The number and changing global distribution of seagrass-proximate people

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Abstract
Seagrass meadows are increasingly recognised as critical natural capital, yet global seagrass conservation still lacks a basic human geography. Building on examples from forests, here, we provide the first global estimate of seagrass-proximate people, defined as people living within specified distances of known seagrass. We combined a global distribution layer of known, mapped and observed seagrass with multitemporal 1 km GHS-POP population grids to estimate populations within 1 km, 5 km and 10 km of known seagrass from 1975 to 2020, with projections to 2030. In 2020, at least 53.4 million people lived within 1 km of known seagrass, 194.8 million within 5 km, and 352.9 million within 10 km. The number living within 5 km almost doubled between 1975 and 2020, increasing by 94.2 million people, and is projected to reach 214.4 million by 2030. More than 62% of seagrass-proximate people lived in tropical bioregions, where seagrass biodiversity and ecosystem-service importance are high. Country-level patterns revealed two policy geographies, large absolute populations near seagrass in countries such as the Philippines, United States, Italy, Indonesia and Spain, and nationally pervasive seagrass proximity in many Small Island Developing States. Our estimates are conservative because global seagrass mapping remains incomplete. Proximity is not dependence, but it identifies where human wellbeing, coastal development and seagrass conservation are most likely to intersect. These results establish a spatial baseline for integrating people, ecosystem services and justice into global seagrass conservation and policy.

Keywords: human geography; coastal development; population growth; ocean sustainability; coastal expansion; urbanisation

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Introduction

Seagrass meadows are social-ecological systems that stabilise sediments, cycle nutrients, store carbon, support biodiversity, and provide habitat for fish and invertebrates across tropical, subtropical and temperate coastlines (Cullen-Unsworth et al., 2014; McKenzie et al., 2020; Unsworth et al., 2022). They also sustain ecosystem services that matter directly to coastal communities, including fisheries, shoreline protection, cultural values, recreation and tourism (Unsworth et al., 2022; do Amaral Camara Lima et al., 2023; Forrester et al., 2024). Yet these same meadows sit within some of the most heavily used coastal waters on Earth, exposed to nutrient pollution, sedimentation, dredging, reclamation, boating, destructive fishing and aquaculture (Grech et al., 2012; Griffiths et al., 2020; Tuholske et al., 2021; Turschwell et al., 2021; Jones et al., 2025a). While a global challenge for seagrass conservation is knowing where seagrass occurs (Unsworth et al., 2019), part of this challenge is also knowing where seagrass and people coexist.

Proximity is a simple but powerful way to identify that overlap, and important given conservation is inherently about managing people and human behaviour (Bennett et al., 2017; Veríssimo et al., 2024). People living near ecosystems may be more likely to draw food, income, protection, identity or wellbeing from them (Ellis and Ramankutty, 2008). Nearby populations may also shape ecosystem condition through harvesting, pollution, development, infrastructure and governance decisions (Massaro et al., 2025). In forests and coral reefs, proximity-based analyses have helped estimate the number of people living near ecosystems, identify potential pressure and dependence, and inform conservation, development and climate-risk debates (Newton et al., 2020; Sing Wong et al., 2022; Massaro et al., 2025). These studies are useful because they are precise about what proximity can and cannot show. Importantly, proximity is not dependence and does not prove access, use, tenure, knowledge, benefit or stewardship (Newton et al., 2020). It does, however, identify where these relationships are more likely to be important.

This distinction is especially important for seagrass meadows. On one hand, a person may live beside a meadow and never use it; they may also be unaware of its existence entirely (Unsworth et al., 2019). On the other hand, a fisher or gleaner may depend on seagrass-associated resources while living slightly farther away. Yet seagrass-linked benefits are often local, informal and poorly counted (de la Torre-Castro et al., 2014; Nordlund et al., 2018). Many seagrass pressures are also local, including sewage and agricultural nutrients, sediment runoff, port expansion, shoreline engineering and moorings (Grech et al., 2012; Tuholske et al., 2021; Jones et al., 2025a). A global estimate of seagrass-proximate people would therefore provide a first spatial baseline for where human wellbeing, coastal development and seagrass conservation are most likely to intersect.

Such a baseline is currently missing. Seagrass meadows are increasingly promoted in global biodiversity, climate and blue economy policy (Duarte et al., 2025), but these agendas often still treat seagrass primarily as natural capital stocks (Gomis et al., 2025). That framing misses the human geography of seagrass systems. For example, who lives near it, where population pressure is growing, or where conservation decisions may affect coastal livelihoods, access and rights. This matters because conservation can reshape who uses coastal space, who benefits, and who bears costs (Bennett et al., 2017). Seagrass loss can also undermine fisheries, shoreline protection, water quality and cultural values in places where people may have few alternatives.

Global seagrass mapping remains uneven (Unsworth et al., 2019; McKenzie et al., 2020). Some countries have detailed maps from field surveys, remote sensing or national monitoring, while others are represented mainly by point records, historical observations, citizen-science sightings or expert knowledge. Any global analysis must therefore be clear that estimates based on current global seagrass layers represent people living near known, mapped or observed seagrass, but not necessarily all seagrass meadows.

Here, we provide the first global estimate of the number and changing distribution of seagrass-proximate people. We define seagrass-proximate people as people living within specified distances of known seagrass sites, without assuming dependence. Using a global seagrass distribution layer derived from multiple distinct datasets, and multi-temporal gridded population data, we estimate the number of people living within 1 km, 5 km and 10 km of known seagrass from 1975 to 2020, with projected estimates to 2030. We ask 1) how many people currently live near known seagrass, 2) how has this changed over the past 45 years, and 3) where seagrass-proximate people are concentrated. In doing so, we provide a spatial baseline for bringing human population dynamics into global seagrass conservation and policy.

Methods

Overview

We estimated the number and changing distribution of people living near known seagrass meadows globally. The analysis combined three spatial datasets: a global seagrass distribution layer, multitemporal gridded population data, and global seagrass bioregions. We defined seagrass-proximate people as people living within 1 km, 5 km or 10 km of known seagrass. We used 2020 as the contemporary baseline, 1975–2020 to quantify historical change, and 2025–2030 population layers as projected forward-looking estimates. All analyses were conducted in R (R Core Team, 2026).

Global seagrass distribution layer

We created a global seagrass distribution layer by combining multiple sources of known, mapped and observed seagrass occurrence. These included global seagrass polygon and point data from UNEP-WCMC (UNEP-WCMC and Short, 2021), additional miscellaneous seagrass occurrence records (Strydom et al., 2023; Bartlett et al., 2024), and citizen-science records from SeagrassSpotter (Jones et al., 2025a). Polygon records were retained as mapped seagrass distributions. Point records were converted into 500 m site polygons to represent localised known seagrass occurrences while avoiding the assumption that point records represented precise meadow boundaries (Jones et al., 2025a).

Vector data processing was conducted using *sf* (Pebesma, 2018) and associated spatial libraries for geometry validation, reprojection, buffering, clipping and dissolving. All input geometries were standardised to a common coordinate reference system, cleaned, and converted to valid geometries. The combined seagrass layer was then dissolved to create a single global distribution layer representing known seagrass locations. Terrestrial overlap was removed using a global land polygon layer, ensuring that the final seagrass distribution layer represented coastal and marine areas rather than land. Very small slivers generated during spatial processing were removed. The final layer should be interpreted as a global distribution of known, mapped or observed seagrass, rather than a complete wall-to-wall map of all seagrass extent. This distinction is important because global seagrass mapping effort remains uneven across countries and regions (Unsworth et al., 2019), and there are known limitations within the UNEP-WCMC dataset (McKenzie et al., 2020). Subsequent improvements to the UNEP-WCMC dataset were made following these concerns.

For the population analysis, the final seagrass distribution layer was projected to the coordinate reference system of the population grid and rasterised to the same 1 km grid using *terra* (Hijmans et al., 2026). We then assigned seagrass presence to population grid cells touched by the seagrass distribution layer and calculated the Euclidean distance from each 1 km population grid cell to the nearest seagrass cell. This produced a global distance-to-seagrass raster, which was used to identify population cells within 1 km, 5 km and 10 km of known seagrass.

Population data

We used the Global Human Settlement Layer population grid, GHS-POP R2023A, to estimate the number of people living near known seagrass (Schiavina et al., 2023; Pesaresi et al., 2024). GHS-POP provides gridded estimates of resident population for multiple time periods. We used the 1 km Mollweide population grids for 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015 and 2020. We also included the 2025 and 2030 population layers as projected estimates. Population values represent the number of people per grid cell and can therefore be summed across spatial zones (Pesaresi et al., 2024). We selected the 1 km Mollweide product because it provides a globally consistent equal-area grid suitable for global distance and population analyses. The 1 km resolution also provided a pragmatic balance between spatial detail and computational feasibility. Because the population data are gridded at 1 km resolution, all proximity estimates were calculated on this same grid.

Defining seagrass-proximate peoples

We defined seagrass-proximate peoples as people living within specified distances of known seagrass. We used three distance thresholds: 1 km, 5 km and 10 km. The 1 km threshold represents immediate seagrass adjacency. The 5 km threshold represents local seagrass proximity and is used as the core estimate in the paper. The 10 km threshold represents a broader coastal proximity zone around known seagrass.

These thresholds were chosen to remain conservative and specific to seagrass. Wider buffers, such as 50 km or 100 km have been used for coral reef studies (Sing Wong et al., 2022). While these could in theory capture broad coastal populations, they risk weakening the conceptual link between people and seagrass. As a sensitivity check, we included both these buffers, but did not include them within the key results (Jones, 2026). Our aim was not to estimate all people who may indirectly benefit from seagrass, but to quantify populations living close enough for seagrass conservation or degradation to plausibly intersect with local coastal livelihoods, development pressures or governance.

Estimating global seagrass-proximate populations

For each population year, we used the distance-to-seagrass raster to identify grid cells within 1 km, 5 km and 10 km of known seagrass. Population values from the corresponding GHS-POP raster were then summed within each distance threshold. This produced global estimates of seagrass-proximate population for each year and distance threshold. Historical change was calculated between 1975 and 2020. For each distance threshold, we calculated absolute change as:

$$\Delta P = P_{2020} - P_{1975}$$

and percentage change as:

$$\%\Delta P = \left(\frac{P_{2020} - P_{1975}}{P_{1975}}\right) \times 100$$

where P_t is the population living within the specified distance of known seagrass in year t. Projected change was calculated in the same way for 2020–2030 and 1975–2030, but these results were interpreted as forward-looking indicators because the 2025 and 2030 GHS-POP layers are projections.

Country-level summaries

To identify where seagrass-proximate populations are concentrated politically, we summarised population estimates by country for 2020. Country boundaries were obtained from Natural Earth using *rnaturalearth* (Massicotte and South, 2026) and projected to the same coordinate reference system as the population grid using *sf* (Pebesma, 2018). For each distance threshold, population cells within the seagrass proximity zone were summed within each country polygon. We also extracted total national population from the same GHS-POP layer, allowing us to calculate both the absolute number of seagrass-proximate people and the percentage of each country's population living near known seagrass. We also extracted total national population from the same GHS-POP layer, allowing us to calculate both the absolute number of seagrass-proximate people and the percentage of each country's population living near known seagrass:

$$\%P_{total,i,d} = \left(\frac{P_{near,i,d}}{P_{total,i}}\right) \times 100$$

where $P_{near,i,d}$ is the population of country i living within distance threshold d of known seagrass, and $P_{total,i}$ is the total population of country i.

We also linked country-level seagrass-proximate population estimates with national poverty data from the World Bank Poverty and Inequality Platform / World Development Indicators. Because poverty thresholds vary in relevance across development contexts, we applied income-class-adjusted poverty headcount ratios: the $3.00/day poverty line for low-income countries, the $4.20/day line for lower-middle-income countries, and the $8.30/day line for upper-middle-income countries, all in 2021 purchasing power parity. High-income countries were not assigned income-adjusted international poverty estimates in the main overlay. For each eligible country, we estimated the indicative number of seagrass-proximate people below the relevant poverty line as:

$$P_{poor,i,d} = P_{near,i,d} \times \frac{H_i}{100}$$

where $P_{poor,i,d}$ is the estimated number of seagrass-proximate people below the selected poverty line in country i and distance threshold d, and H_i is the latest available national poverty headcount ratio for that country. These poverty overlays should be interpreted as contextual indicators rather than direct estimates of poverty among seagrass-proximate communities, because national poverty rates may not reflect conditions in coastal or seagrass-proximate populations. Country-level summaries were used to identify countries with the largest seagrass-proximate populations in 2020, countries where the highest proportion of the national population lived near known seagrass, and countries where seagrass proximity may overlap with poverty.

Seagrass bioregion summaries

We also summarised seagrass-proximate peoples across global seagrass bioregions (Short et al., 2007). This is relevant because seagrass decline and recovery across these bioregions are variable (Dunic et al., 2021). Bioregion polygons were projected to the same coordinate reference system as the population grid. For each year and distance threshold, population cells within the seagrass proximity zone were summed within each bioregion. Bioregion summaries were used to examine broad ecological patterns in the distribution and growth of seagrass-proximate peoples. These results complement the country-level summaries by grouping people according to seagrass biogeography rather than political boundaries.

Data interpretation and limitations

Our estimates quantify people living near known seagrass, not people who are seagrass-dependent (Jones et al., 2025b). Proximity does not demonstrate access, use, tenure, knowledge, benefit, stewardship or livelihood reliance. Conversely, some people may depend on seagrass-associated resources while living beyond the thresholds used here. Our estimates should therefore be interpreted as a spatial baseline for potential human-seagrass interaction, not as a direct measure of dependence.

Several additional limitations are important. First, global seagrass mapping is incomplete and uneven (McKenzie et al., 2020). Some regions are represented by detailed mapped polygons, while others are represented mainly by point records or citizen-science observations. Second, the use of 500 m polygons around point records provides a transparent way to include known occurrences, but it does not imply precise meadow extent (Jones et al., 2025a). Third, the analysis uses Euclidean distance on a 1 km grid, which does not capture access by boat, travel time, fishing grounds, tenure, customary use, coastal infrastructure or governance barriers. Finally, population estimates are constrained by the assumptions and uncertainties of the GHS-POP product, especially for earlier historical years and projected future layers (Pesaresi et al., 2024). Several countries known to contain seagrass returned zero seagrass-proximate population estimates because no usable spatial seagrass records were available in the compiled global distribution layer (McKenzie et al., 2020). These zero values should therefore be interpreted as spatial data gaps, not confirmed absence of seagrass or seagrass-proximate people.

Despite these limitations, the analysis provides a globally consistent, transparent and repeatable estimate of seagrass-proximate populations. It establishes a baseline that can be updated as seagrass mapping improves and extended through future overlays with poverty, fisheries dependence, wastewater exposure, governance, protected areas or coastal development data.

Results

Nearly 200 million people live within 5 km of known seagrass

In 2020, at least 53.4 million people lived within 1 km of known seagrass meadows, 194.8 million lived within 5 km, and 352.9 million lived within 10 km (Table 1). These figures show that seagrass meadows are not fringe coastal habitats. They sit close to large human populations, with hundreds of millions of people living within distances where seagrass conservation and degradation may intersect with coastal livelihoods, development or wellbeing.

We use the 5 km threshold as our core estimate of local seagrass proximity. It is close enough to remain ecologically and socially meaningful, while broad enough to capture nearby coastal settlements that may interact with seagrass through fisheries, recreation, water quality, coastal protection or governance. On this basis, almost 195 million people lived close to known seagrass meadows in 2020.

Table 1. Global seagrass-proximate population change, 1975–2030

Distance from known seagrass meadow	1975 pop.	2020 pop.	2030 projected pop.	Change 1975-2020	Change 1975-2030
1km	28.0 million	53.4 million	58.7 million	+90.5%	+109.4%
5km	100.7 million	194.8 million	214.4 million	+93.5%	+112.9%
10km	182.0 million	352.9 million	387.6 million	+93.9%	+113.0%

Seagrass-proximate populations have almost doubled since 1975

The number of people living near known seagrass sites increased sharply between 1975 and 2020 (Fig. 1; Table 1). Within 1 km, the population rose from 28.0 million to 53.4 million, an increase of 25.3 million people (90.5% increase). Within 5 km, it rose from 100.7 million to 194.8 million, adding 94.2 million people (93.5%), and within 10 km, it rose from 182.0 million to 352.9 million, adding 170.9 million people (93.9%).

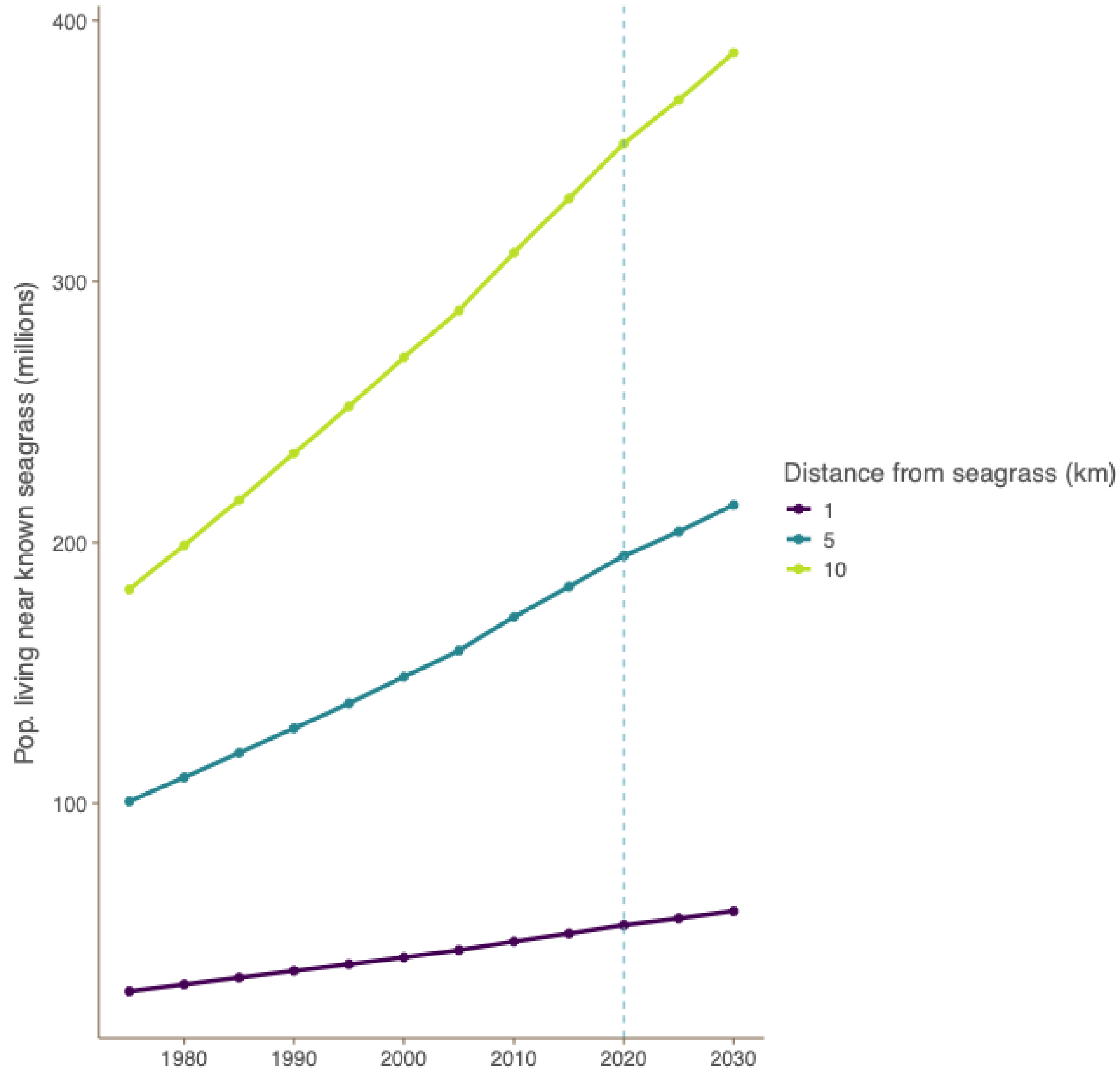

Fig. 1. Global change in seagrass-proximate peoples, 1975–2030. Lines show the number of peoples living within 1 km, 5 km and 10 km of known seagrass. Estimates from 1975–2020 are historical GHS-POP layers; 2025 and 2030 are projected population layers. The dashed line marks the transition from historical to projected population estimates.

Growth was therefore consistent across all three distance thresholds, suggesting that population increase around known seagrass meadows is not limited to the immediate meadow edge, but reflects a broader coastal expansion around seagrass regions. In absolute terms, however, most growth occurred within the wider 10 km zone, where an additional 171 million people lived near known seagrass sites by 2020.

By 2030, more than 214 million people will live within 5 km of seagrass

Projected GHSL layers suggest that the number of seagrass-proximate peoples will continue to grow. By 2030, 58.7 million people are projected to live within 1 km of known seagrass meadows, 214.4 million within 5 km, and 387.6 million within 10 km. At the 5 km threshold, this means the number of seagrass-proximate peoples is projected to increase by a further 19.5 million people between 2020 and 2030. Because the 2025 and

2030 GHSL layers are projections, we treat these as forward-looking indicators, but they point to a trajectory of the number of seagrass-proximate peoples growing rapidly, making the social dimensions of seagrass conservation increasingly difficult to ignore.

Seagrass-proximate peoples are concentrated in tropical bioregions

Seagrass-proximate populations were unevenly distributed across the six global seagrass bioregions (Fig. 2). The Tropical Indo-Pacific contained the largest number of peoples living within 5 km of known seagrass, with 78.2 million peoples. This was followed by the Tropical Atlantic with 42.9 million, the Mediterranean with 35.8 million, the Temperate North Atlantic with 19.7 million, the Temperate North Pacific with 13.8 million, and the Temperate Southern Oceans with 3.7 million. The strongest absolute growth between 1975 and 2020 also occurred in the tropical bioregions. Within 5 km of known seagrass, the Tropical Indo-Pacific added 48.0 million peoples, increasing by 158.6%. The Tropical Atlantic added 26.8 million peoples, increasing by 166.3%. Together, these two bioregions accounted for most of the global increase in seagrass-proximate populations over the study period. By contrast, the Mediterranean added 11.1 million peoples (+45.2%), while temperate bioregions showed smaller absolute increases. These patterns show that seagrass proximity is not distributed evenly across the global seagrass estate. The largest and fastest-growing seagrass-proximate populations are concentrated in tropical coastal regions, where seagrass meadows are often embedded within densely inhabited, rapidly changing social-ecological systems.

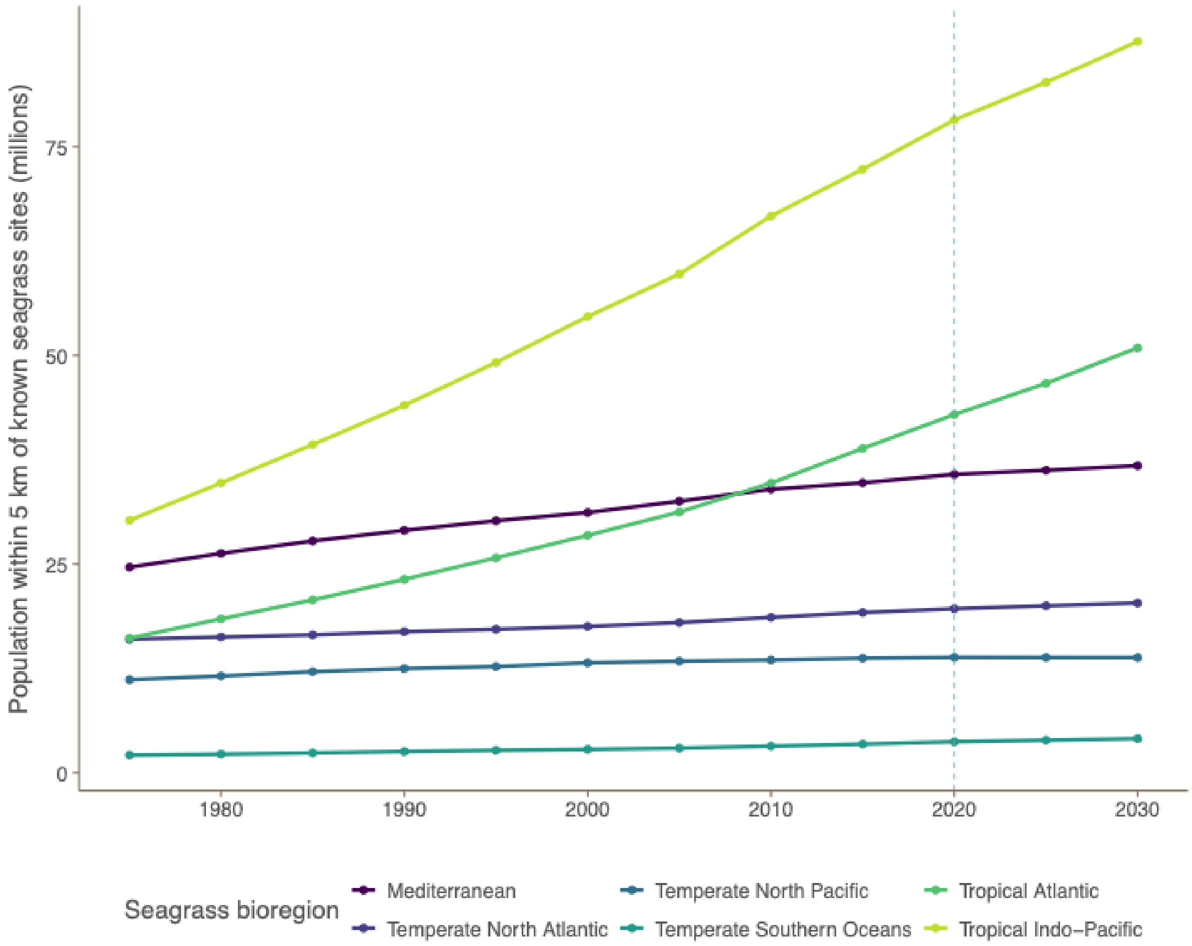

Fig. 2. Seagrass-proximate people by global seagrass bioregion, 1975–2030. Lines show the estimated number of people living within 5 km of known seagrass across the six seagrass bioregions (Short et al., 2007): Temperate North Atlantic, Tropical Atlantic, Mediterranean, Temperate North Pacific, Tropical Indo-Pacific and Temperate Southern Oceans. Estimates from 1975–2020 are historical, while 2025 and 2030 are projected. The dashed line marks the transition from historical to projected population estimates.

A small number of countries contain large seagrass-proximate populations

Country-level summaries revealed strong geographic concentration (Fig. 3). At the 5 km scale, the Philippines had the largest seagrass-proximate population, with 14.5 million peoples living within 5 km of known seagrass. This was followed by the United States (12.3 million), Italy (7.2 million), Indonesia (6.7 million), Spain (6.3 million), Japan (5.2 million), Angola (4.2 million), China (4.1 million), the United Kingdom (4.0 million) and Ghana (3.6 million).

This ranking highlights a mix of archipelagic states, densely populated coastlines, Mediterranean countries, and large coastal economies. It also shows why country-level totals need careful interpretation. Some countries rank highly because seagrass is widespread along populated coastlines whereas others rank highly because national populations are large, even if the proportion of peoples living near known seagrass is relatively small.

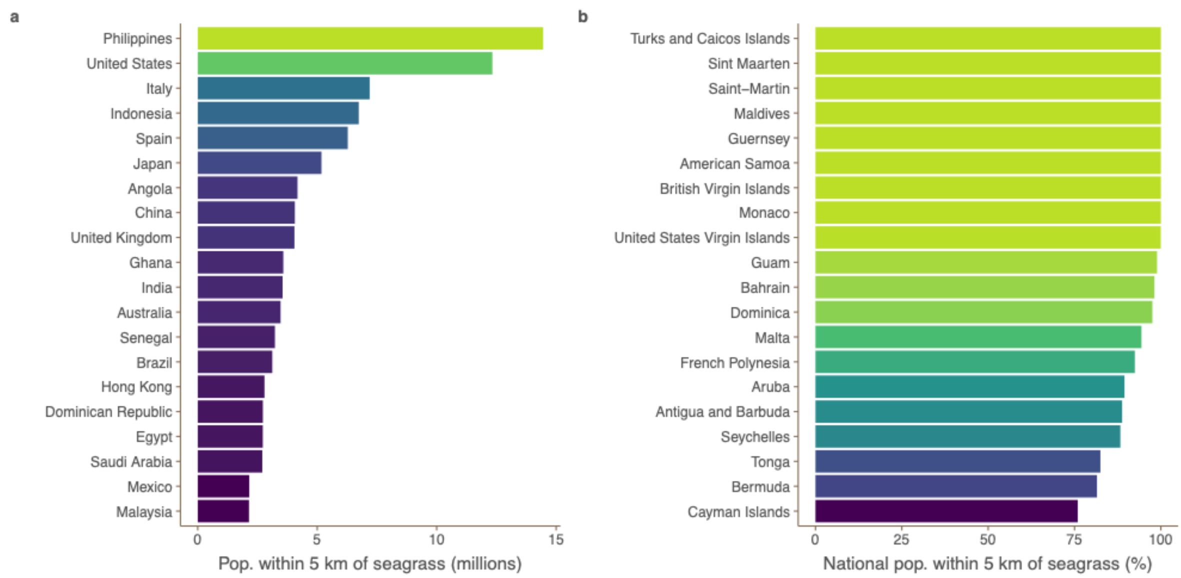

Fig. 3. Country- and territory-level distribution of seagrass-proximate people in 2020. Panel **a** shows the 20 countries and territories with the largest absolute number of people living within 5 km of known seagrass. Panel **b** shows the 20 countries and territories with the highest percentage of national population living within 5 km of known seagrass.

In some island and coastal territories, seagrass proximity is nationally pervasive

The percentage of national population living within 5 km of known seagrass revealed a different pattern. Several small island states and territories had almost their entire population living near known seagrass. These included Guernsey, Turks and Caicos Islands, American Samoa, Saint-Martin, Sint Maarten and the Maldives, each with ~100% of their national population living within 5 km of known seagrass. Other high-percentage cases included the British Virgin Islands, Monaco, the United States Virgin Islands, Guam, Bahrain, Dominica, Malta, French Polynesia, Aruba, Antigua and Barbuda, and Seychelles.

These results show that there are two distinct dimensions of seagrass proximity. In some countries, large absolute numbers of peoples live near known seagrass. In others, particularly small island states and coastal territories, seagrass proximity is nationally pervasive. Both patterns matter for policy, the first for the scale of potential human-seagrass interactions, and the second for the depth of national exposure to seagrass conservation, degradation and governance decisions.

When grouped by national income category, the largest share of mapped seagrass-proximate people occurred in high-income OECD countries, with 48.7 million people living within 5 km of seagrass in 2020, representing 32.6% of the global mapped total. Lower-middle-income countries accounted for 42.2 million people (28.3%), followed by upper-middle-income countries with 31.1 million (20.8%), high-income non-OECD countries with 15.7 million (10.5%), and low-income countries with 11.7 million (7.8%). These patterns should be interpreted cautiously because mapped seagrass availability is uneven across income groups. Higher values in high-income countries likely reflect both genuine coastal population proximity and greater availability of seagrass data, while estimates for low-income countries are likely to be extremely conservative.

Discussion

Seagrass as a global social-ecological system

We estimate that at least 194.8 million people, approximately 2.5% of the global population, lived within 5 km of known seagrass in 2020, almost double that of 1975. By 2030, this number is projected to reach 214.4 million, placing seagrass firmly within the geography of growing coastal societies and positioning them as global social-ecological systems with potentially millions of actors. Broader coastal buffers, like those used for reefs (Sing Wong et al., 2022), produced much larger estimates. In 2020, 1.22 billion people lived within 50 km of seagrass and 1.98 billion within 100 km. We do not use these broader thresholds as headline estimates because they are less specific to plausible local human-seagrass interactions and increasingly reflect general growing coastal population proximity rather than seagrass proximity (Neumann et al., 2015).

The scale of seagrass-proximate peoples is smaller than comparable estimates for forests (Newton et al., 2020). This reflects ecosystem extent and geometry rather than social insignificance. Forest-proximate analyses estimate that 1.6 billion rural people lived within 5 km of forests in 2012, but forests occupy vast terrestrial landscapes. Although seagrass is globally distributed (McKenzie et al., 2020), it occupies a narrow, shallow and fragmented footprint that is tightly bound to the coastal edge and rarely extends more than a few kilometres from land. Against that spatial footprint, nearly 200 million people within 5 km is substantial.

Our estimate is also conservative. At least ten countries known to contain seagrass returned zero seagrass-proximate population estimates because no usable spatial polygons or point records were available in the compiled global distribution layer (McKenzie et al., 2020). These zero values do not mean seagrass is absent, or that no people live near seagrass, but instead, reveal gaps in global seagrass mapping (McKenzie et al., 2020). The estimate is also constrained by uneven within-country spatial records. Existing records are often concentrated in places with active researchers, monitoring programmes or citizen-science participation, leaving some coastlines grossly underrepresented. This is particularly important in parts of Africa (Mwikamba et al., 2024). For example, our global seagrass layer contained roughly 118 seagrass 1 km grid cells for Tanzania, 64 for Mozambique and 22 for Kenya, equivalent to approximately 118 km^2, 64 km^2 and 22 km^2 of potential mapped seagrass in the analysis grid. These values are far below recent remote-sensing estimates of 548.2 km^2 for Tanzania, 1,779.3 km^2 for Mozambique and 679.6 km^2 for Kenya (Traganos et al., 2022). Therefore, as access to spatial seagrass datasets improve, the estimated number of seagrass-proximate people will almost certainly increase, although we cannot yet estimate by how much.

Tropical bioregions carry most human-seagrass overlap

The Tropical Indo-Pacific and Tropical Atlantic together contained 121.1 million people within 5 km of seagrass, equivalent to approximately over 60% of seagrass-proximate peoples at this distance. These two bioregions also accounted for most growth between 1975 and 2020. The Tropical Indo-Pacific added 48.0 million people, while the Tropical Atlantic added 26.8 million.

This concentration makes ecological sense since the Tropical Indo-Pacific is the global centre of seagrass diversity (Short et al., 2007). The largest concentration of seagrass-proximate people therefore overlaps with the region where seagrass biodiversity, functional diversity and ecosystem-service diversity are also exceptionally high. This concentration should therefore shape global conservation priorities. Tropical seagrass meadows are particularly important for support fisheries (Nordlund et al., 2018), particularly for people in poverty (Jones et al., 2022; Jones et al., 2025b), strengthening the case for treating seagrass as part of blue food, coastal livelihood and environmental justice agendas.

Coastal growth increases the stakes for seagrass conservation

The number of seagrass-proximate peoples grew by 93.5% between 1975 and 2020. This mirrors wider global coastal population growth. Global analyses project continued expansion of low-elevation coastal-zone populations, with exposure to coastal hazards increasing under future development and sea-level rise scenarios (Neumann et al., 2015).

For seagrass meadows, this growth has two important implications. First, it increases potential pressure. More people and infrastructure near seagrass can mean higher nutrient loading, sewage exposure, sediment runoff, reclamation, port expansion, and fishing pressure, which are among the dominant drivers of seagrass decline (Grech et al., 2012; Tuholske et al., 2021; Turschwell et al., 2021). Second, it also increases policy relevance. More people near seagrass means more potential beneficiaries of seagrass ecosystem services. Population proximity therefore signals both risk and opportunity. It identifies places where seagrass loss may harm coastal wellbeing, and where protection or recovery could deliver local ecosystem-service benefits.

Our country level summaries highlight two distinct policy geographies. In absolute terms, the largest seagrass-proximate populations occur in countries such as the Philippines, United States, Italy, Indonesia, Spain and Japan. These are places where seagrass conservation may intersect with large coastal populations, urban development, tourism, and wastewater management. Percentage rankings, however, paint a different picture. In Small Island Developing States (SIDS), seagrass proximity can be nationally pervasive. Places such as the Maldives, American Samoa, Turks and Caicos Islands, Sint Maarten, Guam, French Polynesia, Antigua and Barbuda and Seychelles have very high shares of their national populations living within 5 km of known seagrass. In these contexts, seagrass may not only be a local habitat, but part of national exposure to coastal ecosystem change that should be considered more sharply (Hind et al., 2015).

From proximity to dependence

Like forest analyses (Newton et al., 2020), this analysis estimates proximity, not dependence. Proximity to seagrass does not prove access, use, knowledge, benefit, stewardship or reliance. A person may live beside seagrass and never interact with it. Conversely, fishers, gleaners, seafood traders or recreation and tourism operators may depend on seagrass-associated ecosystem services while living beyond 5 or 10 km. The next logical step is to identify where seagrass proximity overlaps with dependence (Jones et al., 2022; Jones et al., 2025b). Such analysis requires better data on small-scale fisheries, household food security, gendered resource use, cultural values, local knowledge, tenure, tourism, markets, coastal protection and governance. However, many, if not most seagrass ecosystem services are hidden in conventional datasets. For example, subsistence fishing, gleaning, and local seafood consumption are often underreported (Nordlund et al., 2018), nursery functions may support fisheries production and catches landed elsewhere (Unsworth et al., 2018), and wellbeing, cultural and identity values rarely enter national accounts (Cullen-Unsworth et al., 2014; McKenzie et al., 2021).

We believe a proximity baseline helps target that work. By making this dataset available, future analyses could overlay seagrass-proximate populations with poverty (Jones et al., 2025b), fisheries dependence (Jones et al., 2022), wastewater exposure (Tuholske et al., 2021) or sediment risk (Yan et al., 2025) for example. Such analysis could move the field towards a typology of global seagrass social-ecological systems such as high-population/high-pressure systems, poverty- and food-security-linked systems or small-island exposure systems. Such analyses are beyond the scope of this study.

Like conservation more broadly (Bennett et al., 2017; Veríssimo et al., 2024), we argue that seagrass conservation is about managing people. Here we show that seagrass meadows are global social-ecological systems, making conservation a human geography issue. At least 195 million people live within 5 km of seagrass, and more than 62% of them tropical bioregions. This places the largest human-seagrass overlap in regions that are also central to global seagrass biodiversity and ecosystem services. Proximity does not inherently signal dependence, but if seagrass conservation is to contribute to biodiversity, climate, and sustainable development goals, it must account for the people who live near these ecosystems, the ecosystem services they may receive, and the pressures they may face or create.

Data availability

Data and supplementary material to support this manuscript, including summary tables across all countries and bioregions, and final raster files for seagrass-proximate people are available from figshare: https://doi.org/10.6084/m9.figshare.32158797.

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