Dredging and Shipping Impacts on the Great Barrier Reef from Port Development and Expansion in Queensland

The Politics of Managing the Great Barrier Reef
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Introduction

Economic activities in Australia and the livelihood of the Great Barrier Reef (GBR) have a long, contentious history, where economic gain and conservation values directly butt up against each other. A major player in the economic landscape of Australia is the system of ports interspersed across the country, with 21 lining the coast of Queensland adjacent to the GBR.[1] These ports range in size, export type, and locality, but all are essential for the growth of the region as they facilitate movements of the supply chain, local and global trade, and stimulate the economy. In the 2020-21 fiscal year the ports were responsible for moving 334 million tonnes of goods worth almost $100 billion for the Queensland economy. Ports remain connected to service industries, coastal communities, regional development, tourism, and national defense. To maintain their status, ports routinely undergo a process of Port Development and Expansion (PDE), whereby land is reclaimed, waterway maintenance takes place, new wharfs are built, infrastructure is created, or a number of other steps are taken to increase economic activity. PDE requires significant construction and increases the activity of maritime related industries in the region in the long run.

PDE in Queensland falls under unique scrutiny for this construction and increase in activity, as the closely connected waterways from the coast to the ocean greatly increases the impact PDE on the coast has on the GBR just off the coast. Impacts from PDE can include damage from dredging, increased shipping, increased activity, impacts from land reclamation, changing industry development, behavioral change, and sustainable development of the water system. There are both positive and negative impacts that arise from PDE, but given its necessity, the Australian government must carefully consider and enact policy to regulate said activity. The issue causing the most direct damage, and the focus of this paper, is the process of dredging used

[1]Queensland Government. *Department of Transport and Main Roads*. “Ports.” 1 March 2022.

as a major component of development and the subsequent damage from increased shipping. This paper will provide a brief background of the unique situation of the Queensland ports, then detail the major impacts of dredging and shipping on the health of the Great Barrier Reef. Current policy and significant policy change from the last 20 years will be evaluated for its effectiveness, ultimately leading this paper to arrive at the conclusion that continued robust, regulatory action by the Australian, Queensland, and Local Governments is necessary to ensure that economic growth does not come at the cost of environmental conservation.

Background

Queensland is the Australian State with the most vested interest in activities pertaining to the Great Barrier Reef, as most governance at the state level over the region falls into the territory of the Queensland government.[2] Of the biggest threats to the reef — climate change, agricultural practice, and coastal development[3] — two fall squarely on the shoulders of people in the Queensland territory. To understand the linkage between port development and impacts on the GBR, Queensland is the prime location for scrutiny.

Queensland ports

Much like the rest of Australia, Queensland relies heavily on ports and shipping to maintain economic output and inputs. In order to supplement this industry, there are roughly ten major and two minor trading ports in Queensland along the Great Barrier Reef coast.[4] The ports all operate under four major port authorities that are Queensland Government-owned corporations, subject to regulation and restriction from international, national, state, and local

[2]Australian Government. *Great Barrier Reef Marine Park Authority*. "Strategies to Manage the Reef." 2022.
[3]Brodie, Jon. *Dredging the Great Barrier Reef: use and misuse of science.* Estuarine, Coastal and Shelf Science, 142. 2014. pp. 1-3.
[4]Australian Government. *Great Barrier Reef Marine Park Authority*. "Ports Along the Great Barrier Reef." 2022.

guidelines largely relating to dredging, dredged material, pollution, and waste. Currently, the region operates under a master 10-year plan known as the Ports Strategy (2014) which provides the overarching roadmap for development of the region.[5] Notably, the plan severely limits where significant development can take place to only the major ports of Townsville, Abbot Point, Hay Point/Mackay and Gladstone.

The major reason for severe limitations on the scope of development came from the UNESCO World Heritage Commission's re-examination of the Great Barrier Reef's status as a World Heritage Area. The committee recommended "not [to] permit any new port development or associated infrastructure outside of the existing and long-established major port areas within and adjoining [the GBR]."[6] The reef's health was increasingly threatened by the PDE over the last decade, with operations notably modifying coastal ecosystems, causing damage with dredging, injuring wildlife, increasing the risk for oil or chemical spills, and contributing significantly to marine debris.[7] Therein lies the problem with the ports of the Queensland region. Unlike other PDE that takes place across Australia to bolster economic systems, Queensland's ports have direct ties to the catchment of the Great Barrier Reef and proximity to the World Heritage Area of national significance. As such, the region falls under unique scrutiny for ecological and environmental considerations from both national and international governance structures, demanding more robust policy creation and oversight.

Dredging

One of the major points raised in considerations for the damage caused by PDE is the issue of dredging, a process wherein the bottom of a waterway (in this case the ocean) is cleaned

[5]Queensland Government. *Department of State Development, Infrastructure, and Planning.* "Queensland Ports Strategy." 2014. https://documents.parliament.qld.gov.au/TableOffice/TabledPapers/2014/5414T5335.pdf
[6]Ibid.
[7]Ibid.

out of debris, loose sediment, or other materials using a dredge. The process is necessary to ensure clear waterways for ships to navigate successfully into port without causing more damage to the environment or ship itself. There are two main types of dredging, capital dredging and maintenance dredging. Maintenance dredging is a mandatory part of port operations that is used to clear areas for continued port operations in response to the yearly accumulation of new sediments and disturbances of the previously cleared seabed. Capital dredging is far more impactful, involving the excavation of previously undisturbed areas of the sea floor in order to create new shipping channels, berths, marinas, harbor areas, and swing basins.[8] While both cause similar damage to marine ecosystems, capital dredging involves far more material and damages vital ecosystems, centering it in the debate.

Dredging is generally recognized as one of the greatest threats facing coastal ecosystems, and to a lesser extent the Great Barrier Reef, with incredibly harmful effects on both the state and resilience of flora and fauna.[9] Dredging itself disrupts the ecosystems of the area it tears up — it is a brutal process that relentlessly clears the sea floor without regard for the life or ecosystem it may encounter — but the newly dredged material also presents a challenge, as disposal of the waste is its own unique threat to the reef. Environmental impacts include decimation of habitat, seabed disturbance, cumulative loss of environmentally significant species and habitat, degradation of water quality, smothering of benthic flora and fauna, turbidity issues, disruption of hydrology, introduction of noise, contaminants, and invasive species, pollution, and an increase in CO_2.[10] All together, the coastal area that is dredged experiences massive disruption that all but entirely smothers the ecosystem with little hope for recovery. Furthermore, dealing

[8]Queensland Government. *Department of Transport and Main Roads.* "Maintenance Dredging Strategy." 25 February 2022.
[9]Australian Government. *Great Barrier Reef Marine Park Authority*. "Great Barrier Reef Outlook Report." 2019.
[10]Australian Government. *Great Barrier Reef Marine Park Authority.* "Ports and Shipping Information Sheet." May 2013.

with dredged materials essentially transports the problem to a fresh and healthy ecosystem for disposal, causing similar impacts in a new region. Disposal fundamentally changes the physical and chemical environment in marine areas surrounding the Great Barrier Reef, causing catastrophic, non-linear effects.[11] It is hard to quantify the amount of damage caused by dredging and related development even with scientific expertise and technology,[12] but estimates place the value of ecological services disrupted in the hundreds of billions USD.

Despite the harm, dredging has a long history and is likely to continue in the future. Almost every single port in Australia, let alone the world, regularly dredges for upkeep in order to keep channels open and looks towards maintenance dredging to open the area for more port activity and increased profits. In response to UNESCO's committee on World Heritage demanding a decrease in port development, then MP Campbell Newman responded that "[they] will protect the environment but [they] are not going to see the economic future of Queensland shut down."[13] The fundamental issue of dredging lies in the clash between pursuing economic incentives from PDE and the future of ecosystems of importance.

Shipping

Similar to the contentious nature of dredging, critics of economic development sans regulation have long bemoaned the damages that PDE brings in the form of increased shipping traffic. Of course, some recognition must be paid to the fact that the entire purpose of port development and expansion is to increase shipping going into and out of the port, but it must still come in moderation. In recent years, there has been a major spike in demand for many materials

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[11]McCook, L., et al. *Synthesis of current knowledge of the biophysical impacts of dredging and disposal on the Great Barrier Reef: report of an Independent Panel of Experts.* Report. 2015.
[12]Teakle, Ian, et al. "Assessing the Impacts of Dredging in the Great Barrier Reef World Heritage Area." *Australasian Coasts & Ports Conference 2015.* 15-18 September 2015.
[13]Ibid.

that Australia exports,[14] demanding a matching increase in capacity at ports and from shipping routes across the region. As shipping by both amount and value continues to increase year after year, with some exception given to the disruptions of the COVID-19 pandemic, it is worth noting the impacts that increased maritime traffic will have on the health and well-being of the Great Barrier Reef.

The GBR Marine Park sees 10,000+ ships in a given year, ranging from personal fishing boats to massive cargo ships to those carrying tourists to military vessels.[15] Every ship, regardless of variety, carries the same threat of accident. Grounding, breakage of coral, disruption of water flows, noise pollution, oil or chemical spills, introduction of contaminants, or interaction with humans all cause damage to a variety of fragile parts of the Great Barrier Reef ecosystem.[16] Additionally, it is worth noting that the shipping industry can cause a loss in aesthetic value on the reef, impacting the tourism industry which is generally beneficial to the reef. Again, the exact numerical impact is hard to quantify, but it remains accepted that increased shipping is one of the two major components in the direct impacts felt on the Great Barrier Reef from Port Development and Expansion.

Policy Framework

Although dredging and increased shipping from PDE pose significant threats to the reef, these challenges have not gone unaddressed. From the start of conservation efforts towards the GBR, public officials sought to provide a legislative foundation for these matters to be dealt with, creating a strong precedent for the future. Hence, in order to fully comprehend the dangers

[14]Ibid.
[15]Australian Marine Conservation Soceity. “Dredging and Shipping Near the Great Barrier Reef.” 2022.
[16]White, Michael. “Sensitive Marine Environments and the Regulation of Shipping: The Great Barrier Reef Experience.” *Asia Pacific Journal of Environmental Law*, Vol 4, Issue 3. 1 July 1999.

of expanded dredging and shipping, it is important to first consider the existing structures that work to combat them.

Dredging

To start, the policy framework surrounding dredging is quite thorough, spanning across international, national, and state-based initiatives. On the global stage, Australia became a signatory to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) — also referred to as the London Protocol — in 2000. Under this treaty, the nation agreed to mitigate pollution caused by sea dumping, eliminating the negative effects of dredging whenever possible, with enforcement overseen by the Commonwealth Department of Environment.[17] Although this collective goal was already in place of much of Australia (and Queensland), joining this international mission helped reaffirm the country's focus, establishing an essential standard along with 42 other countries.[18] Thus, from a global perspective, Australia has participated in installing a legislative framework to address this issue.

Nevertheless, the country's efforts on a domestic scale have been far greater, using their individual authority to confront dredging. Ultimately, this endeavor began with the Great Barrier Reef Marine Park Act of 1975, where the Commonwealth required a permit to be used for all entities who intended to perform sea dumping in the Marine Park.[19] Through this process, public officials determine whether to provide approval for ships to access protected areas after considering environmental, economic, and social realities, forming a rigorous application process. Moreover, as time has progressed, these applications have become harder to gain

[17]Ports Australia. "Dredging and Australian Ports: Tropical and Subtropical Ports." April 2014.
[18]Ibid.
[19]Ibid.

approval, as both the type of dredging (capital or maintenance) and quantity of disposed materials (often needing to be less than 15,000 cubic meters) have come under more scrutiny.[20] Still, the Sea Dumping Act further expanded these powers in 1981, requiring frequent evaluations of waste disposal performance while granting oversight authority over these practices to the GBRMPA with permits.[21] Finally, in 1999, the passage of the Environmental Protection and Biodiversity Conservation (EPBC) Act helped delineate areas of national ecological significance, continuing the objective of protecting vital flora and fauna by requiring more permits for any operations in these locations. With the EPBC Act reviewed every 10 years, this undertaking has remained strong — a reality the Australian Government recognized in 2021 by investing $128.5 million in environmental efforts through this measure.[22] Given all of these key legislative items in place, the nation was able to create clear procedures for dredging, minimizing unnecessary damage.

In turn, these overarching laws allowed for an abundance of state-enforced policies to emerge, putting their practices into action. In 2009, this commenced with the National Assessment Guidelines for Dredging, which outlined the sampling and testing of disposed materials needed before sea dumping could occur.[23] Then, the GBRMPA's Dredging and Spoil Disposal Policy (2010) furthered this by preventing highly contaminated dredge material from being disposed of on the reef, offering management plans and monitoring in overseeing this process. Similarly, the GBRMPA's Water Quality Guidelines for the Great Barrier Reef Marine Park (2010), detailed the maximum concentrations of pesticides, sediments, and nutrients allowed in the GBR, stopping improper waste from being disposed of. Lastly, the Environmental

[20]Australian Government. *Great Barrier Reef Marine Park Authority*. "Checklist Application Information Dredging and Disposal." 31 August 2020.
[21]Ibid.
[22]Australian Government. *Department of Agriculture, Water, and the Environment*. "EPBC Act Reform." 15 March 2022.
[23]Ibid.

Impact Management Policy — produced by the same organization — broadens the authority of the GBRMPA, allowing them to take general action when assessing significant developments in the Marine Park. These policies, born from past legislation and enforced by the state of Queensland, have helped fill out the legislative structure on dredging, providing a comprehensive network centered around mitigating the impacts of dredging. Therefore, a significant framework addressing this challenge exists.

Increased Shipping

Though less elaborate than the framework that exists for dredging, notable policies and practices exist in response to increased shipping as well. With legislation, the Marine Park Act of 1975 is certainly the most important document in addressing this challenge, outlining protected zones in the area while mandating compulsory pilotage.[24] Subsequently, this mission was sharpened with the *Great Barrier Reef Zoning Plan* (2003), which organized shipping traffic into specific shipping areas — preventing possible miscommunications. Together, these regulations created the basis for all shipping routes through the GBR, ensuring any changes to the volume of vessels still align with the proper travel standards.

While these policies are quite significant, perhaps more important are the organizations that oversee these practices, participating in this legislative framework. On the global scale, the International Maritime Organization (IMO) is central in this system, particularly after classifying the Great Barrier Reef as a Particularly Sensitive Sea Area (PSSA) in 1990. This move directly allowed Australia to implement its own protective measures against shipping in the GBR, given that PSSAs are widely recognized for their environmental value. With 175 members, the IMO certainly aided Australia in combating shipping difficulties.[25] Moreover, domestic organizations

[24]Australian Government. *Australian Maritime Safety Authority.* "About Coastal Pilotage." 4 February 2020.
[25]Ibid.

also work to regulate shipping activities in the country. Notably, the GBRMPA, Australian Maritime Safety Authority (AMSA), and Maritime Safety Queensland all work to administer special measures, from navigation monitors to shore-based monitoring. With both national and state-based powers responsible for managing this potential threat, a strong policy network has emerged, encouraging bilateral cooperation. Therefore, the policy framework focused on the rise of shipping is strong as well, working to circumvent any difficulties.

Analysis of Policy

While it is clear that a sweeping policy structure exists to combat both dredging and increased shipping, the efficacy of these regulations still remains vehemently contested. Though proponents of these works claim they have done much to protect the reef, others are more cynical about the long-term impacts of such policies, advocating for more legislation in the future. Environmental improvements, while appreciated, can often be temporary. Hence, for both of these issues, it is necessary to examine their current impact on the GBR.

Dredging

To start, though difficulties remain, it is important to acknowledge the positive effects of recent legislation on dredging. Decades ago, the reality was grim. From 2003-2013 alone, the GBRMPA found that "902,154 cubic meters of capital dredge material and 362,392 cubic meters of maintenance dredge material were disposed of each year within the Marine Park," an abhorrent amount.[26] Worse, with expansions in progress for ports in Townsville, Abbot Point, Gladstone, and Hay Point, the organization projected a rise of "3–17 million cubic meters of capital and maintenance dredge material volumes for disposal" moving forward, with this threat

[26]Ibid.

exponentially worsening.[27] However, while dredging remains a problem, these fears were fortunately disproven. After the passage of the Sustainable Ports Development Act (2015), capital dredging was prohibited and PDE was restricted throughout Queensland (except for the four ports previously mentioned).[28] With this major development, dredging levels fell, protecting the reef in the meantime.

Yet, although this act improved the ecological treatment of the GBR, this positive change was short-lived. The following year, in 2016, the Planning Act heightening coastal development after being declared as "'assessable development,'" allowing for (among other items) dredging to resume in these areas.[29] With an operational works approval, capital dredging could be undertaken in land under tidal water, reasserting the challenges that this practice initially imposed on the environment. While this new legislation marred the advancements from the Sustainable Ports Development Act, later controversies drew questions about its success to begin with. In 2019, the GBRMPA approved "the dumping of more than 1 million tons of dredge spoil near the reef," grounding their decision in the fact that the waste came from maintenance dredging rather than capital dredging — the only practice banned in the act.[30] Not only did this cause some to question the GBRMPA's value, but it motivated others, like Greens Senator Larissa Waters, to petition for all types of sea dumping (including those from maintenance dredging) to be banned.[31] With backlash remaining, Waters' request may be the only path forward. Through adopting stricter regulations, banning sea dumping for all types of dredging, long-term beneficial changes to the environment can be created.

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[27]Ibid.
[28]Ibid.
[29]Australian Government. *Department of Environment and Science.* "Dredging and Allocation of Quarry Material Guidelines." 28 July 2021.
[30]Smee, Ben. "Great Barrier Reef authority gives green light to dump dredging sludge." *The Guardian.* 19 February 2019.
[31]Ibid.

Increased Shipping

With shipping, the situation has improved as well, despite remaining challenges. In 2013, the GBRMPA again shared worrying concerns, noting there had been "an annual average growth rate of 2.1 per cent" of individual ships in Queensland ports — largely due to more coal and mining demands.[32] Indeed, in 2012 alone, 3,950 ships docked at ports bordering the Great Barrier Reef.[33] With these sharp increases in vessels, the organization predicted this startling trend would worsen, encumbering ports entirely. However, this would also prove to be inaccurate due to the passage of new legislation. In 2014, the newfound North-East Shipping Management Plan strengthened shipping management by increasing oversight on travels through environmentally sensitive areas, redirecting routes as necessary. In turn, the number of ships has stabilized since 2014, with only small increases being reported each year.[34] Thus, given that fewer boats occupy the ports, this threat has been quite alleviated.

Similarly, however, while this legislation proved beneficial for a time, larger problems still remain. In particular, marine incidents on the water have continued to increase, with pollution-related disturbances reaching a total of 76 in 2019 — the highest mark in the last decade.[35] Though there is no singular reason for these increases, miscommunication over shipping routes have played a significant role in these incidents, with boats incorrectly identifying where their waste can be disposed of. While this issue currently exists outside the scope of the North-East Shipping Management Plan, the legislation could remedy the situation by incorporating the use of vessel arrival systems (VAS) for bulk commodity ports. VAS, which monitors the progress of ships once they are within 15 days of reaching their destination, allows

[32]Ibid.
[33]Ibid.
[34]Australian Government. *Great Barrier Reef Marine Park Authority.* "Outlook Report Shipping Infosheet." 2019.
[35]Queensland Government. *Department of Transport and Main Roads*. "Marine Incidents in Queensland." 2019.

operators to provide captains with better directions, eliminating any confusion.[36] With better technology, remaining difficulties can be further resolved. Therefore, though significant strides have been made in reducing the threats of increased shipping, more progress could be established for the future.

Conclusion

Environmental conservation is never finished. Dynamic, interconnected systems — especially those connected by water — will continuously push and pull at each other's equilibriums in a never-ending system. With each new development in technology or shift in trading patterns, ports create new activity patterns that impact the reef for better or worse. Part of the mandate of the federal, state, and local governments tasked with the management of the reef is to impose strict scrutiny on these economic systems that change the health of the ecosystem, intervening where necessary. Even as current policy frameworks successfully combat large amounts of the issue, there is always more that can be done to ensure that PDE is developed sustainably without substantial negative impact on the reef and surrounding ecosystem's health.

Moving forward, appropriate authorities must begin to respond to the trend of innovative and emerging technologies being implemented in a wide variety of fields, working to both regulate their harmful consequences and to integrate benefits into the system of reef management. At the most basic level, agencies can begin to expect changes in the technology used for dredging and manner of dredging itself.[37] Mandating a transition towards more sustainable patterns of technology use could not only stabilize the direct impact on the reef, but

[36]Australian Government. *Australian Maritime Safety Authority.* "North-East Shipping Management Plan." 20 January 2021.
[37]Ganic, Eldin. "Interview with HID Dredgers: Developing new types of dredgers to meet more market needs" *DredgingToday*. 17 November 2020.

also contribute to emission cutbacks to address the threat of climate change facing the reef. More drastically, entire industries that rely on ports for viability have begun to shift including both industries that have slowly fallen out of global fashion and those that are shining stars on the world stage. For instance, hydrogen energy has generated huge promise, especially in the region of Queensland,[38] and entirely new port infrastructure must be developed to respond to the emerging industry. This demands a drastic increase in PDE in the coming years, but the implementation of a sustainable energy system provides benefits far beyond the direct effect of infrastructure on the GBR's health.

Port authorities themselves are beginning to recognize the importance of sustainable development for their own continued productivity and are meeting strong environmental standards well past their regulatory requirements.[39] The integrated port system has turned its eye towards sustainability principles, choosing not only to lower their direct impact on the reef wherever possible but to invest in systems that contribute to the larger threat against climate change,[40] the GBR's greatest threat. Innovative ideas are explored and brought into the system when proven viable. The best example of this practice currently underway is the process of land reclamation, whereby ports addressed both the problem of dealing with dredged materials and lack of land space by essentially building new land for the port to expand onto.[41] As technology continues to change, governing authorities can expect to see more of this trend. Working in partnerships with the port authorities of Queensland to establish comprehensive 30-year development plans will provide a strong foundation for preventing damage on the GBR.

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[38]"One step closer to establishing Townsville as a Hydrogen cluster." *Townsville Enterprise*. 9 October 2021.
[39]Wheatley, Kim. Manager of Corporate Affairs, Port of Townsville. 13 June 2022.
[40]Ibid.
[41]Queensland Government. *Department of State Development, Infrastructure, Local Governments, and Planning.* "Townsville Port Expansion Project." 9 November 2021.

Dredging and maritime industries have long had a disastrous and painful footprint on coastal and marine ecosystems, much like the coral reefs of the Great Barrier Reef. As time has gone on, policymakers have appropriately recognized the dangers of unchecked development and worked to curb the negative impacts, but there is still more work to be done. Balancing critical economic issues with environmental conservation has long been and will long continue to be the greatest challenge facing policymakers in regards to management of the Great Barrier Reef, but it is critical to consider as Queensland writes a new port strategy in 2024. Bringing sustainability principles into economic industries as massive as maritime shipping is a drawn-out, multi-billion, multi-decade project, but the trends of both government regulation and private activity give hope for a cleaner, stronger reef in the future.

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