

# Heatwaves and Coastal Vulnerability in Southeast Asia

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## Abbreviation:

MHW: marine heatwave

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In a recent article in this journal, the authors made recommendations for understanding and mitigating the fatal combined effects of heatwaves and air pollution in South Asia, among which the region's land is vulnerable in 2050 and is predicted to have double hazards.<sup>1</sup> From a global perspective, the World Meteorological Organization (Geneva, Switzerland) reports that the years 2023–2027 will 98% have 1.1°C (33.98°F) and 1.8°C (35.24°F) higher temperature, with 2024 as the immediate year affected by El Niño.<sup>2</sup> What this means for Southeast Asian countries surrounded by waters or long maritime borders is different, which has graver synergistic effects on health more from heatwaves and coastal vulnerability.

The Southeast Asian region's coastlines are particularly vulnerable to ocean warming brought on by climate change. The main drivers of this growing pressure are coastal industry, expanding urbanization, and population growth.<sup>3</sup> Given that human activity has been the primary cause of environmental degradation, socioeconomic growth and climate change are intricately linked.<sup>4</sup> May–June 2023 hit consecutive new high records of unprecedented rising global sea surface temperatures with an average of 0.2°C, which must not be under-estimated as this is already a huge amount of heat energy capable of impacts such as coral reef bleaching and cyclone intensification.<sup>5</sup> Last 2021, Super Typhoon Rai incurred US\$794 million worth of damage to coastal areas in the Philippines,<sup>6</sup> devastating lives with loss and trauma.<sup>7</sup> Moreover, in a catastrophic climate scenario, the increasing sea levels in Vietnam will have an impact on 90% of the population. In addition, when sea levels rise, there is a chance that maritime borders could change, which would affect people's access to marine resources and their right to navigate.<sup>8</sup> Combined with heatwaves, workers at Tuong Duong in Vietnam experiencing 44.2°C (111.6°F) risk heatstrokes<sup>9</sup> for a living. Nearby Southeast Asian countries had a similar experience: Luang Prabang in Laos also hit a historic high of 43.5°C (110.3°F), Ponhea Kraek in Cambodia had 41.6°C (106.9°F), and Ang Mo Kio in Singapore had 37°C (98.6°F),<sup>10</sup> but Thailand had 45.4°C (114°F).<sup>11</sup>

Heatwaves pose serious impacts on public health like morbidity and mortality.<sup>12</sup> Marine heatwaves (MHWs) increase the extinction of some heat-sensitive species, harming the environment's biodiversity and the natural coastal defenses against tropical cyclones.<sup>13</sup> It can be noted, however, that because the Indochina Peninsula and the Maritime Continent have differing patterns of land-sea distribution, the changes are not uniform in space. But it is generally agreed that in a warmer world, heatwaves would occur more frequently, last longer, and reach higher extreme temperatures throughout the entirety of Southeast Asia. These modifications imply that in a warmer future, a rare heatwave, such as the one that happens once every 50 years in the current climate, will become wide-spread and occur more regularly.<sup>14</sup> The expected significant increase in heatwave days per year is first observed over Indonesia, Malaysia, and parts of the Philippines.<sup>14</sup>

As MHWs potentially have negative effects not just on marine ecosystems but on coastal populations' health and ability to support their own lives, the development of adaptive management solutions might be influenced by the identification of hotspots and the contribution of El Niño Southern Oscillation (ENSO) to the emergence of MHWs.<sup>15</sup> Aside from the recommendations of the target article, on coastal vulnerability, there should be increased considerations of integrated systems thinking in resilience planning by assessing through the Climate and Ocean Risk Vulnerability Index (CORVI) and utilizing the structured expert judgment (SEJ) for gathering information and calculating risk in data-poor contexts.<sup>16</sup> Ultimately, the United Nations Educational, Scientific, and Cultural Organization (UNESCO; Paris, France) and United Nations Framework Convention on



Climate Change (UNFCCC) highlight the role of education to promote climate action, parts of which are to be emphasized further in the COP28 2023 United Nations Climate Change Conference in Dubai, United Arab Emirates (UAE), but here to be taken as educational opportunities handled by universities<sup>17</sup> and also museums.<sup>18</sup>

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