

An overview on global mangroves distribution

SK Chand Basha*

Department of Zoology and Aquaculture, Acharya Nagarjuna University.522 510, Andhra Pradesh, India

*[E.Mail: mahashaf@gmail.com]

Received 23 May 2016; Revised 17 November 2016

Present study assesses the Global Distribution of Mangroves, important species, Causes of degradation in different countries of the globe. Global mangroves distribution may be categorized as western and eastern zones sprawled in 112 countries of tropical and subtropical regions. Present review describes the distribution of mangroves in important mangroves nations of the aforesaid regions for instance, regarding West Africa, important mangroves nations viz... Mauritania, Nigeria, Democratic republic of Congo and others has been discussed. Keeping in view of its value of biodiversity and services, in the midst of sizeable mangroves degradation, effective conservation of mangroves in a sustainable way is the dire need.

[**Keywords:** Mangroves, South Asian mangroves, South East Asian mangroves and Sustainable development].

Introduction

The term Mangroves denotes a group of 68 woody halophytic plant communities¹ which have the ability to adapt to the extreme transitional zone, which embodies divergent habitats between marine and terrestrial environments. Mangroves are the world's high yielding ecosystems, adaptations of whose are second to none. Mangroves adaptations are unpalatable in terms of adapting to regular fluctuations in tides, higher saline conditions and nil/near nil oxygenic conditions. Evolving stilt roots makes mangroves to cope-up with tidal fluctuations. Evolving xeromorphic and halophytic conditions enables mangroves to adapt to higher saline conditions and evolving pneumatophores becomes an answer to nill/near nill oxygenic conditions. Mangroves accompanies elaborated spectrum of services viz...Protection of coast, Carbon sequestration, Land accretion, Water quality and Pollution control, Food, Timber, Dyes and others, out of these mangroves coastal protection role is incredible in which mangroves protects the coasts from tsunamis, cyclones, floods and sea inundations². Three fourths of the tropical and sub tropical nations coasts has been sprawled by mangroves, but currently less than half of them remains, out of it more than half are in degraded conditions³. For convenience global mangroves distribution are distinguished into two zones¹ 1. West zone 2. East zone. West zone

embodies African coast of Atlantic, North and South American portions, which also comprises Galapagos islands and the East zone embodies eastern part of African coast, South asian countries viz...India and Pakistan, South east asian countries like Indonesian archipelago and Australia and New zealand. East zone found to embodies higher species richness¹.With respect to coordinational extents location of mangroves limited to 32°N and 38°S, sprawling in 112 countries coastlines of tropical and subtropical regions for an area between 167000 and 181000 km²². Bangladesh reported to possess world's single largest mangrove area stretching over 600000 ha². 35% of global mangroves have lost in last two decades⁴.

Objectives of the Review

- To review Global Mangroves distribution starting from Americas on West side, followed by Africa, South asian, South east asian, ending with Australia and New zealand mangroves on East side.
- To review important mangrove nations of different regions and its different aspects viz... Size of mangroves, important mangrove species and causes of mangroves degradation, particularly of anthropological origin.
- To review Indian Mangroves distribution, and some of its important mangrove regions.

Discussion

North and Central American mangroves:

Well stretched Mangroves sprawls along the coastal areas of 34 countries and regions of North and Central America, its spectrum embodies Barbados from north to Panama in south, which also comprising different Caribbean islands. Mangroves of diversified community types are located viz...Estuarine mangroves, Saline pond mangroves, Brackish pond mangroves and others. Grand Cayman's central mangrove wetland is a notable mangrove which is the largest inland mangroves of Caribbean. Mangrove biodiversity potentiality of North and Central America is very limited. Unlike mangrove richness of Asia, meager 10 native species of mangroves viz... *Acrostichum aureum*, *Avicennia bicolor*, *Laguncularia racemosa* and others are known from countries of north and central america with near even distribution across its different countries, Over 2 million hectares of mangroves spreads along the coastal belts of countries of north and central america. Top 5 countries of north and central america reported to have highest mangrove size as of 2005 in descending order- Mexico-36%, Cuba- 24%, U.S.A.-9%, Panama-8% and Bahamas-6%. Land conversion for varied anthropogenic factors severely degrading the mangroves of north and central America⁵.

South American mangroves:

Mangroves sprawl along the coasts of Atlantic and Pacific oceans of 8 South American countries viz... Brazil, Ecuador, Colombia, French Guiana, Peru, Guyana, Suriname, Venezuela totaling to 1977900 ha as of 2005. Nearly 50% of total mangroves area of South America reported from Brazil, which occupies 3rd position in terms of global mangroves area. Top 5 countries of South America with larger tracts of mangroves area in descending order- Brazil-50%, Colombia-18%, Venezuela-11%, Ecuador-8% and Suriname-6%. Biodiversity potentiality of South America is very scanty reporting just 10 native mangrove species viz... *Acrostichum aureum*, *Rhizophora harrisonii*, *R. mangle* and others. Land conversion severely affecting the mangroves of south america. As an illustration we shall discuss Brazilian mangroves from south america⁶.

Brazilian mangroves: Brazilian mangroves though occupy larger tracts of area are patchily distributed along its coasts. The well flourished mangroves are located in the northern states of Brazil embodying Amapa, Maranhao and Para whose favourable ecological

features like very adequate rainfall is the key for its flourishing. *Rhizophora mangle* is the dominating species of bays and estuaries. South eastern mangroves of brazil has been deforested owing to the higher demand of timber and other modern developments but other areas are comparatively unaffected⁷.

African Mangroves:

70 true mangrove species recorded across the globe⁸ out of them 17 mangrove species were distributed in 26 African countries with 8 species distributed in 19 West African countries and 9 species distributed in 7 East African countries. Regarding West African mangroves its distribution in north to south direction sprawls along countries 1.Mauritania, 2.Senegal, 3.Gambia, 4.Guinea Bissau, 5.Guinea, 6.Sierra leone, 7.Liberia, 8.Cote d'Ivoire, 9.Ghana, 10.Togo, 11.Benin, 12.Nigeria, 13.Cameroon, 14.Equatorial guinea, 15.Sao tome and Principe (Island), 16.Gabon, 17.Congo republic, 18.Democratic Republic of Congo and 19.Angola. Regarding East African mangroves its distribution in north to south direction sprawls along countries 1.Somalia, 2.Kenya, 3.Tanzania, 4.Mozambique, 5.Madagascar, 6.Seychelles (archipelago) and 7.South Africa⁸.

West African mangroves embody large scale coverage of mangroves than East Africa owing to its potential riverine base. We would discuss important mangroves of western and eastern Africa in coming deliberations⁸.

West African Mangroves:

Mangroves cover in West Africa amounts to 20,144km² and amongst West African mangroves nations Nigeria embodies large scale mangrove cover measuring to 7,386 km² which is approximately 35% of total West African mangroves⁸. Some of the notable mangroves rich West African countries have been discussed as follows.

Table 1 — Mangroves of Western and Eastern Africa⁸

Western African Mangroves	Eastern African Mangroves
1. <i>Acrostichum aureum</i>	1. <i>Avicennia marina</i>
2. <i>Avicennia germinans</i>	2. <i>Avicennia officinalis</i>
3. <i>Conocarpus erectus</i>	3. <i>Bruguiera gymnorhiza</i>
4. <i>Laguncularia racemosa</i>	4. <i>Ceriops tagal</i>
5. <i>Nypa fruticans</i>	5. <i>Heritiera littoralis</i>
6. <i>Rhizophora harisonii</i>	6. <i>Lumnitzera racemosa</i>
7. <i>Rhizophora mangle</i>	7. <i>Rhizophora mucronata</i>
8. <i>Rhizophora racemosa</i>	8. <i>Sonneratia alba</i>
	9. <i>Xylocarpus granatum</i>
Total: 08	09

(i). Mauritania: The country Mauritania is prevailed by arid (Atlantic coast) desert nature, owing to this mangroves occupies a scanty proportion⁸ of 2.09 km² which is less than 0.1% of total African mangrove cover located in Senegal delta and area proximity to cape timirist. 3 Mangrove species *Avicennia germinans*, *Conocarpus erectus*, and *Rhizophora racemosa* are present in Mauritania and 3 Ramsar mangrove sites - National Park Banc d'Arguin, Diawling National Park and Chat T Boul are demarcated in Mauritania, out of which National park Banc d'Arguin is a distinct transitional area in between Atlantic ocean and Sahara desert⁸.

(ii). Republic of guinea: 300 km long continental shelf sprawls along the Guinean coast is largest in West Africa⁸ harbouring mangroves in most of its coast sparing a few areas and size of the mangroves area is 2039 km² amounting to 7% of total African cover of mangroves, 7 species of mangroves have been reported in guinea⁸ they are *Acrostichum aureum*, *Avicennia germinans*, *Conocarpus erectus*, *Laguncularia racemosa*, *Rhizophora harisonii*, *Rhizophora mangle* and *Rhizophora racemosa*. Four Ramsar mangroves areas has been demarcated in Guinea viz... Iles tristao, Rio kapatchez, Rio pongo and Konkoura⁸.

(iii). Sierra leone: Mangroves sprawled well along the Sierra Leone's coast with higher concentrations in four estuaries of Rokel, Scarcies, Yawri Bay and Sherbro rivers⁸ with mangroves size measures to 1052 km² occupying 3.5% of total African cover of mangroves. There are 6 species of mangroves located in Sierra leone⁸ they are *Avicennia germinans*, *Conocarpus erectus*, *Laguncularia racemosa*, *Rhizophora mangle*, *Rhizophora harisonii* and *Rhizophora racemosa*. Estuary of river Sierra leone has been demarcated as Ramsar site⁸.

(iv). Nigeria: Nigerian mangroves are considered as largest in Africa⁸ measuring to 7386 km² and occupying 22% of African cover of mangroves. Large scale mangroves size is located in Niger delta. Nigeria represents all 8 species of mangroves located in West Africa⁸ they are viz. *Acrostichum aureum*, *Avicennia germinans*, *Conocarpus erectus*, *Laguncularia racemosa*, *Nypa fruticans*, *Rhizophora harisonii*, *Rhizophora mangle*, and *Rhizophora racemosa*. Petroleum exploitation becoming one of the major threats to mangroves in Nigeria⁸.

(v). Democratic Republic of Congo (DCR): DCR is a large country which bestrides the equator and Congo river basin dominates the DCR. The size of mangroves

in DCR totals to 201 km² amounting to 0.7% of total African cover of mangroves. 6 mangrove species are located in democratic republic of Congo⁸ they are *Acrostichum aureum*, *Avicennia germinans*, *Conocarpus erectus*, *Laguncularia racemosa*, *Rhizophora mangle*, *Rhizophora racemosa*. Mangroves of Parc marin des has been demarcated as Ramsar site⁸.

East African Mangroves:

In East African mangroves 3 mangrove species 1. *Avicennia marina*, 2. *Ceriops tagal* and 3. *Rhizophora mucronata* dominates the region. In this paper we shall discuss some of the important east African mangrove nations⁹.

(i). Mozambique: The size of the mangroves extends to 4000 km² and are majorly sprawls along the larger river openings in Zambezi, Buzi and Pungui and estuaries. 9 mangrove species are located in Mozambique with delta of Zambezi predominates in terms of number of species⁹.

(ii). Tanzania: Total size of the mangroves in Tanzania measures to 1335 km², where in Rafiji river delta is a notable mangrove area and 9 mangrove species are reporting from Tanzania⁹.

(iii). Kenya: Mangrove size in Kenya amounts to 500 km² representing 9 species. Major extent of mangroves is reported from Lamu⁹.

South Asian Mangroves: Under this head we would discuss Mangroves of India, Bangladesh, Maldives, Pakistan and Srilanka.

Indian mangroves:

The coastal line of India measures to 7,516.6 km embodying both mainland and island¹⁰ and the mangroves cover in India extends to a sizeable 4628 km²¹¹ bagging fourth position in terms of global cover of mangroves¹⁰ scaling up to 0.14% of India's entire geographical extent¹². The co-ordinates of Mangrove extents in India are 69° E- 89.5° E and 7°N- 23°N¹⁰. 38 Mangroves areas has been designated in India, sprawling the coastal states of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil nadu, A.P, Odisha, West Bengal and Andaman and Nicobar islands, apart from these mangroves are also present in Puducherry and Daman and Diu¹². Based on denseness of mangrove canopy cover in India mangroves has been classified as Very dense, Moderately dense and Open mangroves amounting to 1403 km², 1658.12 km² and 1600.44 km² respectively¹². Indian biodiversity potential of mangroves was found to be of 125 species with 39

true mangroves and rest are associates¹³. In India there is a broad spectrum of significant mangroves viz...Sunderbans, Gulf of Khambat, Gulf of Katchch, Coringa mangroves and others; in this paper we shall discuss two of the significant mangroves. 1. Mangroves of Tamilnadu 2. Bhitarkanika Mangroves.

(i). Mangroves of Tamilnadu: The coastline of Tamilnadu extends for nearly 950 km and the state of Tamilnadu comprises both major and minor mangroves viz... Mangroves of Pichavaram- 1357 ha, Pudhupattinam-800 ha, Muthupet-12000 ha, Gulf of Mannar marine national park- 30 ha, Gulf of Mannar marine-148 ha and Palk Strait-700 ha, out of which in this paper we shall discuss about Pichavaram and Muthupet mangroves as representatives of Tamilnadu¹⁴.

(a). Pichavaram Mangroves: The location of Pichavaram mangroves as per remote sensing images¹⁴ found between rivers – Vellar in North and Coleroon in South. There are 3 reserve forests in Pichavaram mangroves- Killai, Pichavaram and Pichavaram extension area. Regarding biodiversity potential of Pichavaram mangroves there are 13 exclusive mangroves viz...*Acanthus ilicifolius*, *Avicennia marina*, *Avicennia officinalis*, *Bruguiera cylindrica*, *Rhizophora apiculata* and others out of these *Avicennia marina* dominates the mangroves amounting to 74% of the entire population¹⁴. MSSRF (M.S.Swaminathan Research Foundation) studies suggest that degradation of Pichavaram mangroves is owing to poor scientific management methods¹⁵.

(b). Muthupet Mangroves: The location of Muthupet mangroves is at the southern tip of the delta of Cauvery which sprawls along the districts of Thiruvavur, Nagapattinam and Thanjavur and is the integral part of great Vedaranyam swamp. Administratively Muthupet mangroves has been classified into 6 reserve forests. Regarding biodiversity potential of Muthupet mangroves there are 6 true mangrove species – *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Avicennia marina*, *Excoecaria agallocha*, *Rhizophora mucronata* and *Lumnitzera racemosa* out of these *Avicennia marina* overwhelmingly dominates the entire population amounting to 95%. MSSRF studies suggest that felling of trees intrinsically affects Muthupet mangroves¹⁴.

(ii). Bhitarkanika Mangroves: Bhitarkanika mangroves are considered as the second largest mangrove wetlands of Indian mainland scaling to

nearly 145 km² ¹ it has been designated as conservation area embodying Bhitarkanika National park and Wild life sanctuary and Gahirmatho marine sanctuary. Regarding Bhitarkanika mangroves biodiversity potentiality, 64 plant species reported from it comprising of True mangroves- 28, Mangroves associates- 4 and others-32. 33.25% was the average mangroves canopy cover of Bhitarkanika. Another significance of Bhitarkanika mangroves is *Crocodilus porosus*- Salt water crocodile an endangered animal has been protecting in Bhitarkanika mangroves, it also supports olive ridley sea turtle and other flora and fauna. Bhitarkanika has been severely effected owing to varied anthropogenic factors like land conversion for agriculture¹.

Bangladesh Mangroves:

Sunderbans mangroves are the World's largest surviving mangroves extends in both India and Bangladesh with majority of 62% located in Bangladesh, another important feature of Sunderbans is tigers in habituates the Sunderbans mangroves, where no other mangroves had such a distinct feature. In total 24 mangrove species has reported from Sunderbans, out of which *Heritiera fomes* and *Excoecaria agallocha* are predominant mangrove species⁹.

Maldivian Mangroves:

Maldivian mangroves extends for a size of 4.18 km² along its coral islands which embodies Landhoo, Gaafaru, Kelai, Kaashidu and Farukolhu. The number of mangrove species ranges between 2 to 7 amongst different islands of Maldives. *Bruguiera cylindrica* is the dominant mangrove species. Floral composition of Maldivian mangroves are much alike to Srilankan mangroves⁹.

Pakistan Mangroves:

Most of the Pakistan mangroves sprawls in Indus delta extending for a size of 2600 km² located in the coastal provinces of Balochistan and Sindh. 8 species of mangroves are known from Indus delta and Makran coast represents 5 mangrove species⁹.

Srilankan Mangroves:

Srilankan mangroves are one of the notable mangroves of the world, they stretch for a size of 12189 ha along the coastal districts of Srilanka viz...Colombo, Jaffna, Batticola, Ampara, Puttalam, Hambantota and Trincomalee¹⁶. Mangroves of Puttalam lagoon-Dutch bay-Portugal bay complex is

denoted as largest with a size of 3385 ha¹⁷. Other largely stretched mangrove areas are Trincomalle, Batticaloa and Hambantota. In total 20 true species of mangrove has been reported from srilanka out of which very common species of mangroves found in srilanka are *Avicennia officinalis*, *Avicennia marina*, *Lumnitzera racemosa* and *Exoecaria agallocha*. Some of the common species are *Bruguiera gymnorhiza*, *Ceriops tagal*, *Nypa fruticans* and *Rhizophora apiculata*. Rare species found in srilanka are *Sonneratia alba*, *Exoecaria indica* and *Bruguiera cylindrical*¹⁶.

South East Asian Mangroves:

The Proportion of South East Asian (S.E.A.) Mangroves in World's mangroves is 33.5% i.e. 51049 km² of 150000 km²¹⁸. Mangroves of South East Asia are most diversified in world¹⁹. The vegetation of south east asian mangroves reported to have 268 plant species which embodies 129 shrubs and trees, 50 terrestrial herbs, 28 epiphytes and climbers separately and others, out of 268 plant species 52 exclusively in habituates in mangrove ecosystem and therefore considered as true mangroves¹⁹.¹⁹ Reported that across the globe there are 60 true mangrove species despite the number differences between varied reports since S.E.A represents 52 true mangroves it can be considered as hub of mangrove species richness¹⁹.

As per individual country reports of S.E.A. vis-à-vis to representation of 52 true mangroves, Indonesia stood first with 48 species known from it, that is why it may be considered as mega biodiversity hub of S.E.A, other countries of S.E.A. listed in descending order in terms of it's biodiversity potentiality are Malaysia-42 species, P.N.G (Papua New guinea)- 40 species, Philippines- 38 species. Some of the 52 mangrove species located in S.E.A are *Acanthus ilicifolius*, *Acrostichum aureum*, *Avicennia alba*, *Bruguiera gymnorhiza*, *Ceriops tagal*, *Rhizophora stylosa*, *Sonneratia ovata* and others. Another significant feature of S.E.A's mangrove flora is 18% are reported to be endemic to S.E.A. In terms of relative proportion of mangrove areas of South East Asian countries, Indonesia is first in position with occupancy rate of 59.8% followed by Malaysia-11.7%, Myanmar-8.8%, P.N.G-8.7% and others¹⁹. We shall discuss in this paper some of the important mangrove rich nations of South East Asia.

(i). Indonesia: Indonesia harbours largest extent of mangroves in S.E.A, but since 1980 considerable percentage of mangroves has been declined due to varied reasons like land conversion, there is some kind of opaqueness regarding the exact extent of mangroves

in Indonesia and 2.5 million hectares is more often cited as Indonesia's mangroves size. Greater extent of mangroves area has been coming from Papua province in Indonesia followed by Sumatra-19% and Indonesian borneo-16% the major bottleneck regarding Indonesia's mangroves data is lack of accuracy and accompanying errors further dilutes the accuracy of data¹⁹.

(ii). Malaysia: Malaysia follows Indonesia in terms of extent of mangrove size reported to have nearly 11.7% of total S.E.A's mangroves. Owing to considerable decline of mangroves the data shows mangroves of size 570000 hectares has been reported in 2000¹⁹. Majorly mangroves in Malaysia distributed along the states of Peninsular Malaysia- Kedah, Perak, Selangor and Johor and in East Malaysia – Sabah and Sarawak. Descending order of distribution of mangrove extent in different states of Malaysia embodies Sabah, Perak, Sarawak, Selangor and Johor²⁰. Larger extent of mangroves sprawled along the western coast of peninsular Malaysia than its eastern coast due to sheltered nature of the former²¹. Land conversion and modern coastal developments did had a negative impact on Malaysian mangroves¹⁹.

(iii). Myanmar: The Mangrove size in Myanmar is 425000 ha in 2000 occupying 8.8 % of mangroves of S.E.A major regions of Myanmar reported to have considerable mangroves are Ayeyarwady division with 46% followed by Tanintahryi division – 37% and Rakhine state – 17%. Aquaculture costs highly mangroves in Myanmar¹⁹.

(iv). Papua New Guinea (P.N.G): P.N.G reported to harbour 400000 ha of mangroves area in 2000 occupying 8.7% of total mangrove area in S.E.A. Greater size of mangrove area found along Papua gulf which is the opening place of several rivers¹⁹.

(v). Philippines: Philippines occupy nearly 2.2% of mangroves of S.E.A.¹⁹ Reported that the entire mangroves area of Philippines is 500000 ha at the end of previous century, considerable degradation of mangroves in Philippines is owing to brackish water aquaculture development¹⁹.

(vi). Thailand: The entire mangrove area of Thailand is calculated as 244161 ha¹⁹ and occupying 5.0% of total mangroves of S.E.A. Larger tracts of mangroves sprawls along the coasts of western and eastern peninsula, Delta of chao phraya and south eastern coast¹⁹. Notable mangrove areas (provinces) in descending order of mangroves extent are Phang Nga, Satul, Trang, Kabi and others²². In Thailand also aquaculture did played a negative effect on mangroves¹⁹.

Australian Mangroves:

Australian Mangroves are considered as third largest mangrove area in the globe where in, Indonesia and Brazil occupies first two positions. The size of Australian mangroves amounts to 11500 km² which is 6.4% of total global mangrove area. Australian mangroves sprawl along the coastal regions of Western Australia, Queensland, Victoria, New South Wales, South Australia and North territory. Mangroves are not reported from Tasmania. *Avicennia marina* and *Rhizophora stylosa* are the common mangrove species of Australia²³.

New Zealand Mangroves:

The location of New Zealand mangroves are limited to North island's northern coastlines, sprawling along divergent habitats of estuaries, tidal creeks, lagoons, shallow harbours and rivers extending to the north of 38°S latitude. Some of the places known for mangrove inhabitations in North island are Tapotupotu Bay, Parengarengo Harbour, Rangaunu Harbour, Houhora Harbour, Mangonui Harbour and Taipa river. New Zealand's only and indigenous species of mangroves is *Avicennia marina australasica* also known as Manawa in habituates in North island of New Zealand, apart from it the same is also reported from New Caledonia, Lord Howe Island and South eastern coastal area of Australia²⁴. *Avicennia marina australasica* has been an integral part of New Zealand flora for nearly 19 million years²⁵.

Conclusion

In the midst of varied anthropogenic factors viz... Shrimp culture, Agriculture, Climate change and other factors which costs mangroves rampantly, there is a need of holistic conservation strategies, different measures that were already been practicing currently are Biospheres, National parks, Sanctuaries and other legal provisions, in addition to these utilizing existing remote sensing satellite services for effective mapping of Mangroves cover across the globe would also be a viable option for Sustainable development of Mangroves across the globe.

Acknowledgements

SK Chand Basha is immensely thankful to his guide Prof.K.R.S.Sambasiva Rao for guidance, H.O.D. of Zoology and Aquaculture, A.N.U. for timely help, U.G.C. for awarding B.S.R fellowship, to his parents for sustaining a conducive academic atmosphere and finally to Almighty for his blessings.

References

- 1 Badola, R. & Hussain S.A. (2003) Valuation of the Bhitarkanika Mangrove ecosystem for ecological security and sustainable resource use. Study Report. Wildlife Institute of India. Dehra Dun. 101 pp.
- 2 Miththapala, S. (2008) Mangroves. Coastal Ecosystems Series Volume 2 pp 1-28 + iii, Colombo, Sri Lanka: Ecosystems and Livelihoods Group Asia, IUCN.
- 3 Anonymous,n.d.Mangrove Forest in India (http://cwc.gov.in/CPDACWebsite/Paper_Research_Work/Paper%20Research%20Work%20.pdf)
- 4 Mathew, Grace and Jeyabaskaran, R and Prema, D (2010) *Mangrove Ecosystems in India and their Conservation*. In: Coastal Fishery Resources of India-Conservation and sustainable utilisation. Society of Fisheries Technologists, pp. 186-196.
- 5 Anonymous,n.d.Chapter 6 North and Central America (<ftp://ftp.fao.org/docrep/fao/010/a1427e/a1427e07.pdf>)
- 6 Anonymous,n.d.Chapter 8 South America (<ftp://ftp.fao.org/docrep/fao/010/a1427e/a1427e09.pdf>)
- 7 Global Forest Resources Assessment 2005, Thematic study on Mangroves-Brazil.
- 8 UNEP (2007) Mangroves of Western and Central Africa. UNEP- Regional Seas Programme/ UNEP-WCMC.
- 9 K.Kathiresan &N.Rajendran, 2005, Mangrove ecosystems of the Indian ocean region, Indian Journal of Marine Sciences Vol.34 (1), March 2005, pp.104-113.
- 10 A.K.Singh, Abubakar Ansari, Dinesh Kumar and U.K.Sarkar. Status, Biodiversity and Distribution of Mangroves in India: An overview, Uttar Pradesh state biodiversity board, 22nd May 2012, International Day for Biological Diversity, Marine Biodiversity.
- 11 MOEF (Ministry of Environment and Forests, Government of India, Annual Report 2014-15.
- 12 MOEF (Ministry of Environment and Forests, Government of India, Annual Report 2011-12.
- 13 K.Kathiresan, Importance of mangrove forests of India. Jour. Coast. Env, Vol.1, No.1, 2010.
- 14 V. Selvam, L. Gnanappazham, M. Navamuniyammal, K. K. Ravichandran and V. M. Karunakaran, ATLAS OF MANGROVE WETLANDS OF INDIA, Part I - Tamil Nadu, November 2002.100 pp.
- 15 V.Selvam, K.K.Ravichandran, V.M.Karunakaran, K.G.Mani, Evanjalin Jessie Beula and L.Gnanappazham (2010): Pichavaram mangrove wetlands: Situation Analysis, Chennai, 39 pp.
- 16 Anonymous,n.d. Mangroves of Sri Lanka, IUCN (<https://www.globalnature.org/bausteine.net/f/6462/VimukthiWeerathunga-MangrovesofSL.pdf?fd=2>)
- 17 Anonymous,n.d. Information Brief on Mangroves in Sri Lanka, IUCN (http://cmsdata.iucn.org/downloads/sri_lanka_information_brief_of_mangroves.pdf)
- 18 World Atlas of Mangroves,2010,Launching ceremony at CBD COP 10, Nagoya (<https://www.cbd.int/cooperation/pavilion/nagoya-presentations/2010-10-21-session1-mangroves-en.pdf>)
- 19 Wim Giesen, Stephan Wulffraat, Max Zieren and Liesbeth Scholten, RAP PUBLICATION 2006/07, MANGROVE GUIDEBOOK FOR SOUTHEAST ASIA
- 20 Anonymous,n.d (http://studentsrepo.um.edu.my/2070/4/BAB_1.pdf)
- 21 Behara Satyanarayana, Indra F.Idris, Khairul A.Mohamad,

- Mohd-L.Husain, Noor A.M.Shazili and Farid Dahdough-Guebas, Mangrove species distribution and abundance in relation to local environmental settings: a case study at Tumpat, Kelantan Delta, east coast of peninsular Malaysia, *Botanica Marina* 53 (2010): 79-88
- 22 Twesukdi Piyakarnchana, n.d. The Present State of Mangrove Ecosystems in Southeast Asia and the Impact of Pollution (<http://www.fao.org/3/contents/37251441-217a-51cd-a670-49154b90ed60/AB751E01.htm#tbl1>)
- 23 http://www.mangroveswatch.org.au/index.php?option=com_content&view=section&layout=blog&id=18&Itemid=300032
- 24 Morrisey, D. *et al* (2007). The New Zealand Mangrove: Review of the Current State Of Knowledge. Auckland Regional Council Technical Publication Number 325
- 25 New Zealand's mangroves 09 366 2000, Auckland Regional Council (http://www.whauriver.org.nz/wp-content/uploads/2012/05/new_zealands_mangroves_summary.pdf)