | Pygnonotidae | | | | | | | | | | | + | | | - | + | - | - | n. i. |
| 163 | Elang Ikan Kecil | *Ichthyophaga humilis* | Lesser Fish-eagle | Accipitridae | | | | | | | | | | | + | | | B, F | - | - | II | Resident |
| 164 | Elang ikan kepala kelabu | *Ichtyophaga ichthyaetus* | | Accipitridae | | | | | | + | | | | | | | | | | | | |
| 165 | Elang Hitam | *Ictinaetus malayensis* | Black Eagle | Accipitridae | | | | | | | | | | + | + | | | B, F | - | - | II | Resident |
| 166 | Burung Kacembang Gadung | *Irena puella* | Asian Fairy-Bluebird | Oriolidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 167 | Bambangan Merah | *Ixobrychus cinnamomeus* | Cinnamon Bittern | Ardeidae | | | + | + | + | | | | | | + | | | - | - | - | - | Resident |
| 168 | Kokokan Sungai | *Ixobrychus flavicollis* | Black Bittern | Ardeidae | | | + | | | | | | | | + | | | - | - | - | - | Resident |
| 169 | Bambangan Kuning | *Ixobrychus sinensis* | Yellow Bittern | Ardeidae | | | + | + | | | | | | | | | | - | - | - | - | Resident |
| 170 | Bambangan Coklat | *Ixobrychus sehythrinus* | Schrenk's Bittern | Ardeidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 171 | Berencet Loreng | *Kenopia striata* | Striped wWren-babler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 172 | Beluk Ketupa | *Ketupa-ketupu* | Buffy Fish-owl | Tytonidae | | | | + | | | | | | | | | + | - | - | - | II | Migrant |
| 173 | Kapasan Kemiri | *Lalage nigra* | Pied Triller | Campephagidae | | | | | + | | | | | | + | | | - | - | - | - | Resident |
| 174 | Bentet Coklat | *Lanius cristatus* | Brown Shrike | Laniidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 175 | Bentet Kelabu | *Lanius schach* | Long-tailed Shrike | Laniidae | | | + | | + | | | | | | + | | + | - | - | - | - | Migrant |
| 176 | Bangau Tongtong | *Leptoptilos javanicus* | Lesser Adjutant | Ciconiidae | + | | | | | + | + | | + | + | | + | | A, F | V | - | III GH | Migrant |
| 177 | Kedidi Paruh Lebar | *Limicola falcinellus* | Broad-billed sandpiper | Scolopacidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 178 | Trinil Lumpur Asia | *Limnodromus semipalmatus* | Asian Dowitcher | Scolopacidae | | | + | | | | + | | + | + | | | | E, F | R | - | - | Migrant |
| 179 | Biru Laut Ekor Blorok | *Limosa lapponica* | Bar-tailed Godwit | Scolopacidae | | | | | | | | | | + | | | | - | - | - | - | Migrant |
| 180 | Biru Laut Ekor Hitam | *Limosa limosa* | Blac-tailed Godwit | Scolopacidae | | | + | | | | + | | | | + | | | - | - | - | - | Migrant |
| 181 | Bondol Kalimantan | *Lonchura fuscans* | Dusky Munia | Ploceidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 182 | Bondol jawa | *Lonchura leucogastroides* | Javan Munia | Ploceidae | | | + | + | + | | | | | | + | | | - | - | - | - | Migrant |
| 183 | Bondol Haji | *Lonchura maja* | White-headed Munia | Ploceidae | | | | + | | | | | | | | | + | - | - | - | - | Migrant |
| 184 | Bondol Rawa | *Lonchura malacca* | Black-headed Munia | Ploceidae | | | | + | | | | | | | + | | | - | - | - | - | Migrant |
| 185 | Bondol Peking | *Lonchura punctulata* | Scaly breasted Munia | Ploceidae | | | + | + | + | | | | | | | | | - | - | - | - | Migrant |
| 186 | | *Lophura bulweri* | | Phasianidae | | | | | | | | | | | | + | | | | | | |
| 187 | Ambang | *Lophura erythrophthalma* | Crestless fireback | Phasianidae | | | | | | | | | | | | + | | | | | | |
| 188 | Sempidan Biru | *Lophura ignita* | Crested Fireback | Phasianidae | | | | | | + | | | | | + | | | - | V | V | III MY | Migrant |
| 189 | Serindit | *Loriculus exilis* | | Psitracidae | | | | | | | | | | | | | + | | | | | |
| 190 | Serindit Melayu | *Loriculus galgulus* | Blue-crowned Hanging-Parrot | Psitracidae | | | | | | | | | | | + | | + | - | - | - | II | Migrant |
| 191 | Serindit Jawa | *Loriculus pusillus* | Yellow-throated Hanging-Parrot | Psitracidae | | | | | | | | | | | + | | | - | - | - | II | Migrant |
| 192 | Ciung Air Pongpong | *Macronous ptilosus* | Fluffy-backed Tit Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 193 | Burung Uncal Buau | *Macropygia emiliana* | Ruddy Cuckoo | Columbidae | | | + | | | | | | | | + | | | - | - | - | - | Resident |
| 194 | Burung Asi Topi Jelaga | *Malacopteron affine* | Sooty-capped Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 195 | Burung Asi Dada Kelabu | *Malacopteron albogulare* | Grey-breasted Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 196 | Burung Asi Topi Sisik | *Malacopteron cinereum* | Scaly-crowned Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 197 | Burung Asi Besar | *Malacopteron magnum* | Rufous-crowned Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 198 | Burung Takur Tenggeret | *Megalaima australis* | Blue-eared Barbet | Capitonidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 199 | Takur Warna Warni | *Megalaima mystacophanos* | Red-throated Barbet | Capitonidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 200 | Burung Takur Tutut | *Megalaima rafflesii* | Red-crowned Barbet | Capitonidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 201 | Burung Takur Topi Emas | *Megalaima henricii* | Yellow-crowned Barbet | Capitonidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 202 | Caladi Batu | *Meiglytes tristis* | Buff-rumped Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 203 | Caladi Badok | *Meiglytes tukki* | Buff-necked Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 204 | Puyuh Hitam | *Melanoperdix nigra* | Black partridge | Phasianidae | | | | | | | | | | | + | + | | - | - | - | III MY | Migrant |
| 205 | Kirik-kirik Laut | *Merops philippinus* | Blue-tailed Bee-eater | Meropidae | | | + | + | + | | | | | + | | | | - | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 206 | Kirik-kirik Biru | *Merops viridis* | Blue-throated Bee-eater | Meropidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 207 | Alap-alap Capung | *Microhierax fringillarius* | Black-thighed Falconet | Falconidae | | | | | | | | | | | + | | | B, F | - | - | II | Migrant |
| 208 | Branjangan Jawa | *Mirafra javanica* | Australian Lark | Alaudidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 209 | Pelatuk Kelabu Besar | *Mulleripicus pulverulentus* | Great Slaty Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 210 | Bluwok | *Mycteria cinerea* | Milk Strok | Ciconiidae | | | + | + | + | + | + | | + | + | | | | A, F | V | V | I | Migrant |
| 211 | Burung Madu Bakau | *Nectarinia calcostetha* | Copper-throated Sunbird | Nectarinidae | | | | | + | | | | | | + | | | A, F | - | - | - | Resident |
| 212 | Burung Madu Sriganti | *Nectarinia jugularis* | Olive-backed Sunbird | Nectarinidae | | | + | + | + | | | | | | + | | | A, F | - | - | - | Migrant |
| 213 | Burung Madu Pengantin | *Nectarinia sperata* | Purple-throated Sunbird | Nectarinidae | | | | | | | | | | | + | | | A, F | - | - | - | Resident |
| 214 | Angsa Kerdil Kapas | *Nettapus coromandelianus* | Cotton pygmy-Goose | Anatidae | | | | + | | + | | | | | | | | A, F | - | - | - | Migrant |
| 215 | Punggok Coklat | *Ninox scutulata* | Brown Hawk-owl | Strigidae | | | | | | | | | | | + | | | - | - | - | II | Migrant |
| 216 | Gajahan Besar | *Numenius arquata* | Eurasian Curlew | Scolopacidae | | | + | + | | | | | | + | + | | | F, H | - | - | - | Migrant |
| 217 | Gajahan Pengala | *Numenius phaeopus* | Whimbrel | Scolopacidae | | | | + | + | | | | | + | + | | | F, H | - | - | - | Migrant |
| 218 | Kowak Malam Kelabu | *Nycticorax nycticorax* | Black-crowned Night-heron | Ardeidae | | | + | + | + | + | | | | | + | + | | - | - | - | - | Migrant |
| 219 | Cirik-cirik Kumbang | *Nyctyornis amictus* | Red-bearded Bee-eater | Meropidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 220 | Kepudang Hutan | *Oriolus xanthonotus* | Dark-throated Oriole | Oriolidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 221 | Kepudang Kuduk Hitam | *Oriolus chinensis* | Black-naped Oriole | Oriolidae | | | + | + | + | | | | | | | | | - | - | - | - | Resident |
| 222 | Cinenen Kelabu | *Orthotomus ruficeps* | Ashy Tailorbird | Silvidae | | | + | | + | | | | | + | + | | | - | - | - | - | Migrant |
| 223 | Cinenen Jawa | *Orthotomus sepium* | Olive-backed Tailorbird | Silvidae | | | + | | + | | | | | | | | | - | - | - | - | Migrant |
| 224 | Cinenen Pisang | *Orthotomus sutorius* | Common Tailorbird | Silvidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 225 | Kancilan Bakau | *Pachycephala grisola* | Mangrove Whistler | Pachycephalidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 226 | Elang Tiram | *Pandion haliaetus* | Osprey | Pandionidae | | | | + | | | + | | | | + | | | B, F | - | - | II | Migrant |
| 227 | Gelatik Batu Kelabu | *Parus major* | Great Tit | Paridae | + | | + | | + | | | | | | | | | - | - | - | - | Resident |
| 228 | Burung gereja erasia | *Passer montanus* | Eurasian Tree Sparrow | Ploceidae | | | + | | + | | | | | | | | | - | - | - | - | Resident |
| 229 | Raja Udang | *Pelargopsis capensis* | Stork-billed Kingfisher | Alcedinidae | | | | | | | | | | + | + | | + | A, F | - | - | - | n.i |
| 230 | Undan Paruh Tolol | *Pelecanus philippensis* | Spot-billed Pelican | Pelecanidae | | | | | | | + | | | | | | | A, F | I | - | - | Resident |
| 231 | Pelanduk Topi Hitam | *Pellorneum capistratum* | Black-capped Babbler | Timaliidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 232 | Sepah Tulin | *Pericrocotus igneus* | Fiery Minivet | Cumpephagidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 233 | Sikep Madu Asia | *Pernis ptilorhynchus* | Oriental Honey-buzzard | Accipitridae | | | | | | | + | | | | | | | B, F | - | - | II | Resident |
| 234 | Kadalan Birah | *Phaenicophaeus curvirostris* | Chesnut-breasted Malkoha | Cuculidae | | | | | | | + | | | | | | | - | - | - | - | Migrant |
| 235 | Pecuk Padi Belang | *Phalacrocorax melanoleucus* | Little Pied Cormorant | Phalacrocoracidae | | | | | + | | | | | | | | | - | - | - | - | Resident |
| 236 | Pecuk Padi Kecil | *Phalacrocorax niger* | Little Cormorant | Phalacrocoracidae | | | + | + | + | | | | | | | | | - | - | - | - | Resident |
| 237 | Pecuk Padi | *Phalacrocorax pygmaeus* | | Phalacrocoracidae | | | | | + | | | | | | | | | - | IK | - | - | Resident |
| 238 | Pecuk Padi Hitam | *Phalacrocorax sulcirostris* | Little Back Cormorant | Phalacrocoracidae | | | | + | + | | | | | | | | | - | - | - | - | Resident |
| 239 | Philentoma sayap-Merah | *Philentoma pyrhopterum* | Rufous-winged Philentoma | Muscicapidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 240 | Philentoma Kerudung | *Philentoma velatum* | Moroon-breasted Philentoma | Muscicapidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 241 | Serak Bukit | *Phodilus badius* | Oriental Bay Owl | Strigiformes | | | | | | | | | | | + | | | - | - | - | II | Migrant |
| 242 | Cikrak Kutub | *Phylloscopus borealis* | Arctic Warbler | Silvidae | | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 243 | Caladi Ulam | *Picoides macei* | Fulvous-breasted macei | Picidae | | | | | + | | | | | | + | | | - | - | - | - | Migrant |
| 244 | Caladi tilik | *Picoides moluccensis* | Sunda Woodpecker | Picidae | | | | | + | | | | | | | | | - | - | - | - | Migrant |
| 245 | Pelatuk Kumis Kelabu | *Picus mentalis* | Checker-throated Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 246 | Pelatuk Sayap Merah | *Picus puniceus* | Crimson-winged Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 247 | Paok Delima | *Pitta granatina* | Garnet Pitta | Pittidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 248 | Paok Hujan | *Pitta moluccensis* | Blue-winged Pitta | Pittidae | | | | | | | | | | | + | | | A, F | - | - | - | Migrant |
| 249 | Tiong Batu Kalimantan | *Pityriasis gymnocephala* | Bornean Bristlehead | Corvidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 250 | Tangkar Kambing | *Platysmurus leucopterus* | Black Magpie | Corvidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 251 | Ibis Rokoroko | *Plegadis falcinellus* | Glossy Ibis | Threskiornithidae | | | | + | + | | | | | | | | | A, F | - | - | - | Migrant |
| 252 | Manyar Jambul | *Ploceus manyar* | Streaked Weaver | Ploceidae | + | | | + | | | | | | | | | | - | - | - | - | Migrant |
| 253 | Trulek Kli-it | *Pluvialis dominica* | Lesser Golden Plover | Charadriidae | | | + | + | | | | | | | | | | - | - | - | - | Migrant |
| 254 | Cerek Besar | *Pluvialis squatarola* | Grey Plover | Charadriidae | | | | + | | | | | | | + | | | - | - | - | - | Migrant |
| 255 | Cica-Kopi Melayu | *Pomatorhinus montanus* | Chesnut-backed Scimitar-babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 256 | Mandar Besar | *Porphyrio porphyrio* | Purple Swamphen | Rallidae | | | + | | + | | | | | | | | | - | - | - | - | Migrant |
| 257 | Tikusan Alis Putih | *Porzana cinerea* | White-browed Crake | Rallidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 258 | Tikusan Merah | *Porzana fusca* | Ruddy-breasted Crake | Rallidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 259 | Prenjak Jawa | *Prinia familiaris* | Bar-winged Prinia | Silvidae | | | + | + | + | | | | | | | | | - | - | - | - | Resident |
| 260 | Prenjak Rawa | *Prinia flaviventris* | Yellow-bellied Prinia | Silvidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |
| 261 | Prenjak Coklat | *Prinia polychroa* | Brown Prinia | Silvidae | | | | | + | | | | | | | | | - | - | - | - | Migrant |
| 262 | Prenjak Sisi Merah | *Prinia subflava* | Tawny-flanked Prinia | Silvidae | | | + | | | | | | | | | | + | - | - | - | - | Migrant |
| 263 | Prenjak | *Prinia veaviventris* | | Silvidae | | | | | | | | | | | | | + | | | | | |
| 264 | Pentis Jawa | *Prionochilus maculatus* | Yellow-brested Flowerpecker | Dicaeidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 265 | Pentis Pelangi | *Prionochilus percussus* | Crimson-breasted Flowerpecker | Dicaeidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 266 | Pentis Kumbang | *Prionochilus thoracicus* | Scarlet-breasted Flowerpecker | Dicaeidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 267 | Pentis Kalimantan | *Prionochilus xanthopygius* | Yellow-rumped Flowerpecker | Dicaeidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 268 | | *Pseudibis davisoni* | | | | | | | | | | | | | | + | | | | | | |
| 269 | Betet Biasa | *Psittacula alexandri* | Red-breasted Parakeet | Psittacidae | | | | | + | | | | | | + | | | - | - | - | II | Migrant |
| 270 | Betet Ekor Panjang | *Psittacula longicauda* | Long-tailed Parakeet | Psittacidae | | | | | | | | | | + | + | | | - | - | - | II | Migrant |
| 271 | Nuri Tanau | *Psittinus cyanurus* | Blue-rumped Parrot | Psittacidae | | | | | | | | | | | + | | | - | - | - | II | Resident |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 272 | Cucak Kurincang | *Pycnonotus atriceps* | Black-headed Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 273 | Cucak Kutilang | *Pycnonotus aurigaster* | Sooty-headed Bulbul | Pycnonotidae | | | + | | + | | | | | | + | | | - | - | - | - | Migrant |
| 274 | Cucak Kelabu | *Pycnonotus cyaniventris* | Grey-Bellied Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 275 | Merbah Kacamata | *Pycnonotus erythropthalmos* | Spectacled Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 276 | Cucak Rumbai Tungging | *Pycnonotus eutilotus* | Puff-backed Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 277 | Merbah Cerucuk | *Pycnonotus goiavier* | Yellow-vented Bulbul | Pycnonotidae | | | + | + | + | | | | | | + | | + | - | - | - | - | Migrant |
| 278 | Cucak Sakit Tubuh | *Pycnonotus melanoleucos* | Black and White Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 279 | Merbah Corok-corok | *Pycnonotus simplex* | Cream-vented Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 280 | Cucak Bessik | *Pycnonotus squamatus* | Scaly-breasted Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 281 | Cucak Rawa | *Pycnonotus zeylanicus* | Straw-headed Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 282 | Merbah Mata Merah | *Pygnonotus brunneus* | Red-eye Bulbul | Pycnonotidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 283 | Pelatuk Kundang | *Reinwardtipicus validus* | Orange-backed Woodpecker | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 284 | Kapinis Jarum Kecil | *Rhaphidura leucopygialis* | Silver-rumped Swift | Apodidae | | | | | | | | | | | + | | | - | - | - | - | n. i. |
| 285 | | *Rhapodytes diardi* | | Cuculidae | | | | | | | | | | | + | | | - | - | - | - | n. i. |
| 286 | Sikatan Rimba Dada Kelabu | *Rhinomyias umbratilis* | Brown-chested Jungle flycatcher | Muscicapidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 287 | | *Rhinortha chlorophaea* | | | | | | | | | | | | | + | | | - | - | - | - | n. i. |
| 288 | Kipasan Belang | *Rhipidura javanica* | Pied Fantail | Muscicapidae | | | + | + | + | | | | | | + | | | D, F | - | - | - | Resident |
| 289 | Kipasan Mutiara | *Rhipidura perlata* | Spotted Fantail | Muscicapidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 290 | | *Rhopodytes diardi* | | | | | | | | | | | | | + | | | | | | | |
| 291 | | *Rhyticeros corrugatus* | | Bucerotidae | | | | | | | | | | | + | | | - | V | V | II | Migrant |
| 292 | Rangkong | *Rhyticeros undulatus* | | | | | | | | | | | | + | | | | | | | | |
| 293 | Puyuh Sengayan | *Rollulus rouloul* | Crested Partridge | Phasianidae | | | | | | | | | | | + | | | - | - | - | III MY | Migrant |
| 294 | Caladi Tikus | *Sasia abnormis* | Rufous Piculet | Picidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 295 | Kucica Batu | *Saxicola caprata* | Pied Bushchat | Turdidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 296 | Empuloh Paruh Kait | *Setornis criniger* | Hook-billed Bulbul | Pycnonotidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 297 | Gelatik Munguk | *Sitta frontalis* | Velvet-fronted Nuthatch | Sittadae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 298 | Elang Ular Bido | *Spilornis cheela* | Crested Serpent Eagle | Accipitridae | | | | | | | | | | + | + | | | B, F | - | - | II | Resident |
| 299 | Elang brontok | *Spizaetus cirrhatus* | | Accipitridae | | | | | | + | | | | | | | | | | | | |
| 300 | Elang Wallace | *Spizaetus nanus* | Crested Serpent Eagle | Accipitridae | | | | | | | | | | | + | | | - | R | - | II | Resident |
| 301 | Tepus Merbah Sampah | *Stachyris erythroptera* | Chesnut-winged Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 302 | Tepus Tugir Merah | *Stachyris maculata* | Chesnut-rumpet Babbler | Timalidae | | | | | | | | | | | + | | + | - | - | - | - | Migrant |
| 303 | Tepus Kaban | *Stachyris nigricolla* | Black-throated Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 304 | Camar Kejar Pomarin | *Stercorarius pomarinus* | Pomarine jaeger | Stercorariidae | | | | | | | | | | + | | | | - | - | - | - | Migrant |
| 305 | Dara Laut Kecil | *Sterna albifrons* | Little Tern | Sternidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 306 | Dara Laut Batu | *Sterna anaethetus* | Bridled Tern | Sternidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 307 | Dara Laut Benggala | *Sterna bengalensis* | Lesser Crested-Tern | Sternidae | | | + | | | | | | | | | | | A, F | - | - | - | Migrant |

Annex 4 *cont.* List Species of Birds of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Common Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 308 | Dara Laut Jambul | *Sterna bergii* | Great Crested | Sternidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 309 | Dara Laut Biasa | *Sterna hirundo* | Common Tern | Sternidae | | | | | + | | | | | | + | | | A, F | - | - | - | Migrant |
| 310 | Dara Laut Tengkuk Hitam | *Sterna sumatrana* | Black-naped Tern | Sternidae | | | | | | | | | | | | | + | - | - | - | - | Migrant |
| 311 | Dederuk Jawa | *Streptopelia bitorquata* | Island Collares-Dove | Columbidae | | | + | + | | | | | | | | | | - | - | - | - | Migrant |
| 312 | Tekukur Biasa | *Streptopelia chinensis* | Spotted Dove | Columbidae | | | + | + | + | | | | | | + | | + | - | - | - | - | Migrant |
| 313 | Kukuk Beluk | *Strix leptogrammica* | Brown Wood-owl | Strigiformes | | | | | | | | | | | + | | | F, H | - | - | II | Migrant |
| 314 | Jalak Putih | *Sturnus melanopterus* | Black-winged Starling | Strigiformes | | | | | + | | | | | | | | | - | - | - | - | Migrant |
| 315 | Kedasi Hitam | *Surniculus lugubris* | Drongo-Cuckoo | Cuculidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 316 | Titihan Telaga | *Tachybaptus ruficollis* | Little Grebe | Podicipedidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 317 | Jingjing Pelulak | *Tephrodornis gularis* | Large Woodshrike | Campephagidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 318 | Seriwang Asia | *Terpsiphone paradisi* | Japanese Paradise | Muscicapidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 319 | Ibis Cucuk Besi | *Threskiornis melanocephalus* | Black-headed Ibis | Threskiornithidae | | | | | + | | + | | | + | | | | A, F | - | - | - | Migrant |
| 320 | Cekakak Sungai | *Todirhampus chloris* | Collared Kingfisher | Alcedinidae | | | | | + | | | | | | | | | - | - | - | - | Resident |
| 321 | Cekakak suci | *Todirhampus sanctus* | Cekakak Suci | Alcedinidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 322 | Punai Siam | *Treron bicincta* | Orange-breasted Green | Columbidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 323 | Punai | *Treron capellei* | | Columbidae | | | | | | | | | | | | + | | | | | | |
| 324 | Punai Lengkuak | *Treron curvirostra* | Thick-billed Green-Pigeon | Columbidae | | | | | | | | | | | | | | - | - | - | - | Migrant |
| 325 | Punai Lengkuak | *Treron curvirostra* | Thick-billed Green-Pigeon | Columbidae | | | | | | | + | | | | + | | | | | | | |
| 326 | Punai Bakau | *Treron fulvicollis* | Cinnamon-Headed Green- Pigeon | Columbidae | | | | | | | + | | | | | | | - | - | - | - | Resident |
| 327 | Punai Kecil | *Treron olax* | Little Green-Pigeon | Columbidae | | | | | + | | | | | | + | | | - | - | - | - | Migrant |
| 328 | Punai Gading | *Treron vernans* | Pink-necked Green-Pigeon | Columbidae | | | | + | + | | + | | | | + | | | - | - | - | - | Resident |
| 329 | Pelanduk Merah | *Trichastoma bicolor* | Ferruginous Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 330 | Kancilan | *Trichastoma malaccense* | | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 331 | Kancilan Sunda | *Trichastoma sepiarium* | Horsfield's Babbler | Timalidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |
| 332 | Trinil Semak | *Tringa glareola* | Wood Sandpiper | Scolopacidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |
| 333 | Trinil Nordmann | *Tringa guttifer* | Nordmann's Greenshank | Scolopacidae | | | | | | | + | | + | | | | | E, F | I | I | I | Migrant |
| 334 | Trinil Pantai | *Tringa hypoleucos* | Common Sandpiper | Scolopacidae | | | + | | | | | | | + | | | | - | - | - | - | Migrant |
| 335 | Trinil Kaki Hijau | *Tringa nebularia* | Common Greenshank | Scolopacidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |
| 336 | Trinil Rawa | *Tringa stagnatilis* | Marsh Sandpiper | Scolopacidae | | | + | | | | | | | | + | | | - | - | - | - | Migrant |
| 337 | Trinil Kaki Merah | *Tringa totanus* | Common Redshank | Scolopacidae | | | + | | | | + | | | | | | | - | - | - | - | Migrant |
| 338 | | *Turnix sylvatica* | | | | | | | | | | | | | | | | | | | | |
| 339 | Serak Rawa | *Tyto alba* | BarnOwl | Strigiformes | | | + | + | | | | | | | | | | - | - | - | II | Migrant |
| 340 | Trinil Terik | *Xenus cinereus* | Terek Sandpiper | Scolopacidae | | | + | + | | | + | | | | + | | | - | - | - | - | Migrant |
| 341 | Burung Anis Merah | *Zoothera citrina* | Orange-headed Thrush | Turdidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 342 | Burung Kacamata Laut | *Zosterops chloris* | Lemon-bellied White-eye | Zosteropidae | | | + | | + | | | | | | | | | - | - | - | - | Migrant |
| 343 | Burung Kacamata Jawa | *Zosterops flavus* | Javan White-eye | Zosteropidae | | | + | | | | | | | | + | | | - | R | - | - | Resident |
| 344 | Burung Kacamata Biasa | *Zosterops palpebrosus* | Oriental White-eye | Zosteropidae | | | + | | + | | | | | | | | | - | - | - | - | Migrant |

Annex 5 List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 1 | Ikan Betok | *Abudefduf coelelinus* | Pomacentridae | | | | | | | | | | + | | | | - | - | - | - | |
| 2 | Ikan Julung-julung | *Acantognathus sp.* | Hemiramphidae | | | | | | | + | | | | | | | - | - | - | - | |
| 3 | Ikan Butana | *Achanthurus mata* | Thenthidae | | | | | | | | | | + | | | | - | - | - | - | |
| 4 | Ikan Boso | *Actinogobius ommaturus* | Bobidae | | | + | | | | | | | | | | | - | - | - | - | |
| 5 | Ikan Piso | *Aeolscus strigatus* | Centricidae | | | | | | | | | + | | | | | - | - | - | - | |
| 6 | Ikan pari | *Aetobatus narinari* | Bobidae | | | + | | + | | | | | | | | | - | - | - | - | |
| 7 | Ikan Kuweh | *Alectis indica* | Carangidae | | | + | | | | | | | | | | | - | - | - | - | |
| 8 | | *Alepes jedaba* | | | | + | | | | | | | | | | | - | - | - | - | |
| 9 | Ikan Trubuk | *Alosa tol* | Clupidae | | | + | | | | | | | | | | | - | - | - | - | |
| 10 | | *Atherina temminckl* | Centracpomidae | | | + | | | | | | | | | | | - | - | - | - | |
| 11 | Ikan Serinding | *Ambassis gymnocephalus* | Centracpomidae | + | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 12 | Ikan Serinding | *Ambassis interupta* | Centracpomidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 13 | Ikan Srinding | *Ambassis kopsi* | Ambassidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 14 | Ikan Serinding | *Ambassis nalua* | Centracpomidae | | | + | | | | | | | | | | | - | - | - | - | Migrant |
| 15 | Ikan Serinding | *Ambassis sp.* | Centracpomidae | | | | | | | | | | | + | | + | - | - | - | - | |
| 16 | | *Amblyglyphidodon aureus* | Pomacentridae | | | | | | | | | | | + | | | - | - | - | - | |
| 17 | | *Amblyglyphidodon curacao* | Pomacentridae | | | | | | | | | | + | + | | | - | - | - | - | |
| 18 | Ikan Kelabau | *Amblyrhynchichthys truncatus* | Cyprinidae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 19 | Ikan Giru | *Amphiprion ocellaris* | Pomacentridae | | | | | | | | | | + | | | | - | - | - | - | |
| 20 | Ikan Garu | *Amphiprion percula* | Pomacentridae | | | | | + | | | | | | | | | - | - | - | - | |
| 21 | | *Amphiprion sandaracinos* | | | | | | | | | | | + | | | | - | - | - | - | |
| 22 | Ikan Betok | *Anabas testudineus* | Anabantidae | | | + | | + | + | + | | | | + | + | | - | - | - | - | Migrant |
| 23 | Ikan Sidat Laut | *Anguilla australis* | Anguillidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 24 | | *Anodontostoma chacunda* | | | | + | | | | | | | | | | | - | - | - | - | |
| 25 | | *Anthias monotoni* | Serranidae | | | + | | | | | | | | | | | - | - | - | - | |
| 26 | Ikan Belanak | *Aplocheilus panchax* | Mugilidae | | | + | | | | | | | | | | | - | - | - | - | |
| 27 | Ikan Glagah | *Apogon poecilopterus* | Apongidae | | | + | | | | | | | | | | | - | - | - | - | |
| 28 | | *Apogon quinquifasaata* | Apogonidae | | | | | | | | | | | | | | - | - | - | - | |
| 29 | Ikan Glagah | *Apogon sealei* | Apongidae | | | | | | | | | | + | | | | - | - | - | - | |
| 30 | Ikan Glagah | *Apogon sp.* | Apongidae | | | | | | | | | | + | | | | - | - | - | - | |
| 31 | Ikan Manyung Duri | *Arius argyropleuron* | Aridae | | | | | | | + | | | | | | | - | - | - | - | Migrant |
| 32 | Ikan Manyung Duri | *Arius caelatus* | Arlidae | | | | | | | + | | | | + | + | | - | - | - | - | Migrant |
| 33 | Ikan Manyung | *Arius macoletus* | Arlidae | | | + | | | | | | + | | + | + | | - | - | - | - | Migrant |
| 34 | Ikan Manyung Duri | *Arius macronotacanthus* | Aridae | | | + | | | | + | | | | | | | - | - | - | - | |
| 35 | Ikan manyung duri | *Arius maculatus* | Aridae | | | | | | | + | | | | | | | - | - | - | - | |
| 36 | Ikan Manyung Duri | *Arius sagor* | Aridae | | | + | | | | + | | | | | | | - | - | - | - | Migrant |
| 37 | Ikan Manyung | *Arius sp.* | Anidae | | + | | | | | + | | | + | | | | - | - | - | - | Migrant |
| 38 | Ikan Manyung Duri | *Arius storni* | Aridae | | | | | | | + | | | | | | | - | - | - | - | Migrant |
| 39 | Ikan manyung | *Arius thalassinus* | Aridae | + | | | | + | | | + | | | + | + | | - | - | - | - | Migrant |
| 40 | Ikan duri kuning | *Arius truncatus* | Anidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 41 | Ikan Manyung Duri | *Arius utik* | Arlidae | | | | | | | + | | | | | | | - | - | - | - | Migrant |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 42 | Ikan duri manyung | *Arius venosus* | Ariidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 43 | | *Atherina temminseki* | Atherinidae | | | + | | | | | | | | | | | - | - | - | - | |
| 44 | Ikan Gronggong | *Atherina valenciennesi* | Atherinidae | | | + | | | | | | | | | | | - | - | - | - | |
| 45 | Ikan Tongkol | *Auxis* sp. | Thunnidae | | | + | | | | | | | + | | | | - | - | - | - | Migrant |
| 46 | Ikan Tongkol | *Auxis thazard* | Thunnidae | + | | | | | | | | | | | | | - | - | - | - | Migrant |
| 47 | Ikan Baung Tikus | *Bagrichthys macracanthus* | Bagridae | | | | | | | | | | | + | + | + | - | - | - | - | Resident |
| 48 | Ikan Gulamah | *Bahaba polykladiskos* | Sciaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 49 | Ikan Gulamah | *Bahaba* sp. | Sciaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 50 | Ikan Gulamah | *Bahaba taipingensis* | Sciaenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 51 | Ikan Gulamah | *Bahaba taipingensis* | Sciaenidae | | | | | | | | | | | | | | - | - | - | - | |
| 52 | Ikan Paku | *Barbichthys laevis* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 53 | Ikan Bonun | *Barbucca Diabolica* | Balitoridae | | | | | | | | | | | + | + | | - | - | - | - | |
| 54 | Ikan Lundu | *Batrachocephalus mino* | Aridae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 55 | Ikas Sepat | *Belontia hasselti* | Belontidae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 56 | Ikan Tangkit | *Betta anabantoides* | Belontidae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 57 | Ikan Tangkit | *Betta foerschi* | Belontidae | | | | | | | | | | | + | | | - | - | - | - | |
| 58 | Ikan Cupang | *Betta pugnans* | Belontidae | | | | | | | + | | | | | | | - | - | - | - | |
| 59 | Ikan Glodok | *Boleophthalmus boddarti* | Apocrypteidae | + | | + | | + | | + | | | | | | | - | - | - | - | |
| 60 | Ikan Gelang Gendis | *Brachygobius doriae* | Gobidae | | | | | | | | | | | + | + | | - | - | - | - | Resident |
| 61 | | *Bredensteinia insignis* | Akysidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 62 | Ikan Beloso | *Butis butis* | Eleotridae | + | | | | | | + | | | | | | | - | - | - | - | |
| 63 | Ikan Beloso | *Butis gymnopomus* | Eleotridae | | | | | | | + | | | | | | | - | - | - | - | |
| 64 | Ikan Beloso | *Butis melanostigma* | Eleotridae | + | + | | | | | + | | | | | | | - | - | - | - | |
| 65 | Ikan Ekor Kuning | *Caesio erythrogaster* | Lutjanidae | | | | | | | | + | | + | | | | - | - | - | - | |
| 66 | | *Callionymus sagitta* | Callionymidae | | | + | | | | | | | | | | | - | - | - | - | |
| 67 | | *Callionymus schwepi* | Callionymidae | | | + | | | | | | | | | | | - | - | - | - | |
| 68 | Ikan Kuwe | *Carangoides chrysophrys* | Carangidae | | | | | + | | | | | | | | | - | - | - | - | |
| 69 | Ikan Kuweh Lilin | *Carangoides* sp. | Carangidae | | | | | | | | + | | | | | | - | - | - | - | |
| 70 | Ikan Selar | *Caranx boops* | Carangidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 71 | Ikan Selar Bentong | *Caranx crumenophthalmus* | Carangidae | | | | | + | | | | | | | | | - | - | - | - | |
| 72 | Ikan Selar Batang | *Caranx kalla* | Carangidae | + | | | | | | + | | | | | | | - | - | - | - | |
| 73 | Ikan Selar Kuning | *Caranx leptolepis* | Carangidae | | | | + | | | | | | | | | | - | - | - | - | |
| 74 | Ikan Kale Panjang | *Caranx nieuhofi* | Carangidae | | | | | | | + | | | | | | | - | - | - | - | |
| 75 | Ikan Selar Kuning | *Caranx sexfasciatus* | Carangidae | | | | | | | + | | | | | | | - | - | - | - | |
| 76 | Ikan Selar | *Caranx* sp. | Carangidae | + | + | | | | | + | + | | + | | | | - | - | - | - | |
| 77 | Ikan Cucut | *Carcharias* sp. | Carcharhinidae | + | + | | | | | + | + | | + | | | | - | - | - | - | |
| 78 | Ikan Buntal | *Carnotetraodon lorteti* | Tetraodontidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 79 | | *Cellinus fasciatus* | | | | | | | | | | | + | | | | - | - | - | - | |
| 80 | Ikan Baung | *Cephalocassis melanochir* | Ariidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 81 | Ikan kerapu karang | *Cephalopholis cyanostigma* | Serranidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 82 | | *Cephalopholis pachycentron* | Serranidae | | | | | | | | | | | + | + | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 83 | Ikan kerapu | *Cephalopholis* sp. | Serranidae | | | | | | | | | | + | | | | - | - | - | - | |
| 84 | Ikan Bandera | *Chaetodon auriga* | Chaetodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 85 | Ikan Kepe-kepe | *Chaetodon melanotus* | Chaetodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 86 | Ikan kupu-kupu | *Chaetodon octofasciatus* | Chatodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 87 | | *Chaetodon oxycephalus* | Chaetodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 88 | | *Chaetodon plebesus* | Chaetodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 89 | | *Chaetodon semeion* | Chaetodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 90 | | *Chaetodon trifasciatis* | Chaetodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 91 | Ikan kepe-kepe | *Chaetodon vagabundus* | Chaetodontidae | | | | | | | | | | + | | | | - | - | - | - | |
| 92 | Ikan Runtuk | *Channa bankanensis* | Channidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 93 | Ikan Judung | *Channa lucius* | Channidae | | | | | | | | + | | | + | + | + | - | - | - | - | Migrant |
| 94 | Ikan Tomang | *Channa micropeltes* | Channidae | | | | | | | + | | | | + | + | | - | - | - | - | Migrant |
| 95 | Ikan Serandang | *Channa pleuropthalmus* | Channidae | | | | | | | + | | | | + | + | | - | - | - | - | Migrant |
| 96 | Ikan Bandang | *Channa* sp. | Channidae | | | | | | | | | | + | | | | - | - | - | - | Migrant |
| 97 | Ikan Arwana | *Channa striata* | Channidae | | | + | | | | | | | + | + | + | + | - | - | - | - | Migrant |
| 98 | Ikan Banden | *Chanos chanos* | Channidae | + | | + | + | + | | | | | | | | | - | - | - | - | |
| 99 | Ikan nun | *Chellinus fasciatus* | Labridae | | | | | | | | | | | + | + | | - | - | - | - | |
| 100 | Ikan Seluang | *Chela laubuca* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 101 | | *Chelmon rostratus* | Chatodontidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 102 | | *Chelonodon patoca* | Tetraodontidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 103 | Ikan Parang-parang | *Chirocentrus dorab* | Clopeidae | | | | | | | + | | | + | | | | - | - | - | - | |
| 104 | Ikan Gigi Anjing | *Choerodon anchorago* | Labridae | | | | | | | | | | | | | | - | - | - | - | |
| 105 | | *Choerodon schoenleinii* | Labridae | | | | | | | | | | | | | | - | - | - | - | |
| 106 | | *Chonerchines manilus* | Carangidae | | | | | | | + | | | | | | | - | - | - | - | |
| 107 | | *Chonerhinos modestus* | Tetraodontidae | | | | | | | + | | | | | | | - | - | - | - | |
| 108 | Ikan Talang-talang | *Chorinemus tala* | Carangidae | | | + | | + | | | + | | | | | | - | - | - | - | |
| 109 | | *Chorinemus toloparah* | Carangidae | + | | | | | | | | | | | | | - | - | - | - | |
| 110 | | *Chromileptes altivelis* | | | | | | | | | | | + | | | | - | - | - | - | |
| 111 | | *Chromis analis* | Pomacentridae | | | | | | | | | | + | | | | - | - | - | - | |
| 112 | | *Chrysiptera springeri* | | | | | | | | | | | + | | | | - | - | - | - | |
| 113 | | *Chrysiptera tricincta* | | | | | | | | | | | + | | | | - | - | - | - | |
| 114 | Ikan Napoleon | *Cilliarus undulatus* | | | | | | | | | + | | + | | | | - | - | - | - | |
| 115 | Ikan Keli Panjang | *Clarias batrachus* | Cloridae | | | | | + | | + | | | + | | | | - | - | - | - | |
| 116 | Ikan Duri | *Clarias melanoderma* | Cloridae | | | | | | | + | | | | | | | - | - | - | - | |
| 117 | Ikan keli panjang | *Clarias nieuhoff* | | | | | | | | + | | | | | | | - | - | - | - | |
| 118 | Ikan Kelik | *Clarias teijsmanni* | Cloridae | | | | | | | | | | | + | + | | - | - | - | - | Resident |
| 119 | Ikan Bulu Ayam | *Clupea brachysoma* | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 120 | Ikan Tembang | *Clupea dispilnolus* | Clupeidae | | | + | | | | | | | | | | | - | - | - | - | |
| 121 | Ikan Tembang | *Clupea fimbricata* | Clupeidae | + | + | + | | | | | + | | | | | | - | - | - | - | |
| 122 | Ikan Bulu Ayam | *Clupea hypselosoma* | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 123 | Ikan Lenguru | *Clupea ilelogaster* | Clupidae | | | | | | | | | | | | | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 124 | Ikan Bulu Ayam | *Clupea lile* | Clupeidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 125 | Ikan Tembang | *Clupea platygaster* | Clupeidae | + | | | | | | | | | + | | | | - | - | - | - | |
| 126 | Ikan Tembang | *Clupea spp.* | Clupeidae | | | | | | | | | | | | | | - | - | - | - | |
| 127 | Ikan Tembang | *Clupea toli* | Clupeidae | | | + | | | | | | | | | | | - | - | - | - | |
| 128 | Ikan Bulu Ayam | *Colla dussumieri* | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 129 | Ikan Ringau | *Coius quadrifasciatus* | Detrioididae | | | | | | | | | | | + | | | - | - | - | - | |
| 130 | Ikan Malung | *Congresox talabon* | Muraenesocidae | | | | | | | | | | + | | | | - | - | - | - | |
| 131 | Ikan Temperas | *Cyclocheilichthys apogon* | Caprindae | | | | | | | | | | | + | + | | - | - | - | - | |
| 132 | Ikan Kekulai | *Cyclocheilichthys armatus* | Caprnidae | | | | | | | | | | | + | | | - | - | - | - | |
| 133 | Ikan Kungkum | *Cyclocheilichthys janthochir* | Caprnidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 134 | Ikan Ilat-ilat | *Cynoglossus bilineatus* | Soleidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 135 | Ikan Ilat-ilat | *Cynoglossus borneensis* | Soleidae | | | + | | | | | | | | | | | - | - | - | - | |
| 136 | Ikan Ilat-ilat | *Cynoglossus brachicephalus* | Soleidae | | | + | | | | | | | | | | | - | - | - | - | |
| 137 | Ikan ilat-ilat | *Cynoglossus cynoglossus* | Soleidae | | | | | | | | | | | | | | - | - | - | - | |
| 138 | Ikan Lidah | *Cynoglossus feldmanni* | Soleidae | | | | | | | + | | | | | | | - | - | - | - | |
| 139 | Ikan Ilat-ilat | *Cynoglossus kaupi* | Soleidae | | | | | | | | | | | + | + | | - | - | - | - | Resident |
| 140 | Ikan Lidah | *Cynoglossus lida* | Soleidae | | | + | | | | | | | | | | | - | - | - | - | |
| 141 | Ikan Ilat-ilat | *Cynoglossus lingua* | Soleidae | | | | | | | | | | | | | | - | - | - | - | |
| 142 | Ikan Ilat-ilat | *Cynoglossus microlepidotus* | Soleidae | | | | | | | + | | | | | | | - | - | - | - | |
| 143 | Ikan Lidah | *Cynoglossus punctiops* | Soleidae | | | | | | | + | | | | | | | - | - | - | - | |
| 144 | Ikan Lidah | *Cynoglossus spp.* | Soleidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 145 | Ikan jelame | *Dangila ocellata* | Lutjanidae | | | | | | | | | | + | | | | - | - | - | - | Resident |
| 146 | Ikan Kiu-kiu | *Dascyllus carneus* | Pomacentridae | | | | | | | | | | | + | + | | - | - | - | - | |
| 147 | Ikan Pari | *Dasyatis sp.* | Dastatidae | | | | | | | | | | + | | | | - | - | - | - | |
| 148 | Ikan Layang | *Decapterus kurroides* | Carangidae | + | + | | | | | | + | | + | + | | | - | - | - | - | Migrant |
| 149 | Ikan Layang Dedes | *Decapterus macrosoma* | Carangidae | + | | | | | | | | | | | | | - | - | - | - | |
| 150 | Ikan Layang | *Decapterus russelli* | Carangidae | + | + | | | | | | | | | | | | - | - | - | - | |
| 151 | Ikan Layang | *Decapterus spp.* | Carangidae | | | | | | | | | | + | | | | - | - | - | - | |
| 152 | Ikan Gulamah | *Dendrophyssa russelli* | | | | | | | | + | | | | | | | - | - | - | - | |
| 153 | | *Dorosoma chacunda* | Clupeidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 154 | Ikan Kil-kil Buaya | *Doryichthys martensi* | Syngnathidae | | | | | | | | | | | + | | | - | - | - | - | |
| 155 | Ikan Ketang-ketang | *Drepane punctata* | Chaetodontidae | | | | | | | + | | | | | | | - | - | - | - | |
| 156 | Ikan Japuh | *Dussumieria acuta* | Clupeidae | | + | | | | | + | | | | | | | - | - | - | - | |
| 157 | Ikan Japuh | *Dussumieria hasselti* | Clupeidae | | | | | | | + | + | | | | | | - | - | - | - | |
| 158 | | *Ecutir insidiator* | | | | + | | | | | | | | | | | - | - | - | - | |
| 159 | Ikan Baju | *Eirmotus octozona* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | Resident |
| 160 | Ikan Kurau | *Eleutheronema tetradactylum* | Polynemidae | + | | + | | | | + | | + | + | | | | - | - | - | - | Resident |
| 161 | Ikan Payus | *Elops hawaiensis* | Elorsidae | | | + | | | | | | | + | | | | - | - | - | - | |
| 162 | Ikan Bilis | *Engraulis grayi* | Engraulidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 163 | | *Engraulis kammalensis* | Engraulidae | | | + | | | | | | | | | | | - | - | - | - | |
| 164 | Ikan Bilis | *Engraulis malabaricus* | Engraulidae | | | + | | | | | | | | | | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 165 | Ikan Bilis | *Engraulis mystax* | Engraulidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 166 | Ikan Kerapu | *Ephinephelus boenack* | Serranidae | | | | | | | | | | | | | | - | - | - | - | Resident |
| 167 | Ikan Kerapu | *Ephinephelus coioides* | Serranidae | | | | | | | | | | | + | | | - | - | - | - | Resident |
| 168 | Ikan Kerapu | *Ephinephelus nebulosus* | Serranidae | + | | | | | | | | | | | | | - | - | - | - | Resident |
| 169 | Ikan Kerapu | *Ephinephelus sp.* | Serranidae | + | | | | | + | | | | + | | | | - | - | - | - | Resident |
| 170 | Ikan Kerapu | *Ephinephelus fauvina* | Serranidae | + | | + | | | | | | | | | | | - | - | - | - | Resident |
| 171 | Ikan Kerapu | *Ephinephelus boenack* | | | | + | | | | | | | | | | | - | - | - | - | |
| 172 | | *Epinephelus coioides* | Serranidae | | | | | | | | | | | | + | | - | - | - | - | |
| 173 | Ikan Tongkol | *Euthynnus affinis* | Katanwonidae | + | | | | | + | | | | | | | | - | - | - | - | Resident |
| 174 | Ikan Tongkol | *Euthynnus spp.* | Katanwonidae | | + | | | | | | + | | | | | | - | - | - | - | Resident |
| 175 | Bawal hitam | *Formio sp.* | | | | | | | | | | | + | | | | - | - | - | - | |
| 176 | | *Gastrophysus lunaris* | | | | | | | | + | | | | | | | - | - | - | - | |
| 177 | Ikan Keras Kaki | *Gazza minuta* | Leiognathidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 178 | Ikan Kapas | *Gerres filamentosa* | Leiognathidae | | | + | | | | | | | | | | | - | - | - | - | |
| 179 | Ikan Kapas | *Gerres macrosoma* | Leiognathidae | | | + | | | | | | | | | | | - | - | - | - | |
| 180 | Ikan Kapas | *Gerres punctatus* | Leiognathidae | + | | | | | | | | | | | | | - | - | - | - | |
| 181 | Ikan Kapas | *Gerres sp.* | Leiognathidae | | | | | | | + | | | | | | | - | - | - | - | |
| 182 | Ikan Bobosok Hitam | *Glossogobius biocellatus* | Gobiidae | | | + | | | | | | | | | | | - | - | - | - | |
| 183 | Ikan Beloso | *Glossogobius giuris* | Gobiidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 184 | | *Glyptothorax major* | Sisoridae | | | | | | | | | | | + | | | - | - | - | - | |
| 185 | Ikan Tunggulang | *Gobiopterus brachypterus* | Gobiidae | | | + | | | | | | | | | | | - | - | - | - | |
| 186 | | *Gymnothorax ille* | Muraenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 187 | Ikan Langkung | *Hampala macrolepidota* | Cyprinidae | | | | | | | | | | | + | | | - | - | - | - | |
| 188 | Ikan Nomae | *Harpadon neherues* | Scopelidae | | | | | | | + | | | + | | | | - | - | - | - | |
| 189 | Ikan Tembakang | *Helostoma temminckii* | Anabantidae | | | | | | + | | | | | + | + | | - | - | - | - | |
| 190 | Ikan Meyang | *Hemianus stormi* | Ariidae | + | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 191 | Ikan Duri | *Hemipimelodus borneensis* | Ariidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 192 | Ikan Manyung Duri | *Hemipimelodus microcephalus* | Ariidae | | | | | | | + | | | | | | | - | - | - | - | |
| 193 | Ikan Kenyulung | *Hemirhamphodon kapuasensis* | Hemirhamphidae | | | | | + | | | | | | + | + | | - | - | - | - | Migrant |
| 194 | Ikan Julung-julung | *Hemirhamphodon pogonognatus* | Hemirhamphidae | | | | | | | | | | | + | | | - | - | - | - | |
| 195 | Ikan Julung-julung | *Hemirhamphus sp.* | Hemirhamphidae | | | | | | + | + | | | + | | | | | | | | |
| 196 | Ikan Julung-julung | *Hemirhamphus unifasciatus* | Hemirhamphidae | | | + | | | | | | | | | | | - | - | - | - | Resident |
| 197 | Ikan Tratjas | *Hemirhampus dussumieri* | Hemirhamphidae | | | + | | | | | | | | | | | - | - | - | - | Resident |
| 198 | Ikan Julung-julung | *Hemirhampus georgii* | Hemirhamphidae | + | | | | | | | | | | | | | - | - | - | - | Resident |
| 199 | Ikan Terubuk | *Hilsa sp.* | | | | | | | | | | | + | | | | - | - | - | - | |
| 200 | | *Ilisha kampeni* | Pristigasteridae | | | | | | | | | | | + | | | - | - | - | - | |
| 201 | Ikan Gulamah | *Johnius belangeri* | Scaenidae | | | + | | | | + | | | | + | + | | - | - | - | - | Resident |
| 202 | Ikan Gulamah | *Johnius dussumieri* | Scaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 203 | Ikan tiang layar | *Johnius sp.* | Sciaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 204 | Ikan tirus | *Johnius trachycephalus* | Sciaenidae | | | | | | | | | | | + | + | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 205 | Cakalang | *Katsuwonus pelamis* | Katanwonidae | | | | | | + | | | | | | | | - | - | - | - | |
| 206 | Ikan Keting | *Ketengus* sp. | Aridae | | | | | + | | | | | | | | | - | - | - | - | |
| 207 | Ikan Lais | *Kryptopterus apogon* | Aridae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 208 | Ikan Lais Juaro | *Kryptopterus cryptopterus* | Aridae | | | | | | | + | | | | | | | - | - | - | - | |
| 209 | Ikan Aur-aur | *Kryptopterus macrocephalus* | Aridae | | | | | | | | | | | + | + | + | - | - | - | - | Resident |
| 210 | Ikan Lais Muncung | *Kryptopterus micronema* | Aridae | | | | | | | + | | | | | | | - | - | - | - | |
| 211 | Ikan Kebal | *Labiobarbus fasciatus* | Cyprinidae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 212 | Ikan Ketulai | *Labiobarbus festivus* | Cyprinidae | | | | | | | | | | | + | | | - | - | - | - | |
| 213 | Ikan Lelemah | *Lactarius lactarius* | Lactaridae | | | + | | | | | | | | | | | - | - | - | - | |
| 214 | Ikan Buntal | *Lagocephalus lunaris* | Tetraodontidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 215 | Ikan Kakap | *Lates calcacifer* | Centropomidae | + | | + | | | + | + | | | + | + | + | | - | - | - | - | Migrant |
| 216 | Ikan Gapi | *Lebistes reticulatus* | Poecilidae | | | | | + | | | | | | | | | - | - | - | - | |
| 217 | Ikan Tikus | *Leiocassis fuscus* | Bagridae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 218 | Ikan Baung Tikus | *Leiocassis micropogon* | Bagridae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 219 | Ikan Baung Tikus | *Leiocassis myersi* | Bagridae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 220 | Ikan Baung Tikus | *Leiocassis stenomus* | Bagridae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 221 | Ikan Kalangkitu | *Leiognathus equulus* | Leiognathidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 222 | Ikan Kalangkitu | *Leiognathus fasciatus* | Leiognathidae | | | + | | | | | | | | | | | - | - | - | - | |
| 223 | Ikan Petak | *Leiognathus* sp. | Leiognathidae | + | | | | + | | + | | | | | | | - | - | - | - | |
| 224 | Ikan Peperek Cina | *Leiognathus splendens* | Leiognathidae | | | + | | | | | | | | | | | - | - | - | - | |
| 225 | | *Lepidocephalichthys pristes* | Cobitidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 226 | Ikan Jelawat | *Leptobarbus hoeveni* | Cyprinsdae | | | | | | + | + | | + | | | | | - | - | - | - | |
| 227 | | *Leptosynanceia asterobilapa* | Synanceidae | | | | | | | + | | | | | | | - | - | - | - | |
| 228 | Ikan Belanak | *Liza carinata acinata* | Mugilidae | | | | | | | + | | | | | | | - | - | - | - | |
| 229 | Ikan Belanak | *Liza macrolepis* | Mugilidae | | | | | | | + | | | | | | | - | - | - | - | |
| 230 | Ikan Belanak | *Liza* sp. | Mugilidae | | | | | | | | | | | + | | | - | - | - | - | |
| 231 | Ikan Kakap Batu | *Lobotes surinamensis* | Lobotidae | + | | | | | | | | | | | | | - | - | - | - | |
| 232 | Ikan Tampirosok | *Luciocephalus pulcher* | Luciocephalidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 233 | Ikan kerapu | *Lutjanus bohar* | Lutjanidae | | | | | | | | + | | | | | | - | - | - | - | |
| 234 | Ikan semerah | *Lutjanus fulvus* | Lutjanidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 235 | Ikan Kakap merah | *Lutjanus sanguineus* | Lutjanidae | | | + | | | | | + | | | | | | - | - | - | - | |
| 236 | Ikan Kakap | *Lutjanus* sp. | Lutjanidae | + | + | | | | | | | + | | + | | | - | - | - | - | Migrant |
| 237 | Ikan kakap Putih | *Lutjanus* sp. | Lutjanidae | | | + | | | | | | | | | | | | | | | |
| 238 | | *Lycothrissa crocodilus* | Clupeidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 239 | Ikan Parang | *Macrochirichthys macrochirus* | Cyprinidae | + | | | | | | | + | + | | + | + | | - | - | - | - | |
| 240 | Ikan Betutu | *Macrognathus aculeatus* | Mastocempelidae | | | | | | | + | | | | + | + | | - | - | - | - | |
| 241 | Ikan Tilan | *Macrognathus* sp. | Mastocempelidae | | | | | | | | | | | + | | | - | - | - | - | |
| 242 | Ikan Tilan | *Macrognatus maculatus* | Mastocempelidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 243 | Ikan Lundu | *Macrones gulio* | Bagridae | + | | + | | | | + | | | | | | | - | - | - | - | Resident |
| 244 | Ikan Duri | *Macrones wolfi* | Bagridae | | | | | | | + | | | | | | | - | - | - | - | Resident |
| 245 | Ikan Lonjing | *Mastacembelus erythrotaenia* | Mastacembelidae | | | | | | | | | | | + | + | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 246 | Ikan tilan | *Mastacembelus maculatus* | Mastocembelidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 247 | Ikan Botua | *Megalaspis cordyla* | Carangidae | | | | | | | + | | | + | | | | - | - | - | - | |
| 248 | Ikan Gulamah | *Megalonibea fusca* | | | | | | | | + | | | | | | | - | - | - | - | |
| 249 | Ikan Cengkurungan | *Melagopsis cordyla* | Carangidae | | | + | | + | | | + | | | | | | - | - | - | - | |
| 250 | Ikan Muna | *Monodactylus argenteus* | Monodactylidae | | | + | | | | | | | | | | | - | - | - | - | |
| 251 | Belut | *Monopterus albus* | Synbranchidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 252 | Ikan Belanak | *Mugil cephalus* | Mugilidae | | | + | | | + | + | | | | | | | - | - | - | - | |
| 253 | Ikan Belanak | *Mugil dussumieri* | Mugilidae | + | + | + | | + | | | + | + | | | | | - | - | - | - | Resident |
| 254 | Ikan Belanak | *Mugil sp.* | Mugilidae | | | + | + | | + | | | | | | | | - | - | - | - | |
| 255 | Ikan Belanak | *Mugil troscheli* | Mugilidae | | | | | | | + | | | | | | | - | - | - | - | |
| 256 | Ikan Belanak | *Mugil vlogiensis* | Mugilidae | | | | | | | + | | | | | | | - | - | - | - | |
| 257 | Ikan Remang | *Muraena pardalis* | Muraena | | | + | | | | | | | | | | | - | - | - | - | |
| 258 | Ikan Pucuk Kanipa | *Muraenesox talaban* | Congridae | + | | | | | | | | | | | | | - | - | - | - | |
| 259 | Ikan Baung | *Mystus micracanthus* | Notopteridae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 260 | Ikan Baung | *Mystus nemurus* | Notopteridae | | | | | | | + | | | | + | + | + | - | - | - | - | Resident |
| 261 | Ikan Baung | *Mystus nigriceps* | Notopteridae | | | | | | + | | | + | | + | | + | - | - | - | - | Resident |
| 262 | Ikan Baung | *Mystus oliyuroides* | Notopteridae | | | | | | | | | | | + | + | + | - | - | - | - | Resident |
| 263 | Ikan Baung | *Mystus wyckii* | Notopteridae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 264 | Ikan Selipi Garam | *Nandus nebulosus* | Nandidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 265 | | *Nedystoma dayi* | Ariidae | + | | | | | | | | | | | | | - | - | - | - | |
| 266 | Ikan Kuniri | *Nemipterus sp.* | Notopteridae | | | | | | | | + | | + | | | | - | - | - | - | |
| 267 | | *Neopomacentrus cyanomos* | Pomacentridae | | | | | | | | | | | | | | - | - | - | - | |
| 268 | Ikan Gulamah | *Nibea soldado* | Sciaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 269 | Ikan Belido | *Notopterus bornensis Bleeker* | Notopteridae | | | | | | + | | | | | + | + | | J, K | - | - | - | |
| 270 | Ikan Belido | *Notopterus chitala* | Notopteridae | | | | | | | + | | | | | | | J, K | - | - | - | |
| 271 | Ikan Pelek | *Notopterus notopterus* | Notopteridae | | + | | | | | + | | | | | | | J, K | - | - | - | |
| 272 | | *Odontamblyopus rubicundus* | Gobioididae | | | | | | | + | | | | | | | - | - | - | - | |
| 273 | Ikan Belanak | *Oedalechilus labiosus* | | | | | | | | + | | | | | | | - | - | - | - | |
| 274 | Ikan Lais Puth | *Ompok leiacanthus* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 275 | Ikan Bangko | *Ophichthys sp.* | Ophichthidae | | | | | | | + | | | | | | | - | - | - | - | |
| 276 | Ikan Gabus | *Ophiocephalus striatus* | Ophiocephalidae | | | | | + | | | | + | | | | | - | - | - | - | |
| 277 | Ikan Bulu Ayam | *Ophistopterus macrognathus* | Prestigasteridae | | | + | | | | + | | | | | | | - | - | - | - | |
| 278 | | *Oplopomus oplopomus* | | + | | | | | | | | | | | | | - | - | - | - | |
| 279 | Ikan Mujair | *Oreochromis mossambicus* | Cichlidae | | | | + | + | | | | | | | | | - | - | - | - | |
| 280 | Ikan Nila | *Oreochromis niloticus* | Cichlidae | | | | | + | | | | | | | | | | | | | |
| 281 | Ikan Kaloi | *Osphronemus goramy* | Osphronemidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 282 | Ikan Kebali | *Osteochilus hasselti* | Cyprinidae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 283 | | *Osteochilus kappenii* | Cyprinidae | | | | | | | | | | | + | + | | | | | | |
| 284 | Ikan Kelabau | *Osteochilus melanopleura* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 285 | Ikab Seluang | *Osteochilus spilurus* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 286 | Ikan Kelabau | *Osteochilus waandersii* | Cyprinidae | | | | | | | | | | | + | | | - | - | - | - | Migrant |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 287 | Ikan Manyung Duri | *Osteogeneiosus militaris* | Ariidae | | | | | | | + | | | | | | | - | - | - | - | |
| 288 | Ikan Buntel | *Ostracion nasus* | Ostracidae | | | + | | | | | | | | | | | - | - | - | - | |
| 289 | Ikan Gilingan | *Otolithes argenteus* | Sciaenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 290 | Ikan Janang | *Otolithes cuvieri* | Sciaenidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 291 | Ikan Gigi Karang | *Otolithes latesoides* | Sciaenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 292 | Ikan Tiga Wajah | *Otolithes micradon* | Sciaenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 293 | Ikan Gulamah | *Otolithes pama* | Sciaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 294 | Ikan Gulamah | *Otolithes ruber* | Sciaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 295 | Ikan Blama | *Otolithoides brunneuss* | Sciaenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 296 | Ikan Betutu | *Oxyelectris marmorata* | Electridae | | | | | | + | | | | | + | | | - | - | - | - | Migrant |
| 297 | Ikan Bakut | *Oxyelectris urophthalmoides* | Electridae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 298 | Ikan Bedul | *Oxyrichthys micropeis* | Gobidae | | | + | | | | | | | | | | | - | - | - | - | |
| 299 | Ikan Bawal Putih | *Pampus argenteus* | | + | | + | | | | + | | | | | | | - | - | - | - | Migrant |
| 300 | Ikan Bawal | *Pampus chinensis* | | | | | | | | + | | | | | | | - | - | - | - | Migrant |
| 301 | Bawal putih | *Pampus sp.* | | | | | | | | | | | + | | | | - | - | - | - | |
| 302 | Ikan Kepala Timah | *Panchax panchax* | Cyprinodontidae | | | | | + | | | | | | | | | - | - | - | - | |
| 303 | Ikan Lawang | *Pangasius lithosoma* | Pangasidae | | | | | | | | | | | + | | | - | - | - | - | |
| 304 | Ikan Juaro | *Pangasius polyuranodon* | Pangasidae | | | | | | | + | | | | | | | - | - | - | - | |
| 305 | Ikan Bandeng | *Pangasius sp.* | Pangasidae | | | | | + | | | | | | | | | - | - | - | - | |
| 306 | Ikan Seluang | *Parachela oxygastroides* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 307 | | *Paraglyphidodon nigroris* | Pomacentridae | | | | | | | | | | | | | | - | - | - | - | |
| 308 | | *Parakysis anomalopteryx* | Parakysidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 309 | Ikan Seninding | *Parambassis macrolepis* | Centracpomidae | + | | | | | | | | | | + | + | + | - | - | - | - | |
| 310 | Ikan Bawal Hitam | *Parastromateus niger* | | | + | + | | | | | | | | | | | - | - | - | - | |
| 311 | Ikan Tangkil | *Parnsphonemus sp.* | Belontidae | | | | | | | | | | | + | | | - | - | - | - | |
| 312 | Ikan Dero | *Pellona ditchoa* | Clumpeidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 313 | Ikan Peperang | *Pellona kampeni* | Clupeidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 314 | Ikan Bulu Ayam | *Pellona sp.* | Clumpeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 315 | Ikan Bulu Ayam | *Pellona xanthoptera* | Clumpeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 316 | Ikan Tembakul | *Periophthalmus chrysospilos* | Periophthalmidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 317 | Ikan Blodok | *Periophthalmus variabilis* | Periophthalmidae | | | + | + | | | | | | | | | | - | - | - | - | |
| 318 | Ikan Belodok | *Periophthamodon schlosseri* | | | | | + | | | | | + | | | | | - | - | - | - | |
| 319 | Ikan sebelah | *Pesopodes spp.* | | | | | | | | | | | + | | | | - | - | - | - | |
| 320 | Ikan Baji-baji | *Platycephalus crocodilus* | Platicephalidae | | | + | | | | | | | | | | | - | - | - | - | Resident |
| 321 | Ikan Baji-baji | *Platycephalus scaber* | Platicephalidae | | | + | | | | | | | | | | | - | - | - | - | Resident |
| 322 | Ikan Sembilang | *Plotosus canius* | Plotosidae | + | | + | | | | + | | | | + | + | | - | - | - | - | |
| 323 | Ikan Selangan | *Plotosus sp.* | Plotosidae | | | | | | | | | + | | | | | - | - | - | - | |
| 324 | Ikan kedepar | *Polyacanthus haseli* | | | | | | | | + | | | | | | | - | - | - | - | |
| 325 | Ikan Senangin | *Polynemus dubius* | Polynemidae | | | | | | | + | | | | | | | - | - | - | - | |
| 326 | Ikan Kuro | *Polynemus multifilis* | Polynemidae | | | | | | | + | | | | | | | - | - | - | - | |
| 327 | | *Polynemus sextarius* | Polynemidae | | | + | | | | | | | | | | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 328 | Ikan Kepe-kepe | *Pomacanthus semicirculatus* | Pomacanthidae | + | | | | | | | | | | | | | - | - | - | - | |
| 329 | Ikan Gerot-gerot | *Pomadasys hasta* | Lutjanidae | + | | + | | + | | + | + | + | + | | | | - | - | - | - | Resident |
| 330 | Ikan Ampling | *Pomatomus saltator* | Pomatomidae | | | + | | | | | | | | | | | - | - | - | - | |
| 331 | | *Porochilus obbesi* | Plotosidae | + | | | | | | | | | | | | | - | - | - | - | |
| 332 | | *Porpeoma chacunda* | | + | | | | | | | | | | | | | - | - | - | - | |
| 333 | Ikan Patong | *Pristolepis fasciata* | Pristoleptidae | + | | | | | | | | | | + | + | | - | - | - | - | |
| 334 | Ikan Gulamah | *Protoosbea diacanthus* | | | | | | | | + | | | | | | | - | - | - | - | |
| 335 | | *Psamoperca waigiensis* | Ceutropomidae | + | | | | | | | | | | | | | - | - | - | - | |
| 336 | Ikan Jangan | *Pseudapocryptes lanceolatus* | Gobiidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 337 | | *Pseudomia polystigma* | | + | | | | | | | | | | | | | - | - | - | - | |
| 338 | | *Pseudomugil gertrudae* | | + | | | | | | | | | | | | | - | - | - | - | |
| 339 | Ikan Tigawajo | *Pseudosciaena aneus* | Sciaenidae | | + | | | | | | | | | | | | - | - | - | - | |
| 340 | Ikan Terusan | *Pseudosciaena microlepis* | Sciaenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 341 | Ikan Otot | *Pseudosciaena saldado* | Sciaenidae | + | | | | | | | | | | | | | - | - | - | - | |
| 342 | Ikan Lepu | *Pterois nuali* | Scorpaenidae | | | | | + | | | | | | | | | - | - | - | - | |
| 343 | Ikan Paku | *Puntiopiltes bulu* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 344 | Ikan Beemba | *Puntiopiltes waandersi* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 345 | Ikan Bungkant | *Puntius eugrammus* | Cyprinidae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 346 | Ikan Sari Gantang | *Puntius Rhombocellatus* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 347 | Ikan Seluang Batang | *Rasbora argyrotaenia* | Cyprinidae | | | | | | | + | | | | | | | - | - | - | - | |
| 348 | Ikan Seluang | *Rasbora bankanensis* | Cyprinidae | | | | | | | | | + | | + | + | | - | - | - | - | |
| 349 | Ikan Seluang | *Rasbora cephalotaenia* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 350 | Ikan Seluang | *Rasbora dorsiocellata* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 351 | Ikan Seluang | *Rasbora dusonensis* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 352 | Ikan Seluang | *Rasbora gracilis* | Cyprinidae | | | | | | | | | | | + | | + | - | - | - | - | |
| 353 | Ikan Seluang | *Rasbora kalbarensis* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 354 | Ika Seluang Padi | *Rasbora kalochroma* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 355 | Ikan Bahuk | *Rasbora pauciperforata* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 356 | Ikan Seluang Biris | *Rasbora sp.* | Cyprinidae | | | | | | + | + | | | | | | | - | - | - | - | |
| 357 | Ikan Seluang Merah | *Rasbora tornieri* | Cyprinidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 358 | Ikan Seluang | *Rasbora vaillanti* | Cyprinidae | | | | | | | + | | | | | | | - | - | - | - | |
| 359 | Ikan Kembung | *Rastrelliger brachysoma* | Scombridae | | | | | + | | | | | | | | | | | | | |
| 360 | Ikan Kembung | *Rastrelliger kanagurta* | Scombridae | | | | | + | | | | | | | | | | | | | |
| 361 | Ikan Kembung | *Rastrelliger neglectus* | Scombridae | + | | + | + | | | | + | + | + | | | | - | - | - | - | Migrant |
| 362 | Ikan Kembung | *Rastrelliger brachysoma* | Scombridae | + | | + | | | | | | | | | | | - | - | - | - | |
| 363 | Ikan Kembung | *Rastrelliger kanagurta* | Scombridae | + | | + | | | | | | | | | | | - | - | - | - | |
| 364 | Ikan Kembung | *Ratreliger spp.* | Scombridae | | + | | | | + | | | | | | | | - | - | - | - | |
| 365 | | *Sarda orientalis* | Myctopheidae | + | | | | | | | | | | | | | - | - | - | - | |
| 366 | Ikan Tembang | *Sardinella fimbriata* | Clupeidae | + | | + | | + | + | + | | | | | | | - | - | - | - | |
| 367 | Ikan Lemuru | *Sardinella lemuru* | Clupeidae | + | + | | | | | | + | | | | | | - | - | - | - | |
| 368 | Ikan Siro | *Sardinella siro* | Clupeidae | + | | | | | | | | | | | | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 369 | Ikan Lemuru | *Sardinella* sp. | Clupeidae | | | | | | | | | | + | | | | - | - | - | - | |
| 370 | Ikan Bloso | *Saurida gracilis* | | | | + | | | | | | | | | | | - | - | - | - | |
| 371 | | *Scartelaos viridis* | Gobiidae | + | | | | | | | | | | | | | - | - | - | - | |
| 372 | Ikan Kakatua | *Scarus microrhinus* | Scaridae | | | | | | | | + | | | | | | - | - | - | - | |
| 373 | | *Scatophagus argus* | Chaetodontidae | + | | + | | + | | + | | | | + | + | | - | - | - | - | |
| 374 | Ikan Kerakot | *Sciaena macropterus* | Sciaenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 375 | Ikan Arwana | *Scleropages formosus* | Osteoglabsidae | | | | | | | + | | | | + | + | | - | - | - | - | |
| 376 | Ikan Tengiri | *Scomberomerus commerson* | Scomberomoridae | + | | + | | | | | | + | | | | | - | - | - | - | |
| 377 | Ikan Tengiri | *Scomberomerus guttatus* | Scomberomoridae | + | | + | | | | + | | | | | | | - | - | - | - | |
| 378 | Ikan Tengiri | *Scomberomorus* sp. | Scomberomoridae | | + | + | | | | + | + | | + | | | | - | - | - | - | |
| 379 | | *Secutor ruconius* | Leiognathidae | | | | | | | + | | | | | | | - | - | - | - | Resident |
| 380 | Ikan Peperek | *Secutor* sp. | Leiognathidae | | + | | | | | | | | | + | | | - | - | - | - | Resident |
| 381 | Ikan Selar Belong | *Selar crumenophthalmus* | Carangidae | + | | | | | | | | | | | | | - | - | - | - | |
| 382 | | *Selaroides leptolepsis* | Carangidae | + | | | | | | | | | + | | | | - | - | - | - | |
| 383 | | *Semifodon conciloidee* | | + | | | | | | | | | | | | | - | - | - | - | |
| 384 | | *Seriolla dumerili* | Carangidae | | | + | | | | | | | | | | | - | - | - | - | |
| 385 | | *Seriolla nigrofasciata* | Carangidae | | | + | | | | | | | | | | | - | - | - | - | |
| 386 | Ikan Bulu Ayam | *Setipinna breviceps* | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | Resident |
| 387 | Ikan Bilis | *Setipinna melanochir* | Clupeidae | | | + | | | | + | | | | | | | - | - | - | - | Resident |
| 388 | Ikan Bulu Ayam | *Setipinna* sp. | Clupeidae | + | | | | | | | | | | | | | - | - | - | - | Resident |
| 389 | | *Setipinna taty* | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 390 | Ikan Tunggulang | *Sicyopus zosterophorum* | Gobiidae | | | + | | | | | | | | | | | - | - | - | - | Resident |
| 391 | Ikan Lingkis | *Siganus canaliculatus* | Siganidae | | | | | | | + | | | | | | | - | - | + | - | |
| 392 | Baronang | *Siganus corallinus* | Siganidae | + | | | | | | | | | | | | | - | - | - | - | |
| 393 | Ikan Baranong | *Siganus javus* | Siganidae | + | | + | | | | | + | | | | | | - | - | - | - | |
| 394 | Ikan Samandar | *Siganus* sp. | Siganidae | | | | | + | | | | | | | | | - | - | - | - | |
| 395 | Ikan Gelih | *Sillago sihama* | Sillaginidae | + | | + | | | | + | | | | | | | - | - | - | - | |
| 396 | Ikan Boyor | *Sillago* sp. | Sillaginidae | | | | | | + | | | | | | | | - | - | - | - | |
| 397 | Ikan Lais hutan | *Silurichthys hasselti* | Siluridae | | | | | | | | | | | + | + | + | - | - | - | - | Resident |
| 398 | Ikan Anak Tapa Hutan | *Silurichthys phaiosoma* | Siluridae | | | | | | | | | | | + | + | + | - | - | - | - | Resident |
| 399 | Ikan Lidah | *Solea humilis* | Pleuronectidae | | | + | | | | | | | | | | | - | - | - | - | |
| 400 | Ikan Sumpit | *Sphaerichthys osphromenoides* | Belontidae | | | | | | | + | | | | | | | - | - | - | - | Migrant |
| 401 | Ikan Anak Sepat | *Sphaerichthys vaillanti* | Belontidae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 402 | Ikan alu-alu | *Sphyraena forsteri* | Sphyraenidae | | + | | | | | | + | | | + | + | | - | - | - | - | |
| 403 | Ikan Alu-alu | *Sphyraena jello* | Sphyraenidae | + | | + | | | | + | | | | | | | - | - | - | - | |
| 404 | | *Sporoides oblongus* | | | | | | | | + | | | | | | | - | - | - | - | |
| 405 | Ikan Teri | *Stelophorus commersoni* | Clupeidae | + | | | | | | + | | | | | | | - | - | - | - | |
| 406 | | *Stenogobius ganivitatus* | Gobiidae | + | | | | | | + | | | | | | | - | - | - | - | |
| 407 | Ikan Teri | *Stolepharus* sp. | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 408 | Ikan Teri | *Stolephorus baganensis* | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 409 | Ikan Teri | *Stolephorus commersoni* | Clupeidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 410 | Ikan Teri | *Stolephorus heterolobus* | Clupeidae | | | + | | | | | | | | | | | - | - | - | - | |
| 411 | Ikan Teri | *Stolephorus insularis* | Clupeidae | | | | | | | + | | | | | | | - | - | - | - | |
| 412 | Ikan Teri Nasi | *Stolephorus sp.* | Clupeidae | + | | | | | + | | | | + | | | | - | - | - | - | |
| 413 | Ikan Teri | *Stolephorus tri* | Clupeidae | | + | + | | | | + | + | | | | | | - | - | - | - | |
| 414 | Ikan Teri | *Stolephorus zollingeri* | Clupeidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 415 | Ikan Bawal Hitam | *Stromateus niger* | Formlidae | | | | | | | + | | | | | | | - | - | - | - | |
| 416 | Ikan Bawal | *Stromateus cinereus* | Formlidae | + | + | | | | | | + | + | | | | | - | - | - | - | |
| 417 | | *Synapobranchus brevidorsalis* | | + | | | | | | | | | | | | | - | - | - | - | |
| 418 | Ikan Lidah | *Synaptura aspilos* | Soleidae | | | | | | | + | | | | | | | - | - | - | - | |
| 419 | Ikan Ilat-Ilat | *Synaptura zebra* | Soleidae | | | + | | | | | | | | | | | - | - | - | - | |
| 420 | Belut Tambak | *Synbranchus bengalensis* | Soleidae | | | + | | | | | | | | | | | - | - | - | - | |
| 421 | Ikan Manyung | *Tachysurus sp.* | | | | | | | | + | | | | | | | | | | | |
| 422 | Ikan Buntal | *Takifugu oblongus* | Tetraodontidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 423 | | *Taniodes cirratus* | Gobiidae | | | | | | | + | | | | | | | - | - | - | - | |
| 424 | Ikan Kelkerong | *Terapon jabua* | Therapenidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 425 | Ikan Buntal | *Tetraodon fluviatilis* | Tetraodontidae | + | | | | | | | | | | | | | - | - | - | - | Migrant |
| 426 | Ikan Buntal | *Tetraodon immaculatus* | Tetraodontidae | | | + | | | | | | | | | | | - | - | - | - | |
| 427 | Ikan Buntal | *Tetraodon nigroviridis* | Tetraodontidae | | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 428 | Ikan Buntal | *Tetraodon palembangensis* | Tetraodontidae | + | | | | | | | | | | + | + | | - | - | - | - | Migrant |
| 429 | Ikan Manyung | *Thachynus spp.* | Aridae | | | | | | + | | | | | | | | - | - | - | - | |
| 430 | Ikan bayeman cagal | *Thalassoma lunare* | Labridae | | | | | + | | | | | | | | | - | - | - | - | |
| 431 | Ikan Kerong-kerong | *Theraphon terapa* | Therapenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 432 | Ikan Erong-erong | *Therapon jarbua* | Therapenidae | | | | | | | + | | | | | | | - | - | - | - | |
| 433 | Ikan Kerong-kerong | *Therapon hasseemai* | Therapenidae | + | | | | | | | | | | | | | - | - | - | - | |
| 434 | Ikan Kerong-kerong | *Therapon jarbua* | Therapenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 435 | Ikan Kerong-kerong | *Therapon puta* | Therapenidae | | | + | | | | | | | | | | | - | - | - | - | |
| 436 | Ikan Kerot-kerot | *Therapon sp.* | Theraponidae | | | | | | | | | | | + | | | - | - | - | - | |
| 437 | Ikan Kerong-kerong | *Therapon theraps* | Therapenidae | + | | | | | | | | | | | | | - | - | - | - | |
| 438 | Ikan Layur | *Thrichiurus haumela* | Trichiuridae | | | + | | | | | | | | | | | - | - | - | - | |
| 439 | Ikan Layur | *Thrichiurus savala* | Trichiuridae | | | + | | | | | | | | | | | - | - | - | - | |
| 440 | Ikan Bulu Ayam | *Thrissa hamiltonii* | Clupeidae | | | + | | | | | | | | | | | - | - | - | - | |
| 441 | Ikan Madidihang | *Thunnus albacares* | Scrombridae | | | + | | | + | | | | | | | | - | - | - | - | |
| 442 | Belut Tambak | *Thyrsoidea macrurus* | | | | | | | | + | | | | | | | - | - | - | - | |
| 443 | Ikan Sumpit | *Toxotes chatareus* | Toxotidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 444 | Ikan Sumpit | *Toxotes jaculator* | Toxotidae | + | | | | | | + | | | | | | | - | - | - | - | Resident |
| 445 | Ikan Senyumpit | *Toxotes microlepis* | Toxotidae | | | | | | | | | | | + | + | | - | - | - | - | |
| 446 | Ikan Susur Wedi | *Trachiphalus sp.* | | | | | | | + | | | | | | | | - | - | - | - | |
| 447 | Ikan Sokang | *Triacanthus biaculeatus* | Carangidae | | | + | | | | | | | | | | | - | - | - | - | |
| 448 | Ikan Lowang | *Triacanthus blochi* | Carangidae | | | | | | | + | | | | | | | - | - | - | - | |
| 449 | Ikan Kajang | *Trichiurus glossodon* | Trichiuridae | | | | | | | + | | | | | | | - | - | - | - | |

Annex 5 *cont.* List Species of Fish of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 450 | Ikan Kajang | *Trichiurus muticus* | Trichiuridae | | | | | | | + | | | | | | | - | - | - | - | |
| 451 | Ikan Laur | *Trichiurus savala* | Trichiuridae | + | | | | | | | | | | | | | - | - | - | - | |
| 452 | Ikan Layur | *Trichiurus* sp. | Trichiuridae | + | + | + | | | | + | | | + | | | | - | - | - | - | Migrant |
| 453 | Ikan Sesepat | *Trichogaster leeri* | Anabantidae | | | | | | | | | | | + | + | + | - | - | - | - | Migrant |
| 454 | Ikan Sepat Rawa | *Trichogaster pectoralis* | Anabantidae | | | | | + | | | | | | | | | - | - | - | - | Migrant |
| 455 | Ikan Sepat Jawa | *Trichogaster trichopterus* | Anabantidae | | | + | | + | | | | | | + | + | | - | - | - | - | Migrant |
| 456 | Ikan Layur | *Trichiurus haumela* | Trichiuridae | | | | | + | | | | | | | | | - | - | - | - | |
| 457 | Ikan Kacang-kacang | *Tylosurus crocodilus leiaeveur* | Belonidae | | | + | | | | | | | | | | | - | - | - | - | |
| 458 | Ikan Julung-julung | *Tylosurus leiurus* | Belonidae | | | + | | | | | | | | | | | - | - | - | - | |
| 459 | Ikan Julung-julung | *Tylosurus* sp. | Belonidae | | + | + | | | | | | | | + | | | - | - | - | - | |
| 460 | Ikan Cendro | *Tylosurus strongilurus* | Belonidae | + | | + | | | | + | | | | | | | - | - | - | - | |
| 461 | Ikan Gulamah | *Umbrina* sp. | Sciaenidae | + | | | | | | + | | | | | | | - | - | - | - | |
| 462 | Ikan Biji Nangka | *Upeneus berberinus* | Mullidae | | | + | | | | | | | | | | | - | - | - | - | |
| 463 | Ikan Kuniran | *Upeneus sulphureus* | Mullidae | + | | + | | | | | | | + | | | | - | - | - | - | |
| 464 | Ikan Kada | *Valamugil buchanani* | Mugilidae | + | | | | | | | | | | | | | - | - | - | - | |
| 465 | Ikan Kada | *Valamugil seheli* | Mugilidae | | | + | | | | | | | | | | | - | - | - | - | |
| 466 | Ikan Kada | *Valamugil speigleri* | Mugilidae | | | + | | | | | | | + | | | | - | - | - | - | Resident |
| 467 | Ikan Tapah | *Wallago leeri* | Siluridae | | | | | | | | | | | + | + | + | - | - | - | - | Resident |
| 468 | Ikan Tapah | *Wallago miostoma* | Siluridae | | | | | | | + | | | | | | | - | - | - | - | |
| 469 | | *Weberogobius amoyi* | | + | | | | | | | | | | | | | - | - | - | - | |
| 470 | Ikan Bandera | *Zanclus cornutus* | Chaetodontidae | | | | | + | | | | | | | | | - | - | - | - | |
| 471 | Ikan Jelung-julung | *Zenarchopterus ecturio* | Hemiramphidae | | | | | + | | + | | | | | | | - | - | - | - | |
| 472 | Ikan Bambangan | | | | + | | | | | | + | | | | | | - | - | - | - | |
| 473 | Ikan Bulat | | | | | | | | | | + | | | | | | - | - | - | - | |
| 474 | Ikan Cakalan | | | | + | | | | | | | | | | | | - | - | - | - | |
| 475 | Ikan Kewe | | | | | | | | | | + | | | | | | - | - | - | - | |
| 476 | Ikan Lele | *Clarias batracus* | Clariidae | | | | | | | | | + | | | | | - | - | - | - | |
| 477 | Ikan Patin | | | | | | | | + | | | + | | | | | - | - | - | - | |
| 478 | Ikan Rajungan | | | + | | | | | | | | | | | | | - | - | - | - | |
| 479 | Ikan Temang | | | + | | | | | | | | | | | | | - | - | - | - | |
| 480 | Ikan Tuna | | | | + | | | | | | | | | | | | - | - | - | - | |
| 481 | Ikan kecil | | | | | + | | | | | | | | | | | - | - | - | - | |
| 482 | Ikan Sotong | | | | | + | | | | | | | | | | | - | - | - | - | |

Annex 6 List Species of Crustacean of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 1 | | *Acartia clausi* | | | + | | | | | | | | + | | | | - | - | - | - | |
| 2 | | *Acartia* sp. | | | | | | | + | | | | | | | | - | - | - | - | |
| 3 | Udang rebon | *Acetes* sp | | | | | | | | | | | + | | | | - | - | - | - | |
| 4 | | *Acrocalamus* sp. | | | + | | | | + | | | | | | | | - | - | - | - | |
| 5 | | *Allochester* sp. | | | | + | + | | | | | | | | | | - | - | - | - | |
| 6 | Udang duri | *Alpheus* sp. | Alphedidae | | | + | + | | | | | | + | | | | - | - | - | - | |
| 7 | | *Amphithoe* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 8 | | *Apseudes* | | | | | | | | | | | + | | | | - | - | - | - | |
| 9 | | *Balanus* sp. | Balanidae | | | + | + | | | | | | | | | | - | - | - | - | |
| 10 | | *Calana* sp. | | | | + | | | | | | | | | | | - | - | - | - | |
| 11 | | *Calanus minor* | Cyprididae | | | + | | | | | | | | | | | - | - | - | - | |
| 12 | | *Calanus* sp. | Cyprididae | | + | | + | | | | | + | | | | | - | - | - | - | |
| 13 | | *Calathura* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 14 | | *Caprella* sp. | Caprellidae | | | | | | | | | | + | | | | - | - | - | - | |
| 15 | | *Caridea* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 16 | | *Centropages* sp. | | | + | | | | + | | | | | | | | - | - | - | - | |
| 17 | | *Cistocaeloma omuguensis* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 18 | | *Coenobita* sp. | Coenobitidae | | | + | | | | | | | | | | | - | - | - | - | |
| 19 | Kepiting bakau | *Cordiosoma* sp. | | | | | | | | + | | | | | | | - | - | - | - | |
| 20 | | *Corycaeus* sp. | | | | | | | + | | | | | | | | - | - | - | - | |
| 21 | | *Crasyonix* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 22 | | *Crycaeus* sp. | | | | | | | | | | + | | | | | - | - | - | - | |
| 23 | | *Cyclop* sp. | Cyclopidae | + | | + | | | | | | + | | | | | - | - | - | - | |
| 24 | | *Cypridina* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 25 | | *Daphnia* sp. | Daphnidae | + | | | | | | | | | | | | | - | - | - | - | |
| 26 | | *Dentalium eboreum* | | | | | | | | | | | + | | | | - | - | - | - | |
| 27 | | *Dissyla* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 28 | | *Disarina batavianum* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 29 | | *Doclea* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 30 | | *Ellakatothrix* sp. | | + | | | | | | | | | | | | | - | - | - | - | |
| 31 | | *Erichthonius difformis* | | + | | | | | | | | | | | | | - | - | - | - | |
| 32 | | *Eucalanus* sp. | | | + | | | | | | | + | | | | | - | - | - | - | |
| 33 | | *Euchaeta* sp. | | | | + | | | | | | | | | | | - | - | - | - | |
| 34 | | *Eucypris* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 35 | | *Eugammarus* sp. | | | | + | | | | | | | | | | | - | - | - | - | |
| 36 | | *Eurytemora* sp. | | | + | | | | | | | | | | | | - | - | - | - | |
| 37 | | *Euterpina* sp. | | | | | | | + | | | + | | | | | - | - | - | - | |
| 38 | | *Evadne* sp. | | | + | + | | | + | | | | | | | | - | - | - | - | |
| 39 | | *Gammorus* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 40 | | *Gammarellus* sp. | | | | | | | | | | | + | | | | - | - | - | - | |

Annex 6 *cont.* List Species of Crustacean of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 41 | | *Gnathia* sp. | Paratanaidae | | | | | | | | | | + | | | | - | - | - | - | |
| 42 | | *Grapsus tenuimstatus* | Grapsidae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 43 | | *Helice* sp. | | + | | | | | | | | | | | | | - | - | - | - | |
| 44 | | *Heterotanais* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 45 | | *Hippolyte varians* | | | | | | | | | | | + | | | | - | - | - | - | |
| 46 | | *Ilyoplax deliranmi* | Ocypodidae | | | + | | + | | | | | | | | | - | - | - | - | |
| 47 | | *Ilyoplax Orientalis* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 48 | | *Lepas* sp. | | | + | | | | | | | | | | | | - | - | - | - | |
| 49 | | *Leptognatha* sp. | | | | + | + | | | | | | | | | | - | - | - | - | |
| 50 | | *Limulus* sp. | | | | | + | | | | | | | | | | - | - | - | - | |
| 51 | | *Luceea* sp. | | + | | | | | | | | | | | | | - | - | - | - | |
| 52 | | *Lucifer* sp. | | | | | | | | | | + | | | | | - | - | - | - | |
| 53 | | *Lysiosqaille* sp. | | | | + | + | | | | | | | | | | - | - | - | - | |
| 54 | | *Macrosetella* sp. | | | | | | | | | | + | | | | | - | - | - | - | |
| 55 | | *Macrophthalmus convexus* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 56 | | *Macrophthalmus definitas* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 57 | | *Macrophthalmus telescopium* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 58 | | *Mesopodopsis* sp. | | | | + | | | | | | | | | | | - | - | - | - | |
| 59 | Udang kuning | *Metapenaeus bervicornis* | Penaeidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 60 | Udang krosok | *Metapenaeus burkenroadi* | Penaeidae | | | | | | + | | | | | | | | - | - | - | - | |
| 61 | Udang dogol | *Metapenaeus elegans* | Penaeidae | | | | | | + | | | | | | | | - | - | - | - | |
| 62 | Udang dogol | *Metapenaeus ensis* | Penaeidae | + | | + | | | + | | | | | | | | - | - | - | - | |
| 63 | Udang dogol | *Metapenaeus lysiamsis* | Penaeidae | | | | | | + | | | | | | | | - | - | - | - | |
| 64 | Udang api | *Metapenaeus monoceros* | Penaeidae | | | + | | | + | | | | | | | | - | - | - | - | |
| 65 | Udang mentil | *Metapenaeus* sp. | Penaeidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 66 | | *Metaplax elegans* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 67 | | *Metis* sp. | | | | + | | | | | | | | | | | - | - | - | - | |
| 68 | | *Microsetella* sp. | | | + | | | | + | | | | | | | | - | - | - | - | |
| 69 | Udang satang | *Mocrobrachium rosenbergii* | | | | | | | | + | | | | | | | - | - | - | - | |
| 70 | | *Naupilus* sp. | | + | | + | + | | + | | | + | | | | | - | - | - | - | |
| 71 | | *Ocypoda arenaria* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 72 | Kepiting pasir | *Ocypode* sp. | Ocypodidae | + | | | | | | | + | | | | | | - | - | - | - | |
| 73 | | *Ocypoda urstophthalma* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 74 | | *Odhona* sp. | | | | | | | + | | | + | | | | | - | - | - | - | |
| 75 | | *Oncaea* sp. | | | | | | | + | | | | | | | | - | - | - | - | |
| 76 | | *Oxyurostylis* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 77 | Udang putih | *Palaemonetes* spp. | | | | | | | + | + | | | | | | | - | - | - | - | |
| 78 | | *Paracalanus* sp. | | | | + | | | | | | | | | | | - | - | - | - | |
| 79 | Udang merah | *Parapenaeus* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 80 | | *Parvocalanus* sp. | | | | | | | + | | | | | | | | - | - | - | - | |

Annex 6 *cont.* List Species of Crustacean of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 81 | Udang dogol | *Penaeus indicus* | Penaeidae | | | | | | + | + | + | | | + | | | - | - | - | - | |
| 82 | Udang putih | *Penaeus marquiensis* | Penaeidae | + | | + | | | + | + | | | + | + | + | + | - | - | - | - | |
| 83 | Udang windu | *Penaeus monodon* | Penaeidae | | | + | | | | + | | | | + | + | + | - | - | - | - | |
| 84 | udang jerbung | *Penaeus orientalis* | Penaeidae | | | + | | | + | | + | | | + | + | + | - | - | - | - | |
| 85 | Udang tiger | *Penaeus semiculatus* | Penaeidae | + | | | | | | + | | | | | | | - | - | - | - | |
| 86 | udang rebon | *Penaeus* sp. | Penaeidae | + | | + | + | | + | | + | | | | | | - | - | - | - | |
| 87 | | *Penaeidae* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 88 | | *Phtisica* sp. | Caprellidae | | | | | | | | | | + | | | | - | - | - | - | |
| 89 | | *Pinnixa* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 90 | | *Pinnotheres* sp. | Pinnoteridae | | | | | | | | | | + | | | | - | - | - | - | |
| 91 | Rajungan | *Portunus pelagicus* | Portunidae | | | + | | | | | | | + | | | | - | - | - | - | |
| 92 | Rajungan | *Portunus* spp. | Portunidae | | | | | | | + | | | | | | | - | - | - | - | |
| 93 | | *Pseudocalanus* sp. | | | + | | | | | | | | | | | | - | - | - | - | |
| 94 | | *Saphirella gamma* | | | | | | | | | | | + | | | | - | - | - | - | |
| 95 | | *Sapphirina* sp. | Sapphirinadae | | + | | | | | | | | | | | | - | - | - | - | |
| 96 | | *Scolecithricella abyssalis* | | | | | | | | | | | + | | | | - | - | - | - | |
| 97 | | *Scolecithricella ctenopus* | | | | | | | | | | | + | | | | - | - | - | - | |
| 98 | Kepiting | *Scylla serrata* | Potunidae | + | | + | | | | + | | | + | + | + | + | - | - | - | - | |
| 99 | kepiting bakau | *Scylla* sp. | Potunidae | + | | | | | | | | | | | | | - | - | - | - | |
| 100 | | *Scylla sudata* | Portumidae | | | | | + | | | | | | | | | - | - | - | - | |
| 101 | | *Scylla transquebarita* | Potunidae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 102 | | *Sesarma bidens* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 103 | | *Sesarma bocourti* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 104 | | *Sesarma cumaja* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 105 | | *Sesarma erythrodactylum* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 106 | | *Sesarma fasciatum* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 107 | | *Sesarma longipes* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 108 | | *Sesarma meinerti* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 109 | | *Sesarma onychophora* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 110 | | *Sesarma rousseauxi* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 111 | | *Sesarma smithi* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 112 | Kepiting | *Sesarma* sp. | | + | | + | | | | | | | | | | | - | - | - | - | |
| 113 | | *Sesarma taeniolata* | Grapsidae | | | | | + | | | | | | | | | - | - | - | - | |
| 114 | Udang ronggeng | *Squilla harpax* | | | | | + | | | | | | | | | | - | - | - | - | |
| 115 | Lobster | *Thalassina anomala* | Upogebidae | | | | | | | + | | | + | | | | - | - | - | - | |
| 116 | | *Tigriopus* sp. | | | + | | | | | | | | | | | | - | - | - | - | |
| 117 | | *Uca annulipes* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 118 | | *Uca bellator bellator* | Ocypodidae | | | + | | | | | | | | | | | - | - | - | - | |
| 119 | | *Uca cvocans-vocans* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 120 | Kepiting | *Uca dussumieri* | Ocypodidae | | | | | + | | + | | | | | | | - | - | - | - | |

Annex 6 *cont.* List Species of Crustacean of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Vernacular Name | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 121 | | *Uca lactea* | Ocypodidae | | | | | + | | | | | + | | | | - | - | - | - | |
| 122 | | *Uca siguatus* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 123 | | *Uca* sp. | Ocypodidae | + | | | | | | | | | | | | | - | - | - | - | |
| 124 | | *Uca tetragonon* | Ocypodidae | | | + | | | | | | | | | | | - | - | - | - | |
| 125 | | *Uca triangularis* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 126 | | *Ucaconspicimus* | Ocypodidae | | | | | + | | | | | | | | | - | - | - | - | |
| 127 | Udang karang | | | | | | | | | | | | | | | | - | - | - | - | |
| 128 | Udang PS | | | | | + | | | | | | | | | | | - | - | - | - | |
| 129 | Udang sandul | | | | | + | | | | | | | | | | | - | - | - | - | |
| 130 | Udang serengkeh | | | | | | | | | + | | | | | | | - | - | - | - | |

Annex 7 List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 1 | *Acils* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 2 | *Actaeo pyramis* | | | | | + | | | | | | | | | | - | - | - | |
| 3 | *Acteon tornatilis* | | | | | + | | | | | | | | | | - | - | - | |
| 4 | *Adiata gracilion* | | | | | + | | | | | | | | | | - | - | - | |
| 5 | *Afer comurgi* | | | | + | | | | | | | | | | | - | - | - | |
| 6 | *Agatha* sp. | | | | | + | + | | | | | | | | | - | - | - | |
| 7 | *Alculastrum cylindricum* | | | | | + | | | | | | | | | | - | - | - | |
| 8 | *Alia* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 9 | *Allopeas* sp. | | | | | + | + | | | | | | | | | - | - | - | |
| 10 | *Amaea* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 11 | *Antemotulla* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 12 | *Architectonia maxima* | Architectonicidae | | | + | + | | | | | | | | | | - | - | - | |
| 13 | *Architectonica* sp. | Architectonicidae | | | | | | | | | | + | | | | - | - | - | |
| 14 | *Architectonica trochlearis* | Architectonicidae | | | + | | | | | | | | | | | - | - | - | |
| 15 | *Argobuccinum argus* | | | | + | | | | | | | | | | | - | - | - | |
| 16 | *Assiminea brevicula* | | + | | + | | | | | | | | | | | - | - | - | |
| 17 | *Assiminea woodmansoniana* | | + | | | | | | | | | | | | | - | - | - | |
| 18 | *Astele pulcherrimus* | | | | | + | | | | | | | + | + | + | - | - | - | |
| 19 | *Ataetodea alabrata* | Mesodesmatidae | | | | | + | | | | | | | | | - | - | - | |
| 20 | *Ataxocerithium abnormale* | Mesodesmatidae | | | | + | | | | | | | | | | - | - | - | |
| 21 | *Australaka* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 22 | *Babelia* | | | | | | + | | | | | | | | | - | - | - | |
| 23 | *Batillaria* sp. | | | | | | | | | + | | | | | | - | - | - | |
| 24 | *Bekkochlamys* | | | | | + | | | | | | | | | | - | - | - | |
| 25 | *Bittium attenuatum* | | | | | + | | | | | | | | | | - | - | - | |
| 26 | *Bittium* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 27 | *Blanfordia* sp. | | | | | + | + | | | | | | | | | - | - | - | |
| 28 | *Brotia* sp. | | | | | | | + | | | | | | | | - | - | - | |
| 29 | *Buccinum plectrum* | | | | | + | | | | | | | | | | - | - | - | |
| 30 | *Bulbus* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 31 | *Bulla rhodostoma* | Nassaridae | | | | | + | | | | | | | | | - | - | - | |
| 32 | *Bulla* sp. | Nassaridae | + | | | + | | | | + | | | | | | - | - | - | |
| 33 | *Camitia* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 34 | *Cantarus Coromandelius* | Buccinidae | | | | | + | | | | | | | | | - | - | - | |
| 35 | *Cassidula aurisfelis* | | | | + | | | | | | | + | | | | - | - | - | |
| 36 | *Cassidula mustelina* | | + | | | | | | | | | | + | + | + | - | - | - | |
| 37 | *Cassis comuta* | Buccinidae | | | | | | | | + | | | | | | - | - | - | |
| 38 | *Celecphysis* | | | | | | + | | | | | | | | | - | - | - | |
| 39 | *Ceratoxanthus* | | | | | + | + | | | | | | | | | - | - | - | |
| 40 | *Cerithidea cingulata* | | | | | | | | + | | | | | | | - | - | - | |

Annex 7 *cont.* List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 41 | *Cerithidea obtuse* | Potamididae | | | + | | | | | | | | | | | - | - | - | |
| 42 | *Cerithideopsilla djadjarensis* | | | | + | | | | | | | | | | | - | - | - | |
| 43 | *Cerithidia quadrata* | | | | | | | | | | | + | | | | - | - | - | |
| 44 | *Cerithidia obtusa* | | | | | | | | | | | + | | | | - | - | - | |
| 45 | *Cerithidae cingulata* | Cerithidae | | | | | + | | | | | | | | | - | - | - | |
| 46 | *Cerithidaei obtusa* | Cerithidae | | | | | + | | | | | | | | | - | - | - | |
| 47 | *Cerithiopsis spongicola* | | | | | + | | | | | | | | | | - | - | - | |
| 48 | *Cerithium alveolum* | Cerithidae | | | | + | + | | | | | | | | | - | - | - | |
| 49 | *Cerithium articulatum* | Cerithidae | | | + | | + | | | | | | | | | - | - | - | |
| 50 | *Cerithium asper* | Cerithidae | | | | | + | | | | | | | | | - | - | - | |
| 51 | *Cerithium fasciatum* | Cerithidae | | | | | + | | | | | | | | | - | - | - | |
| 52 | *Cerithium kobelti* | Cerithidae | | | + | | | | | | | | | | | - | - | - | |
| 53 | *Cerithium lutosum* | Cerithidae | | | | | | | | + | | | | | | - | - | - | |
| 54 | *Cerithium nodulosum* | Cerithidae | | | | | | | | + | | | | | | - | - | - | |
| 55 | *Cerithium ruppelli* | Cerithidae | | | | | + | | | | | | | | | - | - | - | |
| 56 | *Cerithium serratum* | Cerithidae | | | + | | | | | | | | | | | - | - | - | |
| 57 | *Chevildea sp.* | | | | | | | | | | | + | | | | - | - | - | |
| 58 | *Chenithidae alata* | Potamididae | + | | | | | | | | | | | | | - | - | - | |
| 59 | *Chicoreus adustus* | | | | | | | | | | | + | | | | - | - | - | |
| 60 | *Clipangopaludina longispira* | | | | | | | | | | | | + | + | + | - | - | - | |
| 61 | *Clathrofenella reticulata* | | | | | + | | | | | | | | | | - | - | - | |
| 62 | *Clathrofenila sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 63 | *Clypeomorus moniliferus* | Cerithidae | | | | | | | | + | | | | | | - | - | - | |
| 64 | *Clypeomorus sp.* | Cerithidae | | | | + | | | | | | | | | | - | - | - | |
| 65 | *Coleophysis sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 66 | *Coleophysis minimus* | | | | | + | | | | | | | | | | - | - | - | |
| 67 | *Coleophysis villicus* | | | | | + | | | | | | | | | | - | - | - | |
| 68 | *Columbella mecrateria* | Comumbellidae | | | | | + | | | | | | | | | - | - | - | |
| 69 | *Conus sp.* | | | | | | + | | | | | | | | | - | - | - | |
| 70 | *Conus litteratus* | | | | | | | | | + | | | | | | - | - | - | |
| 71 | *Conus textile* | | | | | | | | | + | | | | | | - | - | - | |
| 72 | *Conus flavidus* | | | | | | | | | + | | | | | | - | - | - | |
| 73 | *Corbicula sp.* | | | | | | | + | | | | | | | | - | - | - | |
| 74 | *Cylichnatys angusta* | | | | | + | | | | | | | | | | - | - | - | |
| 75 | *Cylichnella culcitella* | | | | | + | | | | | | | | | | - | - | - | |
| 76 | *Cypeonorus monilferus* | Cerithidae | | | | | + | | | | | | | | | - | - | - | |
| 77 | *Dimatys sp.* | | | | | + | + | | | | | | | | | - | - | - | |
| 78 | *Discus sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 79 | *Dolicholatirus* | | | | | + | | | | | | | | | | - | - | - | |
| 80 | *Drupa margaritica* | | | | + | | | | | | | | | | | - | - | - | |
| 81 | *Drupella cornus* | | | | | | | | | + | | | | | | - | - | - | |

Annex 7 *cont.* List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 82 | *Eichinella cumingi* | | | | | + | | | | | | | | | | - | - | - | |
| 83 | *Elobium chinense* | | | | | | | | | | | | + | + | + | - | - | - | |
| 84 | *Engina zonalis* | | | | + | | | | | | | | | | | - | - | - | |
| 85 | *Eocylichna sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 86 | *Epitonium lamellosa* | | | | | + | | | | | | + | | | | - | - | - | |
| 87 | *Euchelus quadricarinatus* | | | | + | | | | | | | | | | | - | - | - | |
| 88 | *Eulimella sp.* | | | | | + | + | | | | | | | | | - | - | - | |
| 89 | *Eugina alveolata* | | | | | | | | | + | | | | | | - | - | - | |
| 90 | *Evalea* | | | | | | + | | | | | | | | | - | - | - | |
| 91 | *Fossarus elegans* | | | | | | | | | | | + | | | | - | - | - | |
| 92 | *Gassidula plecotremaides* | | | | | | | | | | | | | | + | - | - | - | |
| 93 | *Gassidula plecotremaides japonica* | | | | | | | | | | | | + | + | | - | - | - | |
| 94 | *Gemmula kinneri* | | | | + | | | | | | | | | | | - | - | - | |
| 95 | *Gemmula sp.* | | | | | + | + | | | | | | | | | - | - | - | |
| 96 | *Granulena margaritula* | | | | | + | | | | | | | | | | - | - | - | |
| 97 | *Helacus sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 98 | *Hinia paupua* | | + | | | | | | | | | | | | | - | - | - | |
| 99 | *Hinia stolata* | | | | + | | | | | | | | | | | - | - | - | |
| 100 | *Homalopoma sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 101 | *Ischinocerithium sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 102 | *Isognomum isognomum* | Velselidae | | | | | + | | | | | | | | | - | - | - | |
| 103 | *Kleinella sp.* | Velselidae | | | | + | + | | | | | | | | | - | - | - | |
| 104 | *Leptopoma sp.* | Stombidae | | | | + | | | | + | | | | | | - | - | - | |
| 105 | *Leucotina* | | | | | | + | | | | | | | | | - | - | - | |
| 106 | *Limulatys muscarius* | | | | | + | | | | | | | | | | - | - | - | |
| 107 | *Limulatys oolformis* | | | | | + | | | | | | | | | | - | - | - | |
| 108 | *Lineata pintado* | | | | + | | | | | | | | | | | - | - | - | |
| 109 | *Linella sp.* | | | | | + | | | | | | | | | | - | - | - | |
| 110 | *Linularia succincta* | | | | | + | | | | | | | | | | - | - | - | |
| 111 | *Littorina sp.* | | | | | | + | | | | | | | | | - | - | - | |
| 112 | *Littorina carinifera* | Littorinidae | + | | | | | | | | | | | | | - | - | - | |
| 113 | *Littorina coccinea* | Littorinidae | | | | | + | | | | | | | | | - | - | - | |
| 114 | *Littorina kraussi* | Littorinidae | + | | | | | | | | | | | | | - | - | - | |
| 115 | *Littorina lineata* | Littorinidae | | | + | | | | | | | | | | | - | - | - | |
| 116 | *Littorina littoralis* | Littorinidae | | | | | + | | | | | | | | | - | - | - | |
| 117 | *Littorina melanostoma* | Littorinidae | + | | + | | | | + | | | | | | | - | - | - | |
| 118 | *Littorina pinctata* | Littorinidae | | | | + | | | | | | | | | | - | - | - | |
| 119 | *Littorina pintado* | Littorinidae | | | | + | | | | | | | | | | - | - | - | |
| 120 | *Littorina scraba* | Littorinidae | + | | | | + | | + | + | | | | | | - | - | - | |
| 121 | *Littorina sp.* | Littorinidae | | | | + | | | | | | + | | | | - | - | - | |
| 122 | *Littorina striata* | Littorinidae | | | | | + | | | | | | | | | - | - | - | |

Annex 7 *cont.* List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 123 | *Littorina undulata* | Littorinidae | + | | | | | | | + | | | | | | - | - | - | |
| 124 | *Lymnaea* sp. | | | | | | + | | | | | | | | | - | - | - | |
| 125 | *Mammilla* sp. | Naticidae | | | | + | | | | | | | | | | - | - | - | |
| 126 | *Margatas pupulus* | | | | | + | | | | | | | | | | - | - | - | |
| 127 | *Marginilla* sp. | | | | | | | | | | | + | | | | - | - | - | |
| 128 | *Melampus bidentatus* | | | | | | + | | | | | | | | | - | - | - | |
| 129 | *Melampus fasciatus* | | | | | | | | | | | | + | + | + | - | - | - | |
| 130 | *Melampus plecotrematoides* | | | | | | | | | | | | | | + | - | - | - | |
| 131 | *Melampus plecotrematoides japonica* | | | | | | | | | | | | + | + | | - | - | - | |
| 132 | *Melanella major* | | | | | + | | | | | | | | | | - | - | - | |
| 133 | *Melanoides arctocara* | | | | | | | + | | | | | | | | - | - | - | |
| 134 | *Melanoides granifera* | | | | | | | + | | | | | | | | - | - | - | |
| 135 | *Melanoides rustica* | | | | | | | + | | | | | | | | - | - | - | |
| 136 | *Melanoides* sp. | | + | | | + | + | | | | | | | | | - | - | - | |
| 137 | *Melanoides tuberculata* | | | | | | | + | + | | | | | | | - | - | - | |
| 138 | *Melanpus pulchellas* | | + | | | | | | | | | | | | | - | - | - | |
| 139 | *Melo melo* | Volutidae | | | | | | | | + | | | | | | - | - | - | |
| 140 | *Melongena gallcodes* | Naticidae | | | | | + | | | | | | | | | - | - | - | |
| 141 | *Microglyphis* | | | | | + | + | | | | | | | | | - | - | - | |
| 142 | *Mitra cevata* | Mitridae | | | | | + | | | | | | | | | - | - | - | |
| 143 | *Mitra mitra* | | | | | | | | + | | | | | | | - | - | - | |
| 144 | *Modulus modulus* | | | | + | | | | | | | | | | | - | - | - | |
| 145 | *Monodonta labio* | Trochidae | | | | | | | | + | | | | | | - | - | - | |
| 146 | *Mormula* | | | | | | + | | | | | | | | | - | - | - | |
| 147 | *Morula uva* | Thaidinae | | | | | | | | + | | | | | | - | - | - | |
| 148 | *Morula granulata* | Thaidinae | | | | | | | | + | | | | | | - | - | - | |
| 149 | *Morula musiva* | | | | | | | | + | | | | | | | - | - | - | |
| 150 | *Murex* sp. | Muricidae | | | | + | | | | | | | | | | - | - | - | |
| 151 | *Murex tibulus* | Muricidae | | | + | | | | | | | | | | | - | - | - | |
| 152 | *Murex troschel* | Muricidae | | | | | | | | + | | | | | | - | - | - | |
| 153 | *Musculista senhausia* | | + | | | | | | | | | | | | | - | - | - | |
| 154 | *Nakamigawaea* | | | | | + | | | | | | | | | | - | - | - | |
| 155 | *Nassarius* | | | | | | + | | | | | | | | | - | - | - | |
| 156 | *Nassana pusilla* | Naasariidae | | | + | | | | | | | | | | | - | - | - | |
| 157 | *Nassarius camptus* | Buccinidae | | | | | + | | | | | | | | | - | - | - | |
| 158 | *Nassarius* sp. | Naasariidae | | | | + | | | | | | + | | | | - | - | - | |
| 159 | *Natica bicolor* | Naticidae | | | + | | | | | | | | | | | - | - | - | |
| 160 | *Natica canrena* | Naticidae | | | | | + | | | | | | | | | - | - | - | |
| 161 | *Natica catena* | Naticidae | | | | | + | | | | | | | | | - | - | - | |
| 162 | *Natica gaulteriana* | Naticidae | | | | | + | | | | | | | | | - | - | - | |
| 163 | *Natica maculosa* | Naticidae | | | + | | | | | | | | | | | - | - | - | |

Annex 7 *cont.* List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 164 | *Natica* sp. | Naticidae | | | | + | | | | | | | | | | - | - | - | |
| 165 | *Natica tigrina* | Naticidae | | | + | | | | | | | | | | | - | - | - | |
| 166 | *Natica vitellus* | | | | | | | | + | | | | | | | - | - | - | |
| 167 | *Nerita albicilla* | Neritidae | | | | | + | | | + | | | | | | - | - | - | |
| 168 | *Nerita chamaeleon* | Neritidae | | | | | | | | + | | | | | | - | - | - | |
| 169 | *Nerita costata* | Neritidae | | | | | | | + | + | | | | | | - | - | - | |
| 170 | *Nerita lineata* | Neritidae | | | | | | | | | | + | | | | - | - | - | |
| 171 | *Nerita planospira* | | | | | | | | + | | | | | | | - | - | - | |
| 172 | *Nerita plicata* | Neritidae | | | | | + | | | + | | | | | | - | - | - | |
| 173 | *Nerita undata* | Neritidae | | | | | | | | + | | | | | | - | - | - | |
| 174 | *Nerita versicolor* | Neritidae | | | | | + | | | | | | | | | - | - | - | |
| 175 | *Neritina violacea* | | + | | | | | | | | | | | | | - | - | - | |
| 176 | *Neritopsis radula* | | | | | + | | | | | | | + | + | + | - | - | - | |
| 177 | *Notocochlis* sp. | Naticidae | | | | + | | | | | | | | | | - | - | - | |
| 178 | *Nucella canaliculata* | | | | | + | | | | | | | | | | - | - | - | |
| 179 | *Nucella lamellose* | | | | | + | | | | | | | | | | - | - | - | |
| 180 | *Ocenebra javonica* | | | | | | | | | | | | + | + | + | - | - | - | |
| 181 | *Ocenebra orpheus* | | | | | + | | | | | | | | | | - | - | - | |
| 182 | *Odostomea* | | | | | + | | | | | | | | | | - | - | - | |
| 183 | *Odostomia* | | | | | | + | | | | | | | | | - | - | - | |
| 184 | *Oliva marmorea* | Olividae | | | | | + | | | | | | | | | - | - | - | |
| 185 | *Oliva oliva* | Olividae | | | + | | | | | | | + | | | | - | - | - | |
| 186 | *Ovatella myosotis* | | | | | | + | | | | | | | | | - | - | - | |
| 187 | *Palidinella* | | | | | | + | | | | | | | | | - | - | - | |
| 188 | *Papyriscala* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 189 | *Paradrilla* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 190 | *Phoshirasei* | | | | | + | + | | | | | | | | | - | - | - | |
| 191 | *Phytia plitaca* | | | | + | | | | | | | | | | | - | - | - | |
| 192 | *Pila ampullacea* | | | | | | | | + | | | | | | | - | - | - | |
| 193 | *Pisania triforoides* | Buccinidae | | | | | + | | | | | | | | | - | - | - | |
| 194 | *Planaxis sulcatus* | | | | | | | | | + | | | | | | - | - | - | |
| 195 | *Pleuroploca filamentosa* | Fasciolandae | | | + | | | | | | | | | | | - | - | - | |
| 196 | *Pleuroploca trapezium* | Fasciolandae | | | | | | | | + | | | | | | - | - | - | |
| 197 | *Polinices tumidus* | Naticidae | | | | | | | | + | | | | | | - | - | - | |
| 198 | *Proclava pfeffer* | | | | | + | | | | | | | | | | - | - | - | |
| 199 | *Prunum roscidum* | | | | | | + | | | | | | | | | - | - | - | |
| 200 | *Psefigyra* sp. | | | | | + | + | | | | | | | | | - | - | - | |
| 201 | *Pugilana cochlidium* | | | | | | | | | + | | | | | | - | - | - | |
| 202 | *Punctacteon* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 203 | *Pussionela hifar* | Turridae | | | | | + | | | | | | | | | - | - | - | |
| 204 | *Pygmaeorata* sp. | | | | | + | | | | | | | | | | - | - | - | |

Annex 7 *cont.* List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 205 | *Pyramidella acus* | | | | | | | | | | | | + | + | + | - | - | - | |
| 206 | *Pyramidella* sp. | | | | | | | | | | | + | | | | - | - | - | |
| 207 | *Pyramidella sulcata* | | | | + | | | | | | | | + | + | + | - | - | - | |
| 208 | *Pyrene major* | Corumbellidae | | | + | | | | | | | | | | | - | - | - | |
| 209 | *Pyrene ocellata* | Corumbellidae | | | | | | | | + | | | | | | - | - | - | |
| 210 | *Pyrene scripta* | Corumbellidae | | | | | + | | | | | | | | | - | - | - | |
| 211 | *Pyrene testudinaria* | Corumbellidae | | | | | + | | | | | | | | | - | - | - | |
| 212 | *Pyruniculus phiala* | | | | | + | | | | | | | | | | - | - | - | |
| 213 | *Pythia pantherina* | | | | | | | | | | | | + | + | + | - | - | - | |
| 214 | *Rhenoclavis aspera* | Cerithidae | | | | | | | | + | | | | | | - | - | - | |
| 215 | *Rhenoclavis fasciata* | Cerithidae | | | | | | | | + | | | | | | - | - | - | |
| 216 | *Rhenoclavis vertagus* | Cerithidae | | | | | | | + | + | | | | | | - | - | - | |
| 217 | *Rhinoclavis aspera* | Potamididae | | | | | + | | | | | | | | | - | - | - | |
| 218 | *Rhinoclavis vertagus* | Potamididae | | | | | + | | | | | | | | | - | - | - | |
| 219 | *Rhodopetoma* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 220 | *Ringicula* | | | | | | + | | | | | | | | | - | - | - | |
| 221 | *Ringicula dollaris* | | | | | + | | | | | | | | | | - | - | - | |
| 222 | *Risaoa* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 223 | *Ritena squamulata* | | | | | | | | | | | | + | + | + | - | - | - | |
| 224 | *Royella* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 225 | *Salinator fragilis* | | + | | | | | | | | | | | | | - | - | - | |
| 226 | *Salinator* sp. | | | | | | | + | | | | | | | | - | - | - | |
| 227 | *Sinum perspectivum* | | | | | + | | | | | | | | | | - | - | - | |
| 228 | *Siphonofusus* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 229 | *Smaragolia* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 230 | *Stenothyra* sp. | | | | | | + | | | | | | | | | - | - | - | |
| 231 | *Strombus canarium* | Strombidae | | | | | | | | + | | | | | | - | - | - | |
| 232 | *Strombus epidermis* | Strombidae | | | | | | | | + | | | | | | - | - | - | |
| 233 | *Strombus fasciatus* | Strombidae | | | | | + | | | | | | | | | - | - | - | |
| 234 | *Strombus gibberulus* | Strombidae | | | | | | | + | | | | | | | - | - | - | |
| 235 | *Strombus plicatus* | Strombidae | | | | | + | | | | | | | | | - | - | - | |
| 236 | *Strombus terebellatus* | Strombidae | | | | | + | | | | | | | | | - | - | - | |
| 237 | *Strombus urceus* | Strombidae | | | | | + | | | + | | | | | | - | - | - | |
| 238 | *Strombus variabilis* | Strombidae | | | | | + | | | | | | | | | - | - | - | |
| 239 | *Sukosa* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 240 | *Syncera* sp. | | | | + | | | | | | | | | | | - | - | - | |
| 241 | *Synchera philippica* | | | | | | + | | | | | | | | | - | - | - | |
| 242 | *Taincatella* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 243 | *Tectonatica* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 244 | *Telescopium telescopium* | Potamididae | | | + | | + | | + | | | + | | | | - | - | - | |
| 245 | *Tellina crassa* | Tellinidae | | | | | + | | | | | | | | | - | - | - | |

Annex 7 *cont.* List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 246 | *Terebra bifrons* | Terebridae | | | + | | | | | | | | | | | - | - | - | |
| 247 | *Terebra* sp. | Terebridae | | | + | | | | | | | | | | | - | - | - | |
| 248 | *Terebralia palustris* | | | | | | + | | + | | | | | | | - | - | - | |
| 249 | *Terebralia sulcata* | Potamididae | | | | | + | | + | | | | | | | - | - | - | |
| 250 | *Thais echinata* | Thaidinae | | | | | | | | + | | | | | | - | - | - | |
| 251 | *Thais hippocastarum* | Thaidinae | | | | | | | | + | | | | | | - | - | - | |
| 252 | *Thais mancinella* | Thaidinae | | | | | | | | + | | | | | | - | - | - | |
| 253 | *Thatcheria mirabilis* | | | | | | | | | | | | + | + | + | - | - | - | |
| 254 | *Thiosyra albacilla* | | | | | | | | | | | | + | + | + | - | - | - | |
| 255 | *Throcus* | | | | | | + | | | | | | | | | - | - | - | |
| 256 | *Tiara yaguresi* | | | | | + | | | | | | | | | | - | - | - | |
| 257 | *Tiberia pusilla* | | | | | + | | | | | | | | | | - | - | - | |
| 258 | *Tonna* sp. | Tonnidae | | | | + | + | | | | | | | | | - | - | - | |
| 259 | *Trivia oryza* | | | | + | | | | | | | | | | | - | - | - | |
| 260 | *Trochus lineatus* | Trochidae | | | | | | | | + | | | | | | - | - | - | |
| 261 | *Trochus niloticus* | Trochidae | | | | | | | | + | | | | | | - | - | - | |
| 262 | *Trochus pyramis* | Trochidae | | | | | | | | + | | | | | | - | - | - | |
| 263 | *Trochus radiatus* | Trochidae | | | | | | | | + | | | | | | - | - | - | |
| 264 | *Trochus sandwichensis* | Trochidae | | | | | | | | | | | + | + | + | - | - | - | |
| 265 | *Truncatella* sp. | | + | | | | | | | | | | | | | - | - | - | |
| 266 | *Truncatella valida* | | + | | | | | | | | | | | | | - | - | - | |
| 267 | *Turbo imperialis* | Turbinidae | | | | + | + | | | | | | | | | - | - | - | |
| 268 | *Turbo marmoratus* | Turbinidae | | | | | | | | + | | | | | | - | - | - | |
| 269 | *Turbo petholatus revii* | Turbinidae | | | | | | | | | | | + | + | + | - | - | - | |
| 270 | *Turbo sparverius* | Turbinidae | | | | | | | | + | | | | | | - | - | - | |
| 271 | *Turbonella pesa* | Turbinidae | | | | + | | | | | | | | | | - | - | - | |
| 272 | *Turbonella* sp. | Turbinidae | | | | | | | | | | + | | | | - | - | - | |
| 273 | *Turitella* sp. | Turritellidae | | | + | + | + | | | | | + | | | | - | - | - | |
| 274 | *Turitella terebra* | Turritellidae | | | + | | | | | | | | | | | - | - | - | |
| 275 | *Turricula gemmulaeformis* | Turridae | | | | + | | | | | | | | | | - | - | - | |
| 276 | *Turricula granobalteus* | Turridae | | | + | | | | | | | | | | | - | - | - | |
| 277 | *Turricula promensis* | Turridae | | | | + | | | | | | | | | | - | - | - | |
| 278 | *Turricula waringinensis* | Turridae | | | | + | | | | | | | | | | - | - | - | |
| 279 | *Turritella kowiensis* | Turritlidae | | | | | + | | | | | | | | | - | - | - | |

Annex 7 *cont.* List Species of Gastropods of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1994 | CITES 1995 | |
| 280 | *Turritella terebracensa* | | | | | + | | | | | | | | | | - | - | - | |
| 281 | *Umbarium vestiarium* | | | | + | + | | | | | | | | | | - | - | - | |
| 282 | *Urosalpix anereus* | | | | | + | | | | | | | | | | - | - | - | |
| 283 | *Vexillum plicarium* | Costellaridae | | | | | | | | + | | | | | | - | - | - | |
| 284 | *Vexillum* sp. | Costellaridae | | | | + | | | | | | + | | | | - | - | - | |
| 285 | *Volema myristica* | | | | | | | | | + | | | | | | - | - | - | |
| 286 | *Volvara* sp. | | | | | + | | | | | | | | | | - | - | - | |
| 287 | *Volvarinella* | | | | | + | | | | | | | | | | - | - | - | |
| 288 | *Zebina* | | | | | | + | | | | | | | | | - | - | - | |

Annex 8 List Species of Bivalve of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 1 | *Acanthocardia tuberculata* | | | | + | | | | | | | | | | | - | - | - | - | |
| 2 | *Acila divaricata* | | | | | + | | | | | | | | | | - | - | - | - | |
| 3 | *Acrosterigma elongatum* | Cardiidae | | | | | + | | | | | | | | | - | - | - | - | |
| 4 | *Acrosterigma rugosa* | Cardiidae | | | | | + | | | | | | | | | - | - | - | - | |
| 5 | *Acteon vertagus* | Acteonidae | | | | | + | | | | | | | | | - | - | - | - | |
| 6 | *Amonia sp.* | | | | | | | | | | | + | | | | - | - | - | - | |
| 7 | *Anadara antiquata* | Arcidae | | | | + | | | | + | | | + | + | + | - | - | - | - | |
| 8 | *Anadara cornea* | Arcidae | | | + | | | | | | | | | | | - | - | - | - | |
| 9 | *Anadara granosa* | Arcidae | | | + | | | | + | | | | + | + | + | - | - | - | - | |
| 10 | *Anadara inflata* | Arcidae | | | + | + | | | + | | | | | | | - | - | - | - | |
| 11 | *Anadara maculosa* | Arcidae | | | + | | | | | | | | | | | - | - | - | - | |
| 12 | *Anadara multicostata* | | | | | + | | | | | | | | | | - | - | - | - | |
| 13 | *Anadara sp.* | Arcidae | + | | + | | | | | | | | | | | - | - | - | - | |
| 14 | *Anadara transversa* | Arcidae | | | | | + | | | | | | | | | - | - | - | - | |
| 15 | *Anisocorbula* | | | | | + | | | | | | | | | | - | - | - | - | |
| 16 | *Anisodonta* | | | | | + | | | | | | | | | | - | - | - | - | |
| 17 | *Anomia peruviana* | | | | | + | | | | | | | | | | - | - | - | - | |
| 18 | *Arca pelunculoides* | Arcidae | | | | | | | | | | + | | | | - | - | - | - | |
| 19 | *Arca sp.* | Arcidae | | | | | + | | | + | | | | | | - | - | - | - | |
| 20 | *Archectectonia sp.* | | | | | | | | + | | | | | | | - | - | - | - | |
| 21 | *Asaphis violascens* | | | | | | | | | + | | | | | | - | - | - | - | |
| 22 | *Astarte sp.* | | | | | + | + | | | | | | | | | - | - | - | - | |
| 23 | *Astropecten* | | | | | | + | | | | | | | | | - | - | - | - | |
| 24 | *Atactodea striata* | | | | + | + | | | | + | | | | | | - | - | - | - | |
| 25 | *Atrina vexillum* | | | | | | | | | + | | | | | | - | - | - | - | |
| 26 | *Barbatia* | | | | | + | + | | | | | | | | | - | - | - | - | |
| 27 | *Barbatia reveana* | Acridae | | | | | | | | + | | | | | | - | - | - | - | |
| 28 | *Bittium reticulatum* | | | | | | | | | | | + | | | | - | - | - | - | |
| 29 | *Cardium limedo* | Cardiidae | | | | | + | | | | | | | | | - | - | - | - | |
| 30 | *Cardium robustum* | Cardiidae | | | | | + | | | | | | | | | - | - | - | - | |
| 31 | *Cassis cornula* | | | | | | | | + | | | | | | | - | - | - | - | |
| 32 | *Chenthidae cinguiata* | | + | | | | | | | | | | | | | - | - | - | - | |
| 33 | *Chicoreus capucinus* | | | | | | | | + | | | | | | | - | - | - | - | |
| 34 | *Clinicardium sp.* | | | | | | + | | | | | | | | | - | - | - | - | |
| 35 | *Cokadia* | | | | | + | | | | | | | | | | - | - | - | - | |
| 36 | *Corbicula sp.* | | | | | | | | | | | | + | + | + | - | - | - | - | |
| 37 | *Crassatina* | | | | | + | | | | | | | | | | - | - | - | - | |
| 38 | *Crassostrea sp.* | Ostreidae | | | | + | + | | | + | | | | | | - | - | - | - | |
| 39 | *Cyathodonta tumbezensis* | | | | | + | | | | | | | | | | - | - | - | - | |
| 40 | *Cyclinella ulloana* | | | | | + | | | | | | | | | | - | - | - | - | |

Annex 8 *cont.* List Species of Bivalve of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 41 | *Donax comeatus* | Donacidae | | | | | | | | + | | | | | | - | - | - | - | |
| 42 | *Donax cuter* | | | | | + | | | | | | | | | | - | - | - | - | |
| 43 | *Donax sp.* | | | | | | + | | | | | | | | | - | - | - | - | |
| 44 | *Donax variabilis* | | | | | | + | | | | | | | | | - | - | - | - | |
| 45 | *Dosinia biscocta* | | | | | + | | | | | | | | | | - | - | - | - | |
| 46 | *Dosinia ponderosa* | Veneridae | | | | | + | | | | | | | | | - | - | - | - | |
| 47 | *Elliptotellina* | | | | | + | | | | | | | | | | - | - | - | - | |
| 48 | *Fimbria fimbriata* | | | | | + | | | | | | | | | | - | - | - | - | |
| 49 | *Fulvia hungerfordi* | | | | | + | | | | | | | | | | - | - | - | - | |
| 50 | *Gafrarium divaricatum* | Veneridae | | | | | + | | | | | | | | | - | - | - | - | |
| 51 | *Gafrarium pectinatum* | Veneridae | | | | | + | | | + | | | | | | - | - | - | - | |
| 52 | *Gafrarium sp.* | Veneridae | | | | | + | | | | | | | | | - | - | - | - | |
| 53 | *Gafrarium tumidum* | Veneridae | | | | | + | | | | | | | | | - | - | - | - | |
| 54 | *Gari helenae* | | | | | + | | | | | | | | | | - | - | - | - | |
| 55 | *Glycimeris violascens* | Glycimeridae | | | | | + | | | | | | | | | - | - | - | - | |
| 56 | *Haliotis asinine* | | | | | | | | + | | | | | | | - | - | - | - | |
| 57 | *Helodekra subtrigosa* | | | | | + | | | | | | | | | | - | - | - | - | |
| 58 | *Isognomon bicolor* | | | | | | | | | + | | | | | | - | - | - | - | |
| 59 | *Isognomon epipium* | | | | | | | | | + | | | | | | - | - | - | - | |
| 60 | *Isognomon isognomum* | | | | | | | | | | | | + | + | + | - | - | - | - | |
| 61 | *Libitina rostrata* | | | | | | + | | | | | | | | | - | - | - | - | |
| 62 | *Lunulicardia hemicardia* | | | | | | | | | + | | | | | | - | - | - | - | |
| 63 | *Lopha cristagalli* | Ostreidae | | | | | | | | + | | | | | | - | - | - | - | |
| 64 | *Lopha sp.* | Ostreidae | | | | | | | | + | | | | | | - | - | - | - | |
| 65 | *Lucina lans* | | | | | + | | | | | | | | | | - | - | - | - | |
| 66 | *Lutraria incurva* | | | | + | | | | | | | | | | | - | - | - | - | |
| 67 | *Macoma* | | | | | + | | | | | | | | | | - | - | - | - | |
| 68 | *Macoma balthica* | | | | | | | | | | | + | | | | - | - | - | - | |
| 69 | *Mactra antiquata* | | | | + | | | | | | | | | | | - | - | - | - | |
| 70 | *Malleus albus* | Melidae | | | | | + | | | | | | | | | - | - | - | - | |
| 71 | *Malleus malleus* | Melidae | | | | | + | | | | | | | | | - | - | - | - | |
| 72 | *Mediolus* | | | | | | + | | | | | | | | | - | - | - | - | |
| 73 | *Meritrix sp.* | | | | + | | | | | | | | | | | - | - | - | - | |
| 74 | *Mictra chinensis* | | | | | | + | | | | | | | | | - | - | - | - | |
| 75 | *Mocama* | | | | | | + | | | | | | | | | - | - | - | - | |
| 76 | *Modiolus nipponicus* | | | | | | | | | + | | | | | | - | - | - | - | |
| 77 | *Modiulus auriculata* | | | | | | + | | | | | | | | | - | - | - | - | |
| 78 | *Modiulus demissus* | | | | | | + | | | | | | | | | - | - | - | - | |
| 79 | *Modiulus elongatus* | | | | | | + | | | | | | | | | - | - | - | - | |
| 80 | *Modiulus modiulus* | | | | | | + | | | | | | | | | - | - | - | - | |

Annex 8 *cont.* List Species of Bivalve of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 81 | *Murex* sp. | | | | | | | | + | | | | | | | - | - | - | - | |
| 82 | *Musculium* | | | | | | | | | | | | + | + | + | - | - | - | - | |
| 83 | *Musculus japonicus* | | | | | + | | | | | | | | | | - | - | - | - | |
| 84 | *Mycella bidentata* | Montacutidae | | | | | | | | | | + | | | | - | - | - | - | |
| 85 | *Mytilus adulis* | | | | | | + | | | | | | | | | - | - | - | - | |
| 86 | *Mytilus viridis* | Mytilidae | | | | | | | | | | | + | + | + | - | - | - | - | |
| 87 | *Nemocardium bechei* | | | | | + | | | | | | | | | | - | - | - | - | |
| 88 | *Neocyrena formis* | | | | | + | | | | | | | | | | - | - | - | - | |
| 89 | *Nereus* sp. | | | | | | + | | | | | | | | | - | - | - | - | |
| 90 | *Novathaca* sp. | | | | | + | + | | | | | | | | | - | - | - | - | |
| 91 | *Nuculana* sp. | | | | | + | + | | | | | | | | | - | - | - | - | |
| 92 | *Ostrea tubulifera* | | | | | + | | | | | | | | | | - | - | - | - | |
| 93 | *Paphia* | | | | | | + | | | | | | | | | - | - | - | - | |
| 94 | *Paphia textile* | | | | | + | | | | | | | | | | - | - | - | - | |
| 95 | *Parricardium ovale* | | | | | | | | | | | + | | | | - | - | - | - | |
| 96 | *Pecten* | | | | | + | | | | | | | | | | - | - | - | - | |
| 97 | *Perna viridis* | | | | + | + | + | | | | | | | | | - | - | - | - | |
| 98 | *Phaxas cultellus* | | | | | + | | | | | | | | | | - | - | - | - | |
| 99 | *Phlyctiderma japonicum* | | | | | + | | | | | | | | | | - | - | - | - | |
| 100 | *Pholas orientalis* | Pholadidae | | | + | | | | | | | | | | | - | - | - | - | |
| 101 | *Pinctada* | | | | | + | | | | | | | | | | - | - | - | - | |
| 102 | *Pinctada margaritifera* | Pteridae | | | | | | | | + | | | | | | - | - | - | - | |
| 103 | *Pinctada maxima* | Pteridae | | | | | | | | + | | | | | | - | - | - | - | |
| 104 | *Pinna muricata* | | | | | | | | | + | | | | | | - | - | - | - | |
| 105 | *Pitar consanguineus* | | | | | + | | | | | | | | | | - | - | - | - | |
| 106 | *Pitarina striatum* | Veneridae | | | | | + | | | | | | | | | - | - | - | - | |
| 107 | *Placenan* | | | | | + | + | | | | | | | | | - | - | - | - | |
| 108 | *Placuna placenta* | Placunidae | | | + | | | | + | | | | | | | - | - | - | - | |
| 109 | *Polymesoda coaxans* | | | | | | | | | | | + | | | | - | - | - | - | |
| 110 | *Psammotreta ephippium* | | | | | | | | | + | | | | | | - | - | - | - | |
| 111 | *Pteria pinguin* | Pteridae | | | | | | | | + | | | | | | - | - | - | - | |
| 112 | *Saccostrea cucullata* | Ostreidae | | | | | | | | + | | | | | | - | - | - | - | |
| 113 | *Sacella confusa* | | | | | + | | | | | | | | | | - | - | - | - | |
| 114 | *Sanguinolaria speciosa* | | | | | + | | | | | | | | | | - | + | - | - | |
| 115 | *Semelangulus tokuberti* | | | | | + | | | | | | | | | | - | - | - | - | |
| 116 | *Semele flavescens* | | | | | + | | | | | | | | | | - | - | - | - | |
| 117 | *Septa nicobarium* | | | | | | | | + | | | | | | | - | - | - | - | |
| 118 | *Septifer bilocularis* | | | | | | + | | | | | | | | | - | - | - | - | |
| 119 | *Siliqua radiata* | | | | + | | | | | | | | | | | - | - | - | - | |
| 120 | *Siliquaria cumingi* | | | | | | | | + | | | | | | | - | - | - | - | |

Annex 8 *cont.* List Species of Bivalve of Indonesia Mangrove Ecosystem in the South China Sea.

| No. | Scientific Name | Family | Province | | | | | | | | | | | | | Status | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Gov. Policy | IUCN 1990 | IUCN 1994 | CITES 1995 | |
| 121 | *Solemnya* sp. | | | | | | + | | | | | | | | | - | - | - | - | |
| 122 | *Solen grandis* | | | | | + | | | | | | | | | | - | - | - | - | |
| 123 | *Solen strictus* | Solinidae | | | | | | | + | | | | | | | - | - | - | - | |
| 124 | *Spatpema* | | | | | | + | | | | | | | | | - | - | - | - | |
| 125 | *Spondylus ducalis* | Pectinidae | | | | | | | | + | | | | | | - | - | - | - | |
| 126 | *Strigella* sp. | | | | | + | | | | | | | | | | - | - | - | - | |
| 127 | *Sunetta alicae* | Glossidae | | | | | + | | | | | | | | | - | - | - | - | |
| 128 | *Sunetta concinna* | Glossidae | | | | | + | | | | | | | | | - | - | - | - | |
| 129 | *Sunetta menstrualis* | Glossidae | | | | | + | | | | | | | | | - | - | - | - | |
| 130 | *Tellina alternata* | Telinidae | + | | | | + | | | | | | | | | - | - | - | - | |
| 131 | *Tellina crassa* | Telinidae | | | | | + | | | | | | | | | - | - | - | - | |
| 132 | *Tellina ovalina* | | + | | | | | | | | | | | | | - | - | - | - | |
| 133 | *Tellina* sp. | Telinidae | | | | | | | | | | + | | | | - | - | - | - | |
| 134 | *Tellina staurella* | | + | | | | | | | | | | | | | - | - | - | - | |
| 135 | *Tellina thomboides* | | + | | | | | | | | | | | | | - | - | - | - | |
| 136 | *Tellina versicolor* | Telinidae | | | | | + | | | | | | | | | - | - | - | - | |
| 137 | *Thracia phaseolina* | Thraciadae | | | | | | | | | | + | | | | - | - | - | - | |
| 138 | *Thracia villosiuscula* | Thraciadae | | | | | | | | | | + | | | | - | - | - | - | |
| 139 | *Topes* sp. | | | | | | + | | | | | | | | | - | - | - | - | |
| 140 | *Trachicardium magnum* | Cardidae | | | | | + | | | | | | | | | - | - | - | - | |
| 141 | *Trachycardium subrugosum* | | | | | | | | | + | | | | | | - | - | - | - | |
| 142 | *Tridacna crocea* | | | | | | | | | + | | | | | | - | - | - | - | |
| 143 | *Tridacna maxima* | | | | | | | | | + | | | | | | - | - | - | - | |
| 144 | *Tridacna squamosa* | | | | | | | | | + | | | | | | - | - | - | - | |
| 145 | *Venaricardia* sp. | | | | | | | | | | | + | | | | - | - | - | - | |
| 146 | *Venerupis aurea* | Glossidae | | | | | + | | | | | | | | | - | - | - | - | |
| 147 | *Venus meirenaria* | Venenidae | | | | | + | | | | | | | | | - | - | - | - | |
| 148 | *Venus meretrix* | Venenidae | | | | | + | | | | | | | | | - | - | - | - | |
| 149 | *Venus multicostata* | Venenidae | | | | | + | | | | | | | | | - | - | - | - | |
| 150 | *Vepricardium* | | | | | + | | | | | | | | | | - | - | - | - | |
| 151 | *Veremolpa minuta* | | | | | + | | | | | | | | | | - | - | - | - | |
| 152 | *Voluta nivosa* | Volutidae | | | | | + | | | | | | | | | - | - | - | - | |