9. THAILAND

Summary of research topics: *Research on marine plastics in Thailand does not appear to be a main research thrust of any marine laboratory currently. Seven of the eight studies found for this report were conducted since 2016. They focus primarily on survey and monitoring to understand pollution status and on ecological and environmental impact, followed by socio-economic impact.*

Summary of understanding at national level: *Published articles and reports on pollution from marine plastics may not reflect the understanding of the issue at national level due to unpublished work (in English) by the Department of Marine and Coastal Resources (DMCR), under the Ministry of Natural Resources and Environment, including by international coastal cleanups since 2009. Published articles highlight negative impacts of marine plastic debris on several marine taxa groups and all habitats sampled. However, varied methodologies and technologies have been used in monitoring marine litter that only allow a limited understanding of issues. Furthermore, studies of seabed sediments and surface waters are missing, as well as of source differentiation.*

Keywords/research fields: *National approach; solid waste; trade of plastic waste; research foci; marine environs; surveys and monitoring; source differentiation; contribution from fisheries; ALDFG; accumulation zones; hotspots; ecological and environmental impact; socio-economic impact; main players*

9.1 Context

9.1.1 National approach to plastic waste and its management

In 2017, the Thai government made a commitment to reducing plastic use and included waste management in its 20-year national strategy. Two programmes were established: a five-year programme, National Waste Management Master Plan for 2016–2021, and a four-year Plastic Debris Management Plan for 2017–2021. Thailand also partners with the IUCN, which has several projects aimed at helping achieve integrated coastal and marine resources management, such as the 'Tackling Marine Plastics in Thailand: from community-based actions to policies' project, which had a case study in the Koh Yao Yai sub-district.

As the ASEAN Chair in 2019, Thailand placed a particular emphasis on pollution from marine plastics, and helped to advance the issue within ASEAN. Its initiatives included the launch of the Bangkok Declaration on Combating Marine Debris in ASEAN Region at the 34th ASEAN summit in June 2019, which was adopted by the ASEAN Leaders. A Framework of Action on Marine Debris was subsequently adopted. See Part 1, Section 4.2.2.1 and https://asean.org/storage/2019/06/2.-Bangkok-Declaration-on-Combating-Marine-Debris-in-ASEAN-Region-FINAL.pdf.

In January 2020, Thailand placed a ban on single-use plastic bags at major stores, continuing a campaign launched by the government and retailers towards a complete country-wide ban in 2021. In

response to this ban, some Thais have interestingly taken out-of-the-box approaches in place of using plastic bags when shopping. They have used vases, suitcases, hampers and even wheelbarrows, apart from the conventional tote or recyclable bags, in place of single-use plastic bags (NBC News, 2019: available https://www.nbcnews.com/pop-culture/pop-culture-news/after-plastic-bag-ban-thai-shoppers-use-wheelbarrows-hampers-tote-n1111151).

9.1.2 Plastics as a proportion of solid waste

In 2016, the MSW for Thailand was estimated at 27.3 million tonnes, with a projection of reaching 32.5 million tonnes in 2030 and 37.3 million tonnes in 2050 (Kaza et al., 2018). Of the waste generated in 2016, 4.2 million tonnes would have been generated in Bangkok.

Thais are assessed to be using 70 billion plastic bags annually. Based on Jambeck et al. (2015) estimates, Thailand produced 1.03 million tonnes of mismanaged plastic waste in 2010, with approximately 0.15-0.41 million tonnes of plastics that may be entering the marine environment annually. In 2016, the total amount of mismanaged solid waste from coastal provinces was approximately 2.83 million tonnes, of which 12% was plastic. An estimated 15% of plastic waste (ca. 51,000 tonnes) is estimated to be mismanaged and pass through the Thai waters into the oceans each year.

9.1.3 Illegal trade of plastic waste

According to Greenpeace (2019), Thailand's plastic waste imports rose from 69,500 tonnes in 2016 to 481,000 tonnes by 2018, with top exporters being the US and Japan. In response to this, Thailand adopted a temporary three-month prohibition on importing plastic waste, and is seeking to ban these imports by 2021 (Telegraph UK, 2018: available https://www.telegraph.co.uk/news/2018/10/15/thailand-ban-foreign-plastic-waste-2021-south-east-asia-buckles/).

9.2 Research review of pollution from marine plastic

9.2.1 Research overview

Research on marine plastics in Thailand is in progress. The nine studies found were conducted in different decades: one in 2009 and seven between 2016–2020. They geographically cover much of the country's coastline and one offshore island (Koh Tao). A majority focused on survey and monitoring to understand pollution status and on ecological and environmental impact and socio-economic impact.

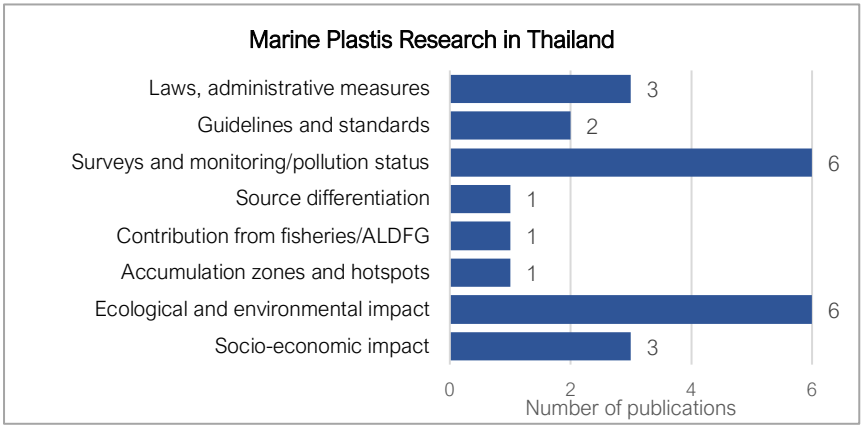

Figure 1.2.9.1. Research foci of marine plastic research conducted in Thailand.

Table 1.2.9.2. List of published work identified and examined in this study for Thailand.

Published Peer-Reviewed Work/Research Team	Aim of Research	Period of Study
Marks et al. (2020) Uni of Hong Kong (China), National Uni of Singapore, Chualongkorn Uni	Assess the challenges to addressing marine plastic pollution in Thailand	N.A.
Wichai-utcha and Chavalparit (2019) Chulalongkorn Uni	Review of 3Rs policy, plastic waste management and its governing laws (i.e. Plastic Debris Management Plan 2017-2021) in Thailand	N.A.
Azad et al. (2018) Prince of Songkla Uni; Vietnam National Uni (Vietnam)	Quantify plastic debris (micro-, meso, macro-) in stomach of economically important fish in the lower Gulf of Thailand	Jan-Apr 2015
Ballesteros et al. (2018) Naturalis Biodiversity Center (Netherlands); Big Blue Dive Resort; Leiden Uni (Netherlands)	Understanding ALDFG (nets, ropes, cages, lines) impacts on six stony coral growth forms; Inventorise ALDFG on reefs	Feb 8-May 2, 2011
Kungskulniti et al. (2018) Mahidol Uni; Center of Excellence on Envtal Health and Toxicology; Tobacco Control Research and Knowledge Management Center; Insight Analysis Group (USA)	Investigate the level of tobacco product waste (TPW) on Thailand's public beaches, and discuss actions to be undertaken to mitigate problem	N.A.
Thushari et al. (2017b) Uva Wellassa Uni (Sri Lanka); Asian Institute of Technology; Chulalongkorn Uni	Quantify abundance and types of coastal debris along 3 beaches in eastern coast of Thailand	mid-Feb-mid-May, mid-May - mid-Oct 2015
Thushari et al. (2017a) Uva Wellassa Uni (Sri Lanka); Asian Institute of Technology; Chulalongkorn Uni	Determine microplastic contamination in three abundant sessile and intertidal invertebrates along 3 beaches of eastern Thailand	Mar-May 2015
Tharamon et al. (2016) Burapha Uni Chanthaburi Campus; Dept of Marine and Coastal Resources Bangkok	Determine microplastic contamination in two species of bivalves at two beaches in Chanthaburi province	Aug-Sep 2014
Thanida et al. (2009) Chulalongkorn Uni; Ministry of Natural Resources & Envt	Quantifying plastic debris present in stomach necropsy of whale shark (*Rhincodon typus*)	Oct 17, 2005

Despite a clear awareness of marine plastic pollution by the scientific community, this topic does not appear to be a main research thrust of any marine laboratory currently. With support from IOC-WESTPAC, Thailand hosted the first regional workshop on microplastic research and monitoring, in Phuket in 2017. (For more details see Part 1, Section 4.8.)

9.2.2 Types of research conducted

Types of plastics research foci

Research in micro- and macro- plastics is roughly equivalent and not very detailed. Studies examining microplastics focused on presence/absence in marine organisms, especially sessile organisms and fish (Tharamon et al., 2016; Thushari et al., 2017a; Azad et al., 2018) and on beaches (Thushari et al., 2017b; Kungskulniti et al., 2018). Studies of macroplastics focused on items found on beaches, in a whale shark (Thanida et al., 2009) and on abandoned fishing gear (Ballesteros et al., 2018).

No peer-reviewed study was found on organic or inorganic contaminants associated with marine plastics.

Coverage of marine environs

Of the nine studies examined, the most commonly studied environ is marine organisms, such as invertebrates (Tharamon et al., 2016; Thushari et al., 2017a; Azad et al., 2018), a whale shark (*Rhincodon typus*) (Thanida et al., 2009), and coral reefs (Ballesteros et al., 2018). The other studies examined the presence/absence of marine plastics on beaches (Thushari et al., 2017b; Kungskulniti et al., 2018).

There is no published study on marine plastics on or in the seafloor and water column.

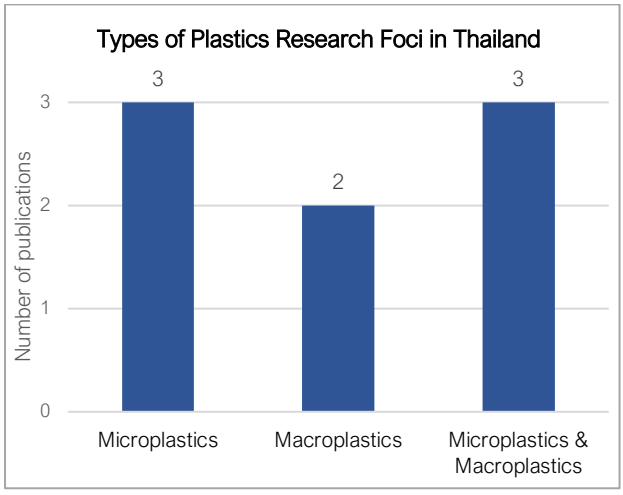

Figure 1.2.9.3. Distribution of marine micro-/macro-plastics researched in Thailand.

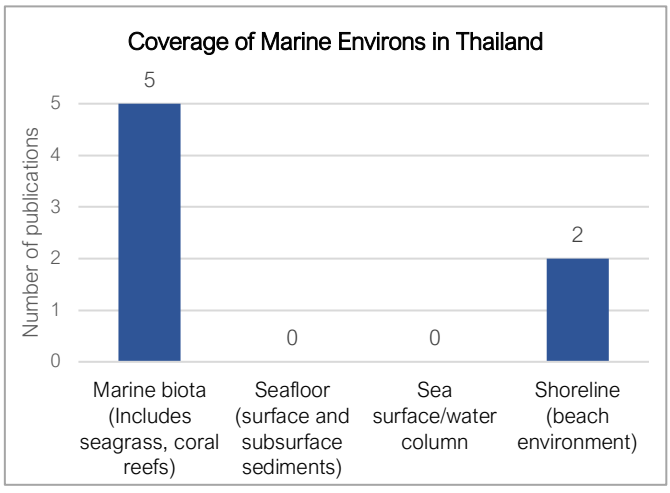

Figure 1.2.9.4. Distribution of marine environs researched in Thailand.

Two studies were not categorised for the purpose of this report as they are reviews on plastic waste management in Thailand (Marks et al., 2020; Wichai-utcha and Chavalparit, 2019).

9.2.3 Survey and monitoring

Most studies have attempted to quantify the status of marine plastics in the marine environment. Several studies examined the distribution and abundance of macroplastics in marine environs such as the shoreline (Thushari et al., 2017a; Kungskulniti et al., 2018), coral reefs (Ballesteros et al., 2018) and the stomach of a whale shark (Thanida et al., 2009). These studies identified macroplastic plastic debris in the following categories: cigarette butts, general plastic, EPS (styrofoam), glass, metal, paper,

rubber, wood, cloth, fishing gear, etc. However, none of them noted the types of plastic polymer. Generally, these studies quantified the abundance of plastics based on counts (i.e. number of cigarette butts, number of debris per transect area, number of derelict gear) and weight per area (i.e. wet weight of debris per transect area, volume of debris per transect area).

All of the microplastic-focused studies have investigated the presence/absence and abundance of microplastics in marine biota (Thushari et al., 2017b), especially commercially-important species (Azad et al., 2018; Tharamon et al., 2016). These studies quantified the abundance of plastics based on counts (i.e. number of fish with microplastics, number of plastic debris per stomach of fishes, number of plastic debris per gram of fish stomach, number of microplastics per individual). Studies of microplastics all adhered to the definition of size <5 mm, and the shapes of microplastics were noted (such as fibre, fragment, film, rod, etc.). However, only 1 of 3 microplastic-focused articles have identified the types of plastic polymers including PS, PET, PA.

Though the data has not been formally published, the Department of Marine and Coastal Resources (DMCR) under the Ministry of Natural Resources and Environment has been leading clean-ups under International Coastal Clean-up Thailand between 2009 and 2015. Plastic disposables were their top marine debris. DMCR has since expanded its work to sampling and quantifying microplastics. This information is not accessible in the English language, but it might be in Thai.

Several independent groups, all led by volunteers, have also been conducting underwater clean-ups in Thailand. These groups mainly comprise recreational divers who collect data and upload them to the global database of Project AWARE's Dive Against Debris.

9.2.4 Source differentiation and pathways

There is no published peer-reviewed study on source differentiation and pathways of marine plastics.

9.2.5 Movement of plastics, accumulation and hotspots

There is no published peer-reviewed study on marine transport accumulation and hotspots of marine plastics.

9.2.6 Ecological and environmental impacts

Studies on the impact of marine plastics on marine organisms are varied. Thanida et al. (2009) reported a case where a single plastic straw was found in the stomach of a whale shark, while subsequent studies reported the presence/absence of microplastics in sessile marine invertebrates (Tharamon et al., 2016; Thushari et al., 2017b). The latter studies indicated that filter-feeding organisms showed comparatively higher accumulation rates of microplastics. This implies that contaminated invertebrates would be ingested by seafood consumers.

One study on ALDFG around Koh Tao found that lost fishing gear caused tissue loss and fragmentation in coral reefs (Ballesteros et al., 2018; see Section 9.2.6).

9.2.7 ALDFG

Ballesteros et al. (2018), a team of researchers from The Netherlands, conducted a reef survey to understand the impact of lost fishing gear (e.g. nets, ropes, cages, lines) on six stony coral growth forms. They inventorised types of fishing gear lost on these reefs to identify and quantify damage caused to corals and concluded that abandoned fishing gear is a major component of marine litter on coral reefs around Koh Tao. They also considered that these ALDFGs affect coral reefs.

9.2.8 Social perceptions and socio-economic impacts

In 2019, a study led by researchers at the Chulalongkorn University reviewed the current status of Thailand's 3Rs policy and plastic waste management, discussed the approaches of Thailand's Plastic Debris Management Plan 2017–2021 and reviewed measures aimed to create more effective plastic waste management strategies (Wichai-utcha and Chavalparit, 2019). In a new 2020 study, Marks et al. also explored challenges met in addressing marine litter pollution in Thailand through particular consideration of the importance of a multi-sectoral and stakeholder engagement in this context.

On another topic, a study highlighted the potential socio-economic impacts of tobacco cigarette pollution on both tourism and human health in Thailand (Kungskulniti et al. 2018). The accumulation of tobacco cigarettes as beach litter is seen to potentially affect visitorship at popular tourist beaches. Additionally, when strewn tobacco cigarettes are leaked and carried into marine environs, they are also expected to fragment into microplastics and release harmful toxic substances.

9.3 Main players in marine plastic research

Although marine plastics research is limited in Thailand, the studies assessed were conducted and led by a varied group of researchers, both local (i.e. First Chulalongkorn University, with four publications, followed by Burapha University Chanthaburi Campus, Prince of Songkla University, Mahidol University) and international (e.g. Uva Wellassa University – Sri Lanka; Vietnam National University – Vietnam; Insight Analysis Group – Corte Maderal, USA; and University of Hong Kong –HK SAR, China).

The Department of Coastal and Marine Resources (DCMR) also plays an active role in leading marine plastics research across Thailand.

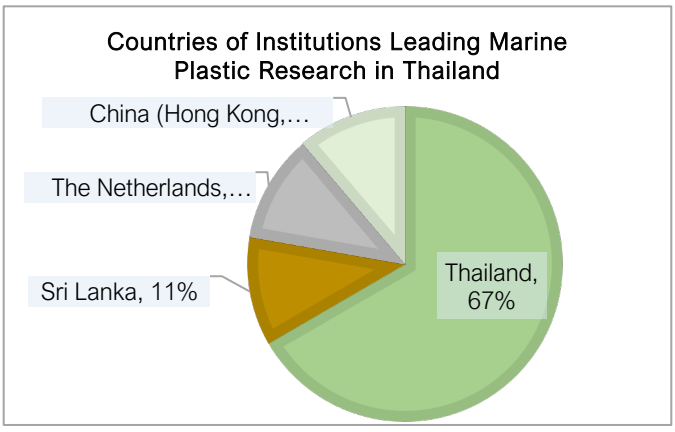

Figure 1.2.9.5. Composition of research efforts in Thailand.

9.4 Summary of understanding

There is a growing awareness of proven and potential issues resulting from pollution from marine plastics in Thailand, among the scientific community and beyond. Existing studies covered common research aspects of marine plastic pollution, such as ecological and environmental impact, and surveys and monitoring. However, there appears to be a lack of understanding of sources and pathways of marine plastics into the marine environment.

Two out of four environs were investigated, of which, the dominant group is marine biota. This suggests that data is lacking to understand pollution from marine plastics in surface waters, the water column and the seabed.

Seven studies sought to quantify the presence and abundance of marine plastic debris. Across the studies, varied approaches and methodologies have been used in monitoring marine litter in Thailand, despite most studies being conducted in marine biota. The types of marine biota were also varied, and the studies used different measures for quantification, making it difficult for direct comparisons. The articles on ecological and environmental impact showed a particular interest in the ingestion of microplastics by marine life, including the endangered migratory whale shark, as well as the entanglement of corals by plastics in the wild, specifically by ALDFG. There are no studies on the physical impacts of marine plastics on endangered migratory species (i.e. dolphins, whales, sea turtles). No investigation on plastic transfer through the food chain has been found so far.

While most of the studies on microplastics were able to categorise samples into various forms including those of fibres, fragments, rods, films, only one study sought to identify plastic polymer types. No research has been found on differences in degradation of different polymer-types in the marine environment or on marine plastics as a pathway for pollution by other organic or inorganic contaminants (e.g. POPs and heavy metals).

Additional work is needed to understand leakage and movement, accumulation and hotspots of marine plastics.