

# A Study of Problem and Awareness of Mangrove Areas in Mu Ko Chumphon National Park, Thailand

Jidapa Promthep<sup>1</sup>, Nutthakarn Phumkokrux<sup>1\*</sup>, Patiya Pattanasak<sup>1</sup>, and Aphittha Yodying<sup>1</sup>

<sup>1</sup>Department of Geography, Faculty of Education, Ramkhamhaeng University, Bangkok, Thailand.

**Abstract.** This study has 2 objectives: 1) to study environmental problems in all dimensions that occur in the area of Mu Ko Chumphon National Park and 2) to study the participation in protection measures, awareness, and conservation of mangrove forest resources of the people in the area of Mu Ko Chumphon National Park using field survey methods and interviews with 10 government officials and 30 people in the area. The results of the study found that the problem occurring in the mangrove forest area is encroachment on the mangrove forest area. There are in terms of making shrimp ponds, illegal logging, and including the issue of garbage floating along the mangrove trees. The conservation method is the cooperation of all parties. There are activities to plant mangrove forests every year and collect garbage to reduce any threat to the ecosystem. As a result, at present the mangrove forest area in Chumphon Islands National Park is continuously increasing.

## 1 Introduction

MU KO CHUMPHON National Park as illustrated in the Fig. 1 has so many dominant tourist attractions located in Chumphon Province, Thailand where the coast is along with the Gulf of Thailand. This national park riches in various natural resources including a large mangrove forest along the coast near the estuary with a diversity of plants and animals. [1] The mangrove forest is important to the environment and economic development of the country. The utilization in terms of the environment is aquatic animals' nurseries, food resources, and their habitats, Carbon Capture & Sequestration helper, Sea coast erosion prevention, waste filter from the coast section, coastline sedimentation booster [2, 3] and maintenance of balance in coastal and nearby ecosystems especially sea grass and coral. Moreover, this also has advantages in economic and social sections such as fishing, tree component utilization, and being community learning resources and conservation. [4, 5]

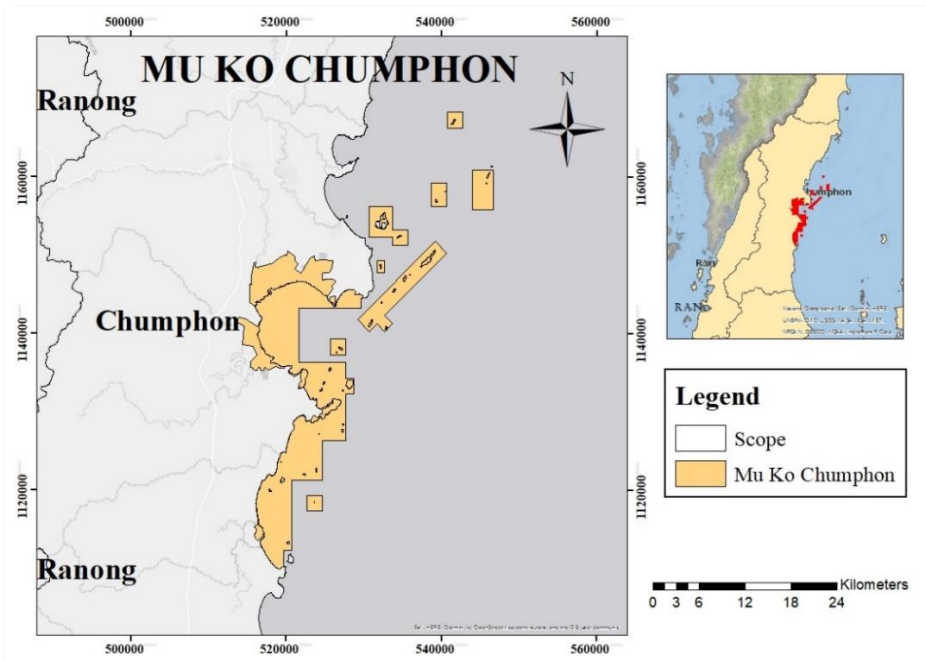
Mangroves tended to decrease and became a big issue caused by deforestation for commercial sectors, an extension of the shrimp pond area, and more population raising and living in the mangrove area [2] including an increase in resort and hotel construction. [6] A change in the Mangrove area also caused estuarine ecosystem issues which could affect to economy and way of life in the area.

---

\* Corresponding author: [ph.nutthakarn@ru.ac.th](mailto:ph.nutthakarn@ru.ac.th)

From the historical record, the Mangrove area in the current area of MU KO CHUMPHON National Park, Thailand was about 81 sq. km. in 1961 then, it decreased rapidly. This was a big problem for the estuarine ecosystem and community thus this area has been raising to be a national park since 1989 to strictly protect, manage, and improve the mangrove then, the name which had given is MU KO CHUMPHON National Park, Thailand since 1999. Moreover, the mangrove area decreased from 31.5 sq. km. in 1996 to 27.8 sq. km. in 2015. [1] Therefore, the awareness of people in the area about the mangrove area decreasing is important to protect the area from now to the future.

All reasons which were mentioned above brought the authors to operate this research with these objectives: 1) to study environmental problems in all dimensions that occur in the area of Mu Ko Chumphon National Park, and 2) to study the participation in protection measures, awareness, and conservation of mangrove forest resources of the people in the area of Mu Ko Chumphon National Park. Moreover, the authors strongly believed that the results can be guidelines to motivate awareness of people and all sectors to conserve, develop, and enhance the mangrove area sustainability in MU KO CHUMPHON National Park, Thailand.



**Fig. 1.** Study area of MU KO CHUMPHON NATIONAL PARK

(Source: Developed from National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., 2021; Developed from Esri, Maxar, Earthstar Geographics, and the GIS User Community, 2022)

## 2 Study Area, Data, and Methods

MU KO CHUMPHON National Park is located on the east side of Chumphon Province of the East-Sothern region of Thailand at latitude about  $10^{\circ} 21' 23''N$  and longitude about  $99^{\circ} 13' 52''E$ . The area was approximately 317 sq. km. covering 5 districts of Chumphon Province: Mueang Chumphon District, Pathio District, Sawi District, Thung Tako District, and Lang Suan District. The area also included 40 islands [7]. However, this research focused

on environmental problems in all dimensions of the mangrove area in MU KO CHUMPHON National Park which had an area of about 27.8 sq. km from the record. [1] The study area is presented in Fig. 1.

All problems in the mangrove area, awareness of people for all risks, and conservation ways in the mangrove area of MU KO CHUMPHON National Park, Thailand were gathered by Semi-structured interview form. The form was tested by of Index of item Objective Congruence: IOC test from 3 specialist experts before use. The form that could be used to extract the results must have IOC values over 0.5 for all questions and be adapted following all suggestions from the experts [8, 9].

The form was used for Interviewing key informants with the In-depth interview method. The interviewers were separated into 2 types: 1) People who make use of this mangrove area (30 people) and 2) Government officers who work in this mangrove area (10 people). Then, all answers were analyzed and reported next.

### **3 Result and Discussion**

#### **3.1 General conditions and tourist highlights of MU KO CHUMPHON National Park.**

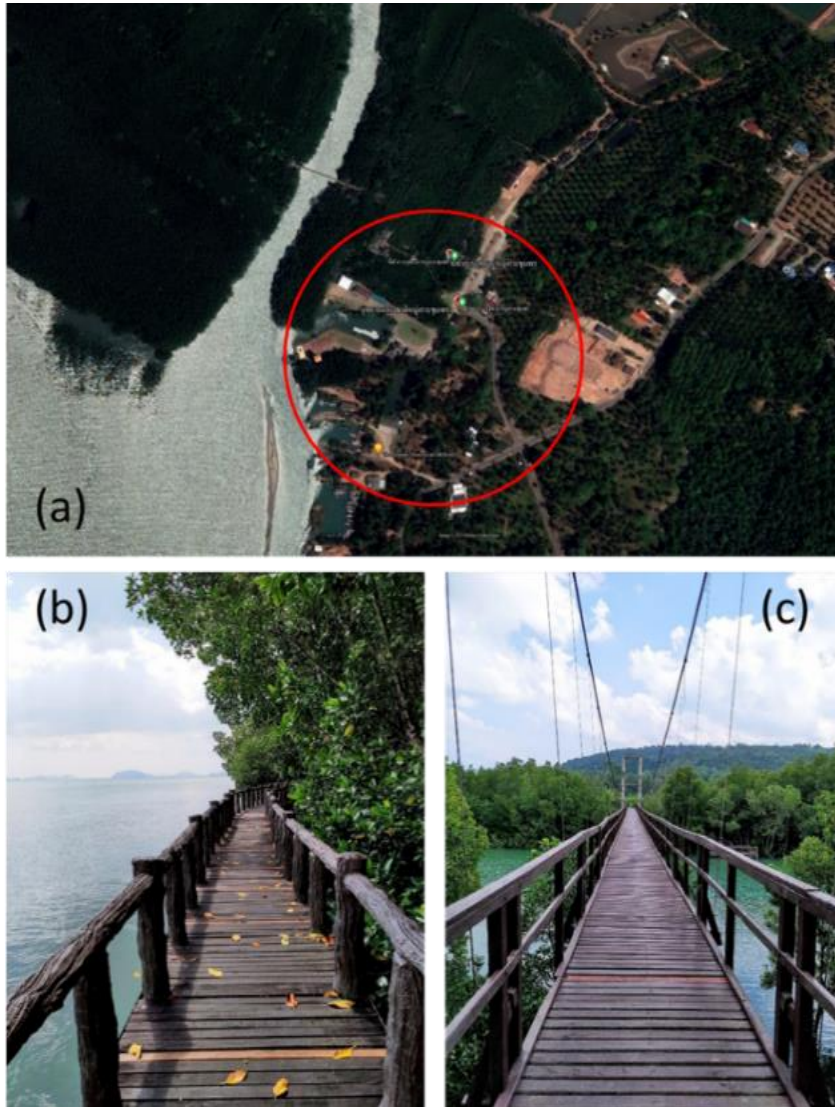
MU KO CHUMPHON National Park is located in a part of the Malay Peninsula in the southern region of Thailand. The area was affected by both southwest and northeast monsoons through the years with high rainfall values of about 2,029.3 mm per year with 173 heavy rain days, leading to high moisture and abundant natural resources in the area. Moreover, there are 5 important natural resources and ecosystems such as coastal and beach ecosystems, coral ecosystems, islands ecosystems, mountain ecosystems, and brackish water ecosystems (including mangrove forests). From these conditions, MU KO CHUMPHON National Park was led to National Park in 1999 to preserve and maintain its natural state, to benefit the education and enjoyment of the people, and to benefit the state and the people [1, 10]

The mangrove area has fine muddy to hard peaty soil rich in organic matter thus plants in the area must be different varying by characteristics of soil and salinity level in the water. There are plants found in the fine muddy and fore tidal area such as Pioneer species, *Avicennia* sp., *Sonneratia* sp., and *Rhizophora* sp. Moreover, there are *Bruguiera* sp., *Ceriop* sp., *Xylocarpus* sp., *Lumnitzera* sp., and *Acanthus* sp. in hard peaty soil and back tidal area. Large and old plants are usually found along with Khlong Chumphon Canal, Khlong Sawi Canal, and Khlong Sawee Thao Canal. [1]

There were tourist highlights such as 1) the tourist service center building, 2) a wooden bridge along the mangrove forest area, and 3) a suspension bridge across a brackish water source in the area to be a nature trail as illustrated in Fig.2. All points have signboards and sound media that provide knowledge about plants, animals and its adaptation to survive in the ecosystem.

#### **3.2 Problems and participation in conservation in the mangrove area.**

Problems and participation in conservation in the mangrove area were extracted by Semi-structured interview form for interviewing key informants with an in-depth interview method. The results were reported into 2 groups below,



**Fig. 2.** Tourist highlights in the mangrove area (a) Tourist Service Center Building, b) Wooden bridge, and c) Suspension bridge

### 3.2.1 Government officers who work in this mangrove area.

The selected government officers were between 30-55 years old with a working time of more than 5 years and were responsible for performing duties according to the orders and policies of the Department of National Parks, Wildlife and Plant Conservation for protecting and planning for conservation of mangrove area in the study area.

The selected officers gave opinions that the mangrove forest should be conserved due to the importance of all life and ecosystems as a habitat for aquatic animals, being a shelter from natural disasters to prevent sea waves and coastal erosion. Moreover, precious natural resources in the area also led to employment and income for people in the community. Therefore, the mangrove forest has many useful in environmental utilization, economic, and social aspects.

Encroachment on mangrove forest areas was the most notable problem which happened in the area. An extension of the shrimp pond was one of the outstanding activities that encroached on the mangrove area due to a lack of law knowledge or fearlessness of the law. Moreover, the encroachment also affected to soil erosion leading to a decrease in nutrients thus all aquatic animals received less food leading to death. These were common problems that many mangrove areas in Thailand and other countries face. [11, 12, 13, 14, 15] However, the selected officers said, “an encroachment problem was continually decreasing due to strict suppression of offenders and giving more conservation knowledge in all ways”.

Furthermore, water and air temperature were also other major problems leading to the degradation of the mangrove ecosystem. This problem brought a reduction of quality mangrove forests leading to more soil erosion then all aquatic animals had no quality home and no food. Therefore, mangrove utilization of people was more difficult and inconvenient. This problem was also commonly found in many mangrove areas all over the world. [16, 17, 18, 19]

Effective ways to protect and conserve mangrove areas was increasing people's awareness of the value of mangrove forests especially to new generation youth. There is a joint youth camp to plant mangrove forests continually which is cooperated by schools, various companies, communities, and officers to increase valuable mangrove areas. This awareness and conservation participation led to an extension of abundant mangrove areas continuously for all life's utilization.

### *3.2.2 People who make use of this mangrove area.*

The selected interviewers were about 30 people separated into men and women at 50% and 50% respectively. The ages of interviewers varied between 17 – 60 years old with various careers and education levels.

The interviewers gave information similar to the officers' group that the major problem was an encroachment on mangrove forest areas such as the illegal cutting of mangrove trees with the wrong methods and an extension of shrimp pond which encroached to the national park area with illegal release of wastewater. Moreover, the interviewers also gave more points that the garbage problem was also a big problem there, especially with plastic and microplastic wastes. The main cause of the problem was the illegal dumping of garbage into the sea leading the garbage waving to the mangrove area while tidal activity then getting stuck at the roots. This problem also reduced the scenery and quality of mangrove forests then affected aquatic animal life and people in the community. Furthermore, plastic problems were one of the serious problems that were increasingly found in many mangrove areas of Thailand and at the international level. [20, 21, 22, 23, 24, 25]

The conservation way was similar to the answer from the officers group, however; the interviewers gave more ways that the garbage collection campaign in the mangrove area must continue operation and promoting knowledge about the conservation and value of mangrove forests must be in the curriculum to learn from family to local sectors.

### **3.3 Conservation guidelines and government policies**

Conservation guidelines were concluded by the author following the answers from 2 groups of interviewers and adapting following the Strategy for managing mangrove resources in Thailand [6] that mangrove forest conservation required Community knowledge development for the mangrove value and encourage cooperation coordinated between sectors. Public relations and continuous coordinated cooperation were causing the development and restoration of mangrove forests as the strategy for managing mangrove forest resources in Thailand.



**Strategic Plan 1: Preventing encroachment and destruction including an increase in mangrove area must be operated by jointly monitoring, restoring, and resolving all problems in mangrove forests to be fertile** [6, 26]. Operational measures following Strategic Plan 1 were: local communities, government, and private sectors needed to cooperate together to prevent encroachment and destruction of the mangrove forests. Moreover, reforestation and restoration activities, and making a living using local wisdom that was beneficial to the community should be encouraged. Furthermore, the complaint center should be built for being a channel to report all concerned problems.

**Strategic Plan 2: Technologies must be used to investigate and utilize the management of mangrove forests for tracking, analyzing, and problem-solving a change in mangrove forests** [6, 26]. Operational measures following Strategic Plan 2 were: 1) Remote sensing technology was used to develop the mangrove forest database and track a change of area and using activities., 2) The mangrove forest database was published for concerned people and sectors to be the support data., and 3) Mangrove resource management action plan needed to develop continuously. Moreover, climate change tracking and simulation by climate models are also important to protect and treat the mangrove area [27].

**Strategic Plan 3: Local wisdom needs to be developed and researched more to utilize, protect, and conserve mangrove forests to get the most benefits with less harming mangrove forests** [6]. Operational measures following Strategic Plan 3 were: 1) Research framework and prioritize research must be operated for mangrove forest development., 2) Participatory Action Research was suggested to use cooperation between local and concerned sectors., and 3) Research network should be established to encourage researching and publishing of mangrove forest protection, conservation, and precious utilization.

**Strategic Plan 4: Encouragement of people, local, educational institutions, and concerned sectors for both government and private sectors needed to be actualized to determine sustainable conservation and resource management guidelines together** [6]. Operational measures following Strategic Plan 4 were: 1) Cooperation between local, education institutes and all sectors needed to be encouraged to pass on local wisdom for rising efficiency in conservation and utilization of mangrove forest resources., and 2) communities, localities, and networks needed to be strengthened to conserve and utilize precious in mangrove forest including awareness and consciousness building to protect the mangrove forest.

**Strategic Plan 5: Developing and expanding the results of mangrove resource management and protection should be continuous practice** [6, 26]. Operational measures following Strategic Plan 5 were: 1) Conservation zones and use of mangrove forests should be determined, and 2) Exchange of knowledge in land use and activities utilization appropriately in mangrove areas should be studied, determined, and encouraged.

**Strategic Plan 6: Legal measures should be reviewed and knowledge regarding mangrove resource laws to local and public** [6]. Operational measures following Strategic Plan 6 were Basic laws related to mangrove resources that needed to be published to local and public in all ways. Moreover, the local and community should get the opportunity to set legal measures which appropriate for the local context together.

## 4 Conclusion

Mangrove forest conservation is the most important to the local and country. Mangrove forests in MU KO CHUMPHON National Park also faced deforestation due to encroachment on forest areas for human occupations and shrimp pond extension without appropriate ways. These problems also led to soil erosion and aqua animal habitat destruction. Moreover,

floating garbage was one of the most dominant problems that interrupted brackish ecosystem activities. However, the local community, government, and private sectors worked hard together to encourage and plan to improve the mangrove forest abundance such as mangrove planting, serious enforcement of the law, and creating awareness in youth and communities following the Strategy for managing mangrove resources in Thailand.

This manuscript was operated under the subject of GEO 4001 Field Techniques in Geography which was a part of the Bachelor of Science Program in Geography, Department of Geography, Faculty of Education, Ramkhamhaeng University, Bangkok, Thailand.

## References

1. Department of National Parks, Wildlife and Plant Conservation. *Mu Ko Chumphon*, (2015) Available at: <https://portal.dnp.go.th/Content/nationalpark?contentId=677>
2. Mangrove Resources Promotion and Development Subdivision. *Mangrove Values*, (2016) Available at: <https://dmcrth.dmcr.go.th/manpro/detail/11683/>
3. D. Akbar, W. E. Yudiatmaja, K. Fadli, Managing mangrove forest in Bintan Island: socio-economic benefits of climate change mitigation and adaptatio. *IOP Conference Series: Earth and Environmental Science* **724**(1), 012103 (2021)
4. K. Jusoff, D. Taha, Managing sustainable mangrove forests in Peninsular Malaysia. *Journal of Sustainable Development*, **1**(1), 88-96 (2008)
5. B.B. Walters, P. Rönnbäck, J.M. Kovacs, B. Crona, S.A. Hussain, R. Badola, J.H. Primavera, E. Barbier, F. Dahdouh-Guebas, Ethnobiology, socio- economics and management of mangrove forests: A review. *Aquatic Botany*, **89**(2), 220-236 (2008)
6. S. R. Biswas, P. L. Biswas, S. H. Limon, E. R. Yan, M. S. Xu, M. S. I. Khan, Plant invasion in mangrove forests worldwide. *Forest Ecology and Management* **429**, 480-492 (2018)
7. Tourism Authority of Thailand. *Muko Chumphon National Park*, (n.d.). Available at: <https://www.tourismthailand.org/Attraction/muko-chumphon-national-park>
8. R. C. Turner, L. Carlson, Indexes of item-objective congruence for multidimensional items. *International journal of testing*, **3**(2), 163-171. (2003).
9. T. Dumrisilp, & C. Tanwarawutthikul, Development and survey of a questionnaire to measure parental perceptions of childhood defecation and constipation. *Pediatrics & Neonatology*. 65(4), 370-374. (2023). <https://doi.org/10.1016/j.pedneo.2023.08.010>
10. Decree: *Determination of the area of land, wetland forest, Ao Thung Kha, Ao Sawi Forest, and various islands in Saphli Subdistrict of Pathio District., Pak Nam Subdistrict, Tha Yang Subdistrict, Hat Sairee Subdistrict, Thung Kha Subdistrict, Wisai Nuea Subdistrict of Mueang Chumphon District, Wisai Tai Subdistrict, Dan Chawi Subdistrict, Tha Hin Subdistrict, Sawi District, Pak Tako Subdistrict of Thung Tako District and Bang Chuet Subdistrict of Lang Suan District in Chumphon Province to be national parks in 1999. Government Gazette*, **116**(74 A.), 1–23 (1999) Available at: <https://www.ratchakitcha.soc.go.th/DATA/PDF/2542/A/009/41.PDF>
11. A.F. Rahman, D. Dragoni, K. Didan, A. Barreto-Munoz, J.A. Hutabarat, Detecting large scale conversion of mangroves to aquaculture with change point and mixed-pixel analyses of high-fidelity MODIS data. *Remote Sensing of Environment*, **130**, 96-107 (2013)
12. E.L. Webb, N.R. Jachowski, J. Phelps, D.A. Friess, M.M. Than, A.D. Ziegler, Deforestation in the Ayeyarwady Delta and the conservation implications of an internationally-engaged Myanmar. *Global Environmental Change*, **24**, 321-333 (2014)

13. J.J. Kelleway, K. Cavanaugh, K. Rogers, I.C. Feller, E. Ens, C. Doughty, N. Saintilan, Review of the ecosystem service implications of mangrove encroachment into salt marshes. *Global Change Biology*, **23**(10), 3967-3983 (2017)
14. A. Estrada, P.A. Garber, R.A. Mittermeier, S. Wich, S. Gouveia, R. Dobrovolski, K.A.I. Nekaris, V. Nijman, A.B. Rylands, F. Maisels, E.A. Williamson, J.B. Marques, A. Fuentes, L. Jerusalinsky, S. Johnson, F.R. de Melo, L. Oliveira, C. Schwitzer, C. Roos, S.M. Cheyne, M.C.M. Kierulff, B. Raharivololona, M. Talebi, J. Ratsimbazafy, J. Supriatna, R. Boonratana, M. Wedana, A. Setiawan, Primates in peril: the significance of Brazil, Madagascar, Indonesia and the Democratic Republic of the Congo for global primate conservation. *PeerJ*, **6**(4869), (2018)
15. S.E. Hamilton, A. Presotto, A.J. Lembo Jr, Establishing the relationship between non-human primates and mangrove forests at the global, national, and local scales. *Plos one*, **17**(11), e0277440 (2022)
16. Q. Zhang, C.Y. Xu, S. Becker, Z.X. Zhang, Y.D. Chen, M. Coulibaly, Trends and abrupt changes of precipitation maxima in the Pearl River basin, China. *Atmospheric Science Letters*, **10**, 132–144 (2009)
17. S.M. Vicente-Serrano, C. Azorin-Molina, A. Sanchez-Lorenzo, J. Revuelto, E. Moran-Tejeda, J.I. LopezMoreno, et al., Sensitivity of reference evapotranspiration to changes in meteorological parameters in Spain (1961–2011). *Water Resource Research*, **50**, 8458–8480 (2014)
18. S. Thakur, D. Maity, I. Mondal, G. Basumatary, P.B Ghosh, P. Das, T.K. De, Assessment of changes in land use, land cover, and land surface temperature in the mangrove forest of Sundarbans, northeast coast of India. *Environment, Development and Sustainability*, **23**, 1917-1943 (2021)
19. S. Samanta, S. Hazra, P.P. Mondal, A. Chanda, S. Giri, J.R. French, R.J. Nicholls, Assessment and attribution of mangrove Forest changes in the Indian Sundarbans from 2000 to 2020. *Remote Sensing*, **13**(24), 4957. (2021).
20. M.R. Cordova, Y.I. Ulumuddin, T. Purbonegoro, A. Shiomoto, Characterization of microplastics in mangrove sediment of Muara Angke Wildlife Reserve, Indonesia. *Marine Pollution Bulletin* **163**, 112012 (2021)  
<https://doi.org/10.1016/j.marpolbul.2021.112012>
21. P. Chaisanguansuk, S. Phantuwongraj, A. Jirapinyakul, T. Assawincharoenkij, Preliminary study on microplastic abundance in mangrove sediment cores at Mae Klong River, upper Gulf of Thailand. *Frontiers in Environmental Science* **11**, 1134988 (2023)
22. T. Jiwarungrueangkul, J. Phaksopa, P. Sompongchaiyakul, D. Tipmanee, Seasonal microplastic variations in estuarine sediments from urban canal on the west coast of Thailand: A case study in Phuket province. *Marine Pollution Bulletin*, **168**, 112452 (2021)
23. N.A. Mazelan, F.M. Yusuff, Community Awareness on Domestic Waste Disposal Towards Its Impact to the Sustainability of Mangrove Forest in Kuala Selangor, *IOP Conference Series: Earth and Environmental Science*, IOP Publishing, **934**(1), 012050 (2021) DOI 10.1088/1755-1315/934/1/012050
24. H. Moniuszko, W.A.M. Malonga, P. Koczoń, S. Thijs, R. Popek, A. Przybysz, Accumulation of plastics and trace elements in the mangrove forests of Bima City Bay, Indonesia. *Plants*, **12**(3), 462 (2023) <https://doi.org/10.3390/plants12030462>
25. S. Pradit, P. Noppradit, P.S. Loh, T. Nitiratsuan, T.P.Q. Le, C. Oeurng, C.A.R. Mohamed, C.W. Lee, X. Lu, G.Z. Anshari, S. Kandasamy, J. Wang, The occurrence of microplastics in sediment cores from two mangrove areas in Southern Thailand,



*Journal of Marine Science and Engineering*, **10**(3), 418 (2022)

<https://doi.org/10.3390/jmse10030418>

26. S. Phumkokrux, N. Phumkokrux, K. Kiriwongwattana, S. O-In, A. Abdulkade, P. Muenratch, Development of Geographic Information System and Database Program for Supporting the Application of Payment for Ecosystem Services Mechanisms Occurs in the Local Area of Thailand. *Journal of Advances in Information Technology Vol, 10*(3). (2019)
27. N. Phumkokrux, P. Trivej, Investigation of Temperature, Precipitation, Evapotranspiration, and New Thornthwaite Climate Classification in Thailand. *Atmosphere, 15*(3), 379. (2024).