Journal of Ecosystem & Ecography

Reimer, J Ecosys Ecograph 2022, 12:6

Mini Review

Open Access

Consequences of Urbanization on Coral Reefs

Nicola Reimer*

Department of Geography, National University of Singapore, Singapore

Abstract

Understanding the processes forming urban coral reefs may be crucial for foreseeing future conservation issues given the expected increases in urbanization in tropical and subtropical countries. To find commonalities among urban coral reefs and explain how urbanization affects hard coral assemblages, we took a case study method. 11 cities in East and Southeast Asia's data were gathered, with a particular focus on Singapore, Jakarta, Hong Kong, and Naha Okinawa. Our review highlights several important traits of urban coral reefs, such as "reef compression" a decline in bathymetric range with increasing turbidity and decreasing water clarity over time and relative to shore, dominance of rounded coral growth forms and low reef complexity, variable inshore-offshore gradients specific to specific cities, early declines in coral cover with recent fluctuating coral cover, and more. Periods of severe effects and quick recovery, as well as hard corals colonizing urban infrastructure we address the possibilities for ecological engineering to support corals in urban locations and give predictions for the dynamics of urban reef communities. Globally, urbanization and population increase in coastal regions are occurring at previously unheard-of rates.

Keywords: Urban; Population; Infrastructure; Hard corals

Introduction

Urbanization-related changes to the maritime environment, such as increased sediment delivery, fertilizers, and pollutants, are particularly harmful to corals that construct reefs and pose a serious danger to coral reef ecosystems. Despite this, many tropical and subtropical towns have urban waterways with hard corals and coral reefs. Numerous urban coral reef ecosystems have been researched separately, but there haven't been any attempts to compile these studies and seek for commonalities among tropical coastal towns. Understanding the factors that have impacted urban coral reefs, which likely represent circumstances for corals across much of their range as coastal development spreads, is important. Urban coral reef ecosystem traits are crucial for predicting future trends in coral reef ecology and conservation, which are currently understudied fields. Due to the unusually harsh abiotic circumstances that define metropolitan maritime habitats, urban coral reefs may differ in composition, physical characteristics, and ecosystem dynamics from coral reefs in more remote locales. Sediment pollution, which is frequently very high in urban waterways, can alter interspecific interactions, select for sediment-tolerant hard corals and symbionts, and produce depth distribution patterns that defy expectations based on conventional paradigms from more pristine reef environments. It can also limit the photosynthetic activity of *zooxanthellae*, be energy-demanding for corals to remove sediments, and impact the reproductive cycles of some coral species. Runoff, wastewater systems, and industrial activities all contribute nutrients to the environment, which can lead to coral bleaching and favourable conditions for macroalgae that compete with corals for space. Important grazers and other ecologically significant taxa may have been removed earlier than overfishing in more distant locations, which may have intensified the effects of nutrient loading and influenced the eco genetic trajectory of coral assemblages in metropolitan settings. High levels of dissolved copper and other toxins, the richness of novel habitat afforded by urban infrastructure, and disrupted ecological linkages associated with ocean sprawl may have all had an impact on this trajectory. The ecological mechanisms and community characteristics that characterize urban coral reefs, as well as their resistance and adaptability to such stressors, are still not well understood [1].

In this research, we consolidate the information that is currently accessible on the urban coral reefs in East and Southeast Asia in an effort to uncover commonalities and traits among urban coral reefs. We concentrate on consequences from urbanisation particularly and explore for patterns across numerous cities, despite the fact that many previous assessments have presented anthropogenic variables that negatively impact corals and coral reefs generally. Despite resource depletion and Although resource use and extraction historically had significant effects on coral reefs close to cities, they have diminished in recent years and are therefore only discussed to the level required to explain past and present trajectories of urbanised reefs. Urban waterways, urban watersheds, or locations with obvious urban gradients in one or more of the abiotic variables particularly relevant for hard corals, as major reef builders, are all considered to be urban coral reefs by this definition. This definition includes recently or currently forming coral reefs as well as coral-dominated habitats close to the latitudinal limits of reef-building corals; evidence of carbonate deposition is not a requirement under this definition. Additionally, even though we use the separation between metropolitan areas as our concept of urban coral reefs purposely omits more precise spatial measurements since the footprint or coastline extent of urbanisation is anticipated to vary significantly between coastal cities and between stressors brought on by urban growth. We concentrate on East and Southeast Asia due to the vast number of coastal towns there that are overlapping with historically coral-dominated reef systems and are rising quickly [2].

Asia is a global hotspot for coral biodiversity, sustaining more than 500 kinds of coral as well as thousands of other invertebrates, algae, and reef fish. This is especially true of the South China Sea and the Coral Triangle. Asia has the largest population and the highest population densities in coastal areas of any continent, and it has been

***Corresponding author:** Nicola Reimer, Department of Geography, National University of Singapore, Singapore, E-mail: reimernic2@gmail.com

Received: 11-Apr-2022, Manuscript No: jee-22-68083, **Editor assigned:** 12-Apr-2022, PreQC No: jee-22-68083(PQ), **Reviewed:** 25-Apr-2022, QC No: jee-22-68083, **Revised:** 1-Jun-2022, Manuscript No: jee-22-68083(R), **Published:** 8-Jun-2022, DOI: 10.4172/2157-7625.1000336

Citation: Reimer N (2022) Consequences of Urbanization on Coral Reefs. J Ecosys Ecograph 12: 336.

seeing the fastest rate of coastal population expansion internationally for several decades. In addition, compared to other regions, Southeast Asia has a higher percentage of its population participating in maritime fishing and living within 30 kilometres of coral reefs. It has led to the overexploitation and degradation of numerous coral reefs close to major urban centres. Therefore, East and Southeast Asia is the best place to study cross-city patterns in urban coral reefs.

The review is divided into three sections:

- case studies of urban coral reefs in several significant coastal cities in East and Southeast Asia
- an assessment of the recurring themes and traits that appear in published literature across these case study cities
- unmet research needs and ongoing urban coastline mitigation efforts.

Despite the fact that there were numerous potential cities in the area, we concentrated our research on the four primary case studies of Singapore, Jakarta, Hong Kong (PR China), and Naha for which full temporal and geographic coral survey data were available. Shorter summaries of the urban coral reefs in Pattaya Thailand, Nha Trang Vietnam, Davao City southern Mindanao, Philippines, Kota Kinabalu northwest Sabah, Malaysia, and Bandar Seri Begawan are included with these four in-depth case studies. In the end, the patterns described in this analysis serve as the foundation for further hypothesis testing and field experimentation that mechanistically elucidates the key factors influencing the structure and function of urban coral reef ecosystems. Such improvements in our understanding of urban reef ecosystems are essential since the rising urbanisation of nearshore habitats in coastal locations is a serious concern. The majority of Singapore's coral cover is confined to a 3- to 6-meter-deep zone between the reef crest and upper reef slope. This depth restriction is brought on by the canopy-forming macroalgae sargassum predominating in the upper reef flats (0–2 m) for the majority of the year (Low, 2015) and the significant light attenuation that occurs as depth increases (> 6 m). high sediment deposition and suspended particles over time. Leptoseris and Oxypora, two genera of coral that are typically found in deeper zones, can be found in Singapore at rather shallow depths. At the same time, the region's characteristic shallow-water species, such Acropora, are not numerous. The most prevalent hard corals belong to a number of taxa that can tolerate silt, including Montipora, Pectinia, and Porites. High sediment loads and light restrictions in Singapore waters can affect calice form, slow growth rates, and restrict other aspects of coral condition even for taxa that are tolerant to sediment. The total reef area in Singapore has significantly decreased during the past century. Hilton and Manning calculated the entire area of intertidal reefs in Singapore fell from 32.2 km^2 in 1922 to 30.5 km^2 in 1953 using historical maps. Allater's investigation revealed additional reductions to 17 km^2 in 1993 and 9.5 km^2 in 2011. Large portions of the subtidal reef have been covered by sediments and man-made structures as a result of dredging and land reclamation, resulting in extensive losses in the subtidal reef zone [3].

Discussion

This has coupled with significant reductions in coral cover at remaining reef locations, especially for deeper environments. For instance, at deep sites, they discovered a drop in coral cover of around 30% (6-7). Data from time series indicate that coral reefs in Singapore could recover quickly from thermal bleaching occurrences. For instance, coral cover at shallow sites studied by Guest et al. (2016) recovered to prebleaching levels after an El Nio-related bleaching event in 1998 in about 10 years. Additionally, the 2010 heat anomaly resulted in a > 20% loss in coral cover; however, by 2012, it had recovered roughly 25% of that lost cover. Given the limited settlement of coral larvae in Singapore, it seems doubtful that new recruitment will be the primary factor in this quick rebound. Instead, taxa that predominate in Singapore's coral reefs, such Merulina, are particularly good at regrowth after partial to almost complete colony mortality and may quickly raise coral cover levels by horizontal spread. Regardless of this broad, primarily anecdotal Hard coral species richness is remarkably high considering the persistent sedimentation that occurs in a large portion of Singapore's territorial waters [4].

Conclusion

Only a portion of the 255 hard coral species that have historically been recorded in Singapore have been discovered in recent. For instance, recorded 161 species in 2006-2007, which is comparable to surveys conducted in more isolated areas of the surrounding area. The genera Bryopsis and Sargassum are macroalgal competitors of coral, but cover on the reef crest is typically modest, at only 20 percent, though this varies greatly between sites and in response to other factors. The Indonesian island of Java's northwest coast is where Jakarta is located. One of the biggest cities on earth, it. The greater metropolitan area's population estimates range from 10 million to 30 million, depending on the limits chosen. Jakarta Bay, a 500 km^2 open embayment that is a portion of the partially confined Java Sea, borders the city to the north. The Ciliwung, Cisadane, and Citarum are three significant rivers that provide freshwater inside or around the bay. Sewage plumes that reach tens of kilometres into the surrounding coastal areas are a persistent problem, as are sewage discharge, runoff, and contamination from heavy metals, organic, and inorganic contaminants. Even though current estimates of the overall amount of reclaimed land are low, coastal building and land reclamation have an impact on water quality and area were lacking, as determined by our review. Additional future plans to reclaim more than half of Jakarta Bay, adjacent to either the 5m or 10m isobaths, would support upscale housing, tourism, shipping, and economic growth while reducing coastal flooding and land subsidence. However, they would have a negative impact on fishermen and those from the lowest socioeconomic strata. In the past, Jakarta and the surrounding areas were home to vast and diversified coral reefs that were crucial for local subsistence and small-scale fisheries. Reconstruction of historical data indicates that Jakarta Bay may have been home to diverse coral assemblages as recently as 1920, including more than 70 acro-porids, more than 30 faviids (now classed as merulinids), more than 20 poritids, and numerous other hard coral families. Other benthic and demersal creatures abundant in Jakarta Bay include 11 species of macroalgae, 36 benthic forams, 171 species of molluscs, a variety of sponges and other invertebrates, and numerous fish species of high commercial value [5, 6].

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgement

None

References

1. Baumard P, Budzinski H, Garrigues P, Sorbe JC, Burgeot, T, et al. (1998) Concentration of PAH in various marine organisms in relation to those in sediments to trophic level. Mar Pollut Bull 36: 951-960.
2. Baumard P, Budzinski H, Garrigues P (1998) Polycyclic Aromatic Hydrocarbons

(PAHs) in sediments and mussels of the western Mediterranean Sea. Environ Toxicol Chem 17: 765-776.

3. Cheng-Di D, Chih-Feng C, Chiu-Wen C (2012) Determination of Polycyclic Aromatic Hydrocarbons in Industrial Harbor Sediments by GC-MS. Int J Environ Res Public Health 9: 2175-2188.
4. Nasher E, Heng LY, Zakaria Z, Salmijah S (2013) Assessing the Ecological Risk of Polycyclic Aromatic Hydrocarbons in Sediments at Langkawi Island, Malaysia. The Scientific World Journal 13.
5. López GI (2017) Grain size analysis. Encyclopedia of Earth Science Series Encyclopedia of Geoarchaeology, Allan S Gilbert Springer 341-348.
6. Li G, Xia X, Yang Z, Wang R, Voulvoulis N (2006) Distribution and sources of polycyclic aromatic hydrocarbons in the middle and lower reaches of the Yellow River, China. Environ Pollut 144: 985-993.