

## Editorial

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# Seagrass research in Southeast Asia

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Southeast Asia is a biologically diverse region with a high diversity of marine species globally (Groombridge and Jenkins 2002, Spalding et al. 2003, Kulbicki et al. 2013, Huang et al. 2015). Bordered by the Bay of Bengal to the west, the Indian Ocean to the South, and the Pacific Ocean to the east, this region has approximately 117,763 km of coastline (Fortes et al. 2018), and two of the largest archipelagic nations (Indonesia and the Philippines) in the world. The region is also undergoing rapid economic development and coastal change, with many marine ecosystems being threatened by anthropogenic activities and, by extension, environmental change (Wilkinson and Salvat 2012).

The coastal and maritime nature of the region translates into a close relationship between the sea and marine resources, with the cultures, communities, and economies of this region (Hung et al. 2013). Traditional seafaring coastal communities are the norm and access to both nearshore and offshore fishing grounds support both commercial and subsistence industries (Bailey and Pomeroy 2008). Seagrass habitats play an important role in the biological, socio-cultural and economic landscape in Southeast Asia (Unsworth and Cullen 2010), but suffer disproportionately in terms of conservation priority. More attention is placed on charismatic habitats such as coral reefs, and fauna, such as the very dugongs and turtles that rely on seagrass habitats. Seagrasses are declining at an unprecedented rate globally (Orth et al. 2006), but information on the loss of seagrass habitats in Southeast Asia is limited, although there is growing evidence of widespread decline and loss throughout the region (Yaakub et al. 2014, Unsworth et al. 2018). Accurate and reliable estimates of seagrass cover and extent in this region are hampered by the paucity of long term monitoring data and freely available information (Waycott et al. 2009). Much of the early research on seagrass in Southeast Asia was concentrated in Indonesia and the Philippines, but the publications and study sites in these early papers are clustered around Northwest Luzon in the Philippines and South Sulawesi in Indonesia (Ooi et al. 2011).

Despite the lack of publications from the Southeast Asian region, it was apparent during the last International

Seagrass Biology Workshop (ISBW) in Wales in 2016, that there is active seagrass research being carried out in small pockets in Southeast Asia. What was deemed lacking was a platform for seagrass scientists in the region to connect and share their work and information. Another common thread from researchers from the Southeast Asian region was that the research is often too small in scale and possibly too localised to be of interest to scientific journals and that this is further hindered by issues arising from fluency in English. This special issue presents an opportunity to bring together the research being carried out across the Southeast Asian region. Ten original research manuscripts and one review have been compiled for this special issue to highlight the trends in research themes, from across the region.

Knowledge on seagrass is increasing across Southeast Asia, with a variety of research themes emerging resulting from access to technology and resources, but is hampered by lack of coordination and collaboration within the region (Fortes et al. 2018). The review by Fortes et al. (2018) highlights locations within the Southeast Asian region where information and research on seagrass resources remain limited, such as in the Andaman and Nicobar Islands, Cambodia, Myanmar, Timor Leste, and Viet Nam. Within this special issue, information on aspects of seagrass community ecology (Phan et al. 2018), fisheries (Jones et al. 2018), and biogeography (Savurirajan et al. 2018), are emerging from some of these data-deficient areas. Remote sensing and the availability of quality license-free satellite imagery has created an opportunity not only for plugging the knowledge gaps in the distribution, location, and extent of seagrass habitats in Southeast Asia, but in monitoring meadow-scale changes and dynamics of seagrass beds (Bramante et al. 2018).

Environmental factors are key drivers which determine where and how seagrass meadows form and how they are maintained. For example, seagrass habitats in Southeast Asia lie mostly in shallow, semi-enclosed coastal systems and large estuaries, where tidal fluctuations bring about considerable daily and seasonal variations in key drivers like light availability and salinity. Here we see that fluctuations in physicochemical parameters such as irradiance (Phandee and Buapet 2018) and salinity (Kongrueang et al. 2018) can affect seagrasses at

the physiological level as well as whole plant communities at the broad scale (Phan et al. 2018). Environmental and historical drivers also play an important role in determining how seagrass populations form, and are maintained. There is evidence that complex geological processes have contributed to the genetic structure observed in the Sunda Shelf and Banda Sea (Wainwright et al. 2018). This study contributes to the growing body of knowledge on seagrass population genetics in Southeast Asia (Nakajima et al. 2014, Arriegado et al. 2015, Hernawan et al. 2017).

Seagrass meadows are a habitat and nursery grounds for myriad flora and fauna, supporting complex food webs, and are a primary source of income and nutrition for coastal communities and artisanal economies. The trophic interactions found in tropical seagrass meadows are poorly understood, despite being an important aspect of seagrass meadow maintenance, and the work of Fong et al. (2018) documents the diversity of gastropod grazers in seagrass meadows, as well as important trophic pathways between seagrasses, their associated epiphytes and the gastropod grazers that feed on them. The overexploitation of seagrass fauna could have important consequences for seagrass meadows and the communities that rely on them for food provisioning services. This is especially important in data deficient areas such as Myanmar, where a depauperate diversity of motile fauna could be heralding larger complications for marine ecosystems in the region (Jones et al. 2018). Such case studies further highlight the importance of rapid attention and conservation action that is required to stem the continued decline of seagrass meadows in the region.

Seagrass restoration is necessary to stem seagrass decline and to return seagrass meadows to a healthy state and is able to provide critical ecosystem services (Orth et al. 2006, van Katwijk et al. 2016). While seagrass restoration is not new in Southeast Asia, there has been varying degrees of success in the survival of transplants in the tropics (Paling et al. 2009). Asriani et al. (2018) in this special issue report on a novel approach of transplanting mixed-seagrass species combinations and found that transplantation increased with species richness. This could inform future seagrass restoration efforts in the Southeast Asian region, as most meadows are multi-specific.

Widespread anthropogenic threats to seagrass habitats and the rapid rate of coastal change in the region call for quick and decisive action on seagrass conservation. This may not always be feasible when there is a paucity of information on the seagrass meadows. Tan et al. (2018) propose a simple method for prioritising sites

for conservation based on a combination of two well-defined indexes: ecosystem service assessments and habitat vulnerability analyses. The proposed method can be carried out with basic information and can incorporate expert opinions of site managers, and can be used as a decision support tool to support conservation and management action.

Conservation of seagrass meadows will ultimately rely on the ability of scientists and managers to work together across the region to effect a change in the attitudes of people towards seagrass habitats, and the review paper in this special issue provides a roadmap for seagrass conservation in the region (Fortes et al. 2018). The proposed roadmap hinges on increasing public awareness and involvement, the collaboration and knowledge sharing of seagrass practitioners across the region, and a deeper understanding of the socio-cultural-economic landscapes of communities which are reliant on seagrass meadows. The research presented in this Special Issue on Seagrass Research in Southeast Asia is hopefully just the tip of the iceberg in terms of the potential for seagrass science in the region. It also represents a small step towards the action needed in order to address the pressing issues facing seagrass meadows in Southeast Asia.

*“These considerations should lead us to look upon all the works of nature, animate or inanimate, as invested with a certain sanctity, to be used by us but not abused, and never to be recklessly destroyed or defaced.” (Alfred Russell Wallace)*

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