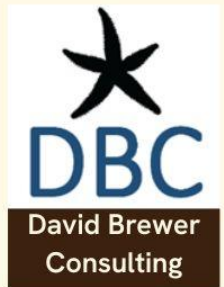




Sedimentation impacts in Moreton Bay: a priority
knowledge synthesis

IMPACTS:

Teleost Fish



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This impact statement is drawn from

Sedimentation Impacts in Moreton Bay, a priority knowledge-synthesis

The report was commissioned by The Moreton Bay Foundation in 2025 to summarise key evidence on how sedimentation affects Moreton Bay’s coastal and marine ecosystems, and the ecological and cultural values they support. The report brings together published and grey literature, conceptual models, and expert review to provide a clear, high-level understanding of sedimentation pressures, their impacts, and remaining knowledge gaps.

This standalone document can be found in the full report. Where references are made to other sections, these are indicated by this symbol: †. A full list of external citations, data sources, and methods used in this document is included in the complete report, available at **moretonbayfoundation.org**

David Brewer Consulting (DBC) has prepared this report for The Moreton Bay Foundation under the contract titled ‘TMBF Priority Knowledge Synthesis: Sedimentation Impacts in Moreton Bay’. Information about the Moreton Bay Foundation can be found at: <https://moretonbayfoundation.org/>

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Version: Final Report

Date issued: 2026

Issued to: The Moreton Bay Foundation

Citation: Brewer, D. T. and Milward, A. S. E. (2026) ‘Sedimentation Impacts in Moreton Bay: a Priority Knowledge Synthesis for The Moreton Bay Foundation’. TMBF, Brisbane, Australia. 244 pp.

Teleost Fish: Sedimentation Impact Statement

Status and trend summary

Table 1 provides a qualitative assessment of the teleost fish communities in Moreton Bay, highlighting their current condition, future trajectory and the impacts of sedimentation. Moreton Bay features a variety of habitats that collectively support a diverse teleost fish fauna ('fish' hereafter). The overall current condition of fish in the Bay is rated as 'Variable', with 'Medium' confidence. This reflects a lack of historic and current information for the status of most fish species. Although most commercially fished species are designated as 'sustainable' in fisheries data, many appear to be on a declining trend. Recreational fishing pressure is very high in Moreton Bay, but catch impacts are largely unknown. As there is ample evidence of modified fish habitats, including evidence of an impacted east-to-west habitat gradient, there is high confidence that sedimentation has driven some of the variability in the current status (condition) of some fish populations.

The condition trend is noted as 'Declining' and with 'High' confidence. This reflects (i) the impacts of sedimentation on key habitats (such corals, shellfish reefs, seagrass beds and soft bottom communities) on which many fish species are dependent, (ii) the decline seen in most commercially fished species, (iii) the large and increasing recreational fishing effort in the Bay, (iv) the impacts of nutrient loads which are causing algal blooms and other system imbalances, (v) the impacts of rising sea temperatures. However, the contribution of sedimentation to the trend is assessed as 'Major' with 'High' confidence. The breadth and impact of these combined pressures is likely to be variable between species. While the impacts of climate change, including the frequency of large floods and associated sediment loads, are on an increasing trend. It also seems clear that, without substantial reversals of habitat loss due to sedimentation, the majority of fish species will remain on a declining trend.

Table 1. Qualitative assessment of the overall status and trend in condition, and of the likely severity and direction of sedimentation-specific impacts, for fish populations in Moreton Bay.

| Value condition assessment | Assessment | Confidence |
|--|------------|------------|
| Current condition | Variable | Medium |
| Contribution of sedimentation to the current condition | Variable | High |
| Condition trend | Declining | High |
| Contribution of sedimentation to trend | Major | High |



Goldspotted
sweetlip (*Plectorhinchus
flavomaculatus*)

Overview

Moreton Bay is recognised as a heterogeneous seascape featuring a mosaic of habitats that collectively support a diverse fish fauna (Olds *et al.*, 2019) (Figure 1). The Moreton Bay Marine Park and adjacent continental shelf waters comprise at least 1,138 fish species (Johnson, 2010). This high diversity reflects the Bay's subtropical location, supporting both tropical and subtropical taxa. Approximately one-third of the fish species in the region are at the latitudinal extremes of their known distribution (Olds *et al.*, 2019). Fish diversity is typically highest on reefs and seagrass meadows, and comparatively lower in shallow mangroves and over unconsolidated soft sediments (Olds *et al.*, 2019).

No-take marine reserves have been enhancing fish abundance and diversity in specific ecosystems, including coral reefs and seagrass meadows, and contributing to the recovery of overfished species (Olds *et al.*, 2019). However, this is not necessarily the case in other ecosystems, like estuaries and ocean beaches, where reserves are small and/or shallow, limiting their benefits for fish (Henderson *et al.*, 2017; Olds *et al.*, 2019; Gilby *et al.*, 2019a). Restoration of impacted habitats, such as shellfish reefs, can also contribute to the recovery of fish communities (Gilby *et al.*, 2021), including by supporting higher fish species richness and the abundance of harvestable fish (Gilby *et al.*, 2019b, c).

Population status

Despite the diverse fish fauna in Moreton Bay, there is little monitoring of the status or health of most fish populations (Dr. Jeff Johnson, Qld Museum, Pers. Comm.). However, fish communities have been well studied in recent times, especially in relation to habitat associations and condition (e.g. Gilby *et al.*, 2018, 2021; Henderson *et al.*, 2017, 2020, 2021, 2024).

Most commercially fished species (a small subset of the Bay's fish fauna) undergo periodic fishery assessments (Teixeira *et al.*, 2021), and their population status is described in the main report (**† Section 5.15**). This section identifies and describes 14 commercially fished species where an assessment for Moreton Bay could be inferred (from state-wide data). Most of these 14 species are assessed as 'Sustainable', although almost all show a declining trend in catches.



Figure 1. Fishes of Quandamooka, Moreton Bay. (a) Grubfish (*Parapercis* sp), photo credit: C. van der Berg; (b) Lionfish (*Pterois* sp.), photo credit: C Roelfseama; (c) *Holocentridae* sp, Photo credit: C. van der Berg.

A broader suite of fish species is also harvested by recreational fishers, including many of the commercially harvested fish species. However, their status is not assessed elsewhere, other than those species involved in the commercial fishery assessments or assessments triggered by national or international listing process for threatened species (e.g. several shark and ray species – see † **Section 5.10**).

The fish fauna of mangroves, seagrasses, inshore reefs, and intertidal flats are well sampled (e.g. Tibbetts and Townsend, 2010; Olds *et al.*, 2012; Henderson *et al.*, 2017; Gilby *et al.*, 2018a; Olds *et al.*, 2019; Henderson *et al.*, 2021, 2024). By contrast, fish surveys in saltmarshes, soft sediments, offshore reefs and surf zones are fewer or incomplete (Olds *et al.*, 2019). Fish diversity and abundances are typically highest on reefs and seagrass meadows, but most species move among habitats to feed and spawn (Olds *et al.*, 2019). These movements connect habitats and link both fish assemblages and food webs across seascapes. However, the combined effects of water quality, coastal urbanisation and fishing also shape fish assemblages in Moreton Bay (Gilby *et al.*, 2016; Olds *et al.*, 2018, 2019; Henderson *et al.*, 2024).

Impacts on populations

Human actions have substantially altered fish assemblages and habitats in Moreton Bay (Olds *et al.*, 2019). Sedimentation, pollution and water quality degradation have contributed to declines in the ecological condition of specific habitats like seagrass meadows, coral reefs, and soft-sediment epibenthic communities. These changes in habitat condition have, in turn, altered the composition of fish assemblages and ecological functioning of these ecosystems (e.g. Gilby *et al.*, 2016; Olds *et al.*, 2019; Thurstan *et al.*, 2019; Henderson *et al.*, 2020). The shorelines of many estuaries and ocean beaches have also been developed, further degrading and reducing natural fish habitats (Olds *et al.*, 2019). Current ongoing monitoring will be critical to the continuing understanding of fish populations in Moreton Bay.

Fishing is one of the most significant human pressures on fish in the Bay (Olds *et al.*, 2019). Many teleost species are harvested by recreational and commercial fishers (Olds *et al.*, 2019). In the Brisbane and Moreton regions in 2019-20, an estimated 350,000 recreational fishers put effort into fishing in this region (Olds *et al.*, 2019). However, the impact of these fishers on fish populations is largely unknown.

Changes in water quality have detrimentally impacted fish habitats and led to alterations in fish assemblages in estuaries, seagrass meadows, and coral reefs (e.g. Henderson *et al.*, 2017; Gilby *et al.*, 2019a; Olds *et al.*, 2019; Henderson *et al.*, 2024; J. Johnson, Qld Museum, pers. comm.; also see other impact statements in the **main report †**). This includes the impacts of sedimentation, which are explored further in the Impacts of sedimentation section below.

Rising sea temperatures have likely led to the movement of some species' distribution to the south of the Bay (e.g. Last *et al.*, 2011), such as Luderick (*Girella tricuspidata*) and Golden-lined spinefoot (*Siganus lineatus*) (J. Page, pers. comm.), and are expected to lead to the arrival of more tropical fish species in the Bay (Olds *et al.*, 2019).

This southern shift in distribution of some historically more tropical species has been a notable change over the past decade or so (Last *et al.*, 2011). For example, the Whipfinn silver biddy (*Gerres filamentosus*), the Common ponyfish (*Leiognathus equulus*) and the Black sand bass (*Psammoperca datnioides*), which were absent or rare in Moreton Bay latitudes prior to the 2000s, are now more common (J. Johnson, Queensland Museum, pers. comm.). Such shifts in distribution are also becoming a substantial and additional influence on the structure of Moreton Bay ecosystems and the status of fish populations.

Value

Ecological value

The fish in Moreton Bay hold significant ecological value by playing crucial roles in maintaining the health, structure, and functions of the Bay's diverse marine ecosystems (Olds *et al.*, 2019). Fish use a variety of habitats and often migrate between them. There is empirical evidence of fish foraging in diverse habitats like saltmarshes, mangroves, intertidal flats, seagrasses, surf zones, and rocky and coral reefs (Olds *et al.*, 2019). The combination of fish movement and fish ecological functions (e.g. herbivory, predation, scavenging) is essential for sustaining biodiversity, maintaining the structure of food webs, and influencing the composition of benthic communities, including coral reefs, seagrass meadows, and kelp forests (Tibbetts and Townsend, 2010; Pearson and Stevens, 2015; Olds *et al.*, 2019). For example, herbivorous fish actively consume algae that could otherwise overgrow seagrasses and corals (Olds *et al.*, 2019). This grazing activity enhances the resilience and recovery capacity of these ecosystems, particularly after disturbances such as floods (Olds *et al.*, 2019). For example, the Dusky rabbitfish (*Siganus fuscescens*) is a key herbivore on seagrass meadows and coral reefs near mangroves, reducing turf algae cover and increasing coral recruits (Gilby *et al.*, 2019a; Henderson *et al.*, 2020). Other key grazing fish include acanthurids, pomacentrids, and other siganids (Tibbetts and Townsend, 2010). However, another herbivore, Luderick, appears to have shifted its distribution to south of the Bay (see Impacts on populations section above), demonstrating a potential loss of resilience for some habitats in the Bay.

Cultural value

The fish fauna of Moreton Bay has historically been of immense cultural, social, and economic value to Indigenous Australians, and the region remains an important fishing area for them today (Olds *et al.*, 2019; Thurstan *et al.*, 2019). The Quandamooka people, comprising the Nunukul, Ngugi, Goenpul, and Gubbi Gubbi (also known as Kabi Kabi) peoples, continue to catch fish and shellfish as part of their traditional way of life, with mullet being culturally and economically significant (Thurstan *et al.*, 2019).

Traditional Custodians have a deeply held cultural responsibility, often referred to as a 'custodial ethic', to care for the waterways, which includes looking after fish populations and their habitats (Ross *et al.*, 2019a).

Economic value

There are eight fish groups targeted commercially and assessed by QDPI in Moreton Bay: Sea mullet (*Mugil cephalus*), Sea bream (e.g. Yellowfin bream, *Acanthopagrus australis*), whiting (*Sillago spp.*), Tailor (*Pomatomus saltatrix*), Snapper (*Chrysophrys auratus*), flathead (*Platycephalus spp.*), Teraglin (*Atractoscion aequidens*) and Pearl perch (*Glaucosoma scapulare*) (Thurstan *et al.*, 2019). Another 13 species groups are commercially fished in the Bay, along with other regions in Queensland (see † **Section 5.15**). Wild-caught commercial fisheries in Moreton Bay contributed an estimated \$24–\$30 million per annum to the economy, making it the most important region in the state by volume and value of fish per unit area (Thurstan *et al.*, 2019). The Fisheries Research and Development Corporation (FRDC) information on Queensland fisheries (see www.fish.gov.au/jurisdiction/queensland) indicates that the commercial fish sector in Queensland is dominated by fish species, but also includes a range of sharks, crustaceans, and molluscs (Fisheries Research and Development Corporation, 2023b).

Recreational fisheries are also a significant economic activity in Moreton Bay, and similarly dominated by fish. Common catches include Trumpeter Whiting, Yellowfin Bream, Sand Whiting, Snapper and Tailor (Thurstan *et al.*, 2019). Approximately one-third of Queensland's anglers live in the Brisbane region around Moreton Bay (Thurstan *et al.*, 2019). Direct expenditure by the recreational sector in Moreton Bay is estimated to be between \$156 million and \$194 million per annum (Thurstan *et al.*, 2019).

History

The history of fish populations in Moreton Bay reveals a dynamic landscape shaped by both natural forces and escalating human impacts, leading to significant alterations in species abundance, diversity, and ecosystem function over time (Olds *et al.*, 2019). For thousands of years prior to European settlement, Indigenous peoples (such as the Quandamooka people) consistently harvested fish from Moreton Bay, with fishing and hunting being central to their cultural identity and practices (Thurstan *et al.*, 2019). However, historical evidence suggests large marine vertebrate populations in the Bay are 'severely degraded' compared to pre-human times (Pierce, 2008).

With European settlement beginning in 1824, Moreton Bay was treated as an open-access 'commons', leading to unrestricted exploitation of fish and other marine animals for commercial and recreational purposes (Ross *et al.*, 2019b). Indigenous traditional fishing methods were often interrupted or halted (Thurstan *et al.*, 2019). From 1944–1981, commercial catches were dominated by Sea Mullet, Yellowfin Bream, whiting, Tailor, prawns, and crab species; with Sea mullet being the fish landed in the greatest quantities (Thurstan *et al.*, 2019).

Fish assemblages have been substantially altered by human actions for many decades, including water quality degradation, coastal urbanisation, and fishing (Olds *et al.*, 2019). For example, increases in nutrient, phosphate, and metal loading since European settlement have led to a minimum 10-fold increase in algal production

(Diggles, 2013) and subsequent impacts on fish habitats by altering the composition and abundance of fish in estuaries, seagrasses, and coral reefs (Olds *et al.*, 2019). The impacts include changes to the diversity and abundance of fish. Development of shorelines, canals, and artificial lakes has altered fish diversity, abundance, and diet in estuaries and surf zones in a variety of ways, including some species that have adjusted their diet to adapt to urban environments (e.g. Yellowfin bream, Snub-nosed garfish [*Arrhamphus sclerolepis*]) (Olds *et al.*, 2019).

Impacts of sedimentation

The impacts of sedimentation on epibenthic bivalve reefs in Moreton Bay are broadly described in the conceptual model (Figure 2). Sedimentation has significantly impacted fish populations and their habitats in Moreton Bay since 1824, primarily due to European land-use practices and urban development (Olds *et al.*, 2019). Increased sediment loads into the Bay have detrimentally impacted critical fish habitats, such as seagrass meadows, coral reefs, estuaries, mangroves, shellfish reefs and soft-sediment communities (Olds *et al.*, 2019; Gilby *et al.*, 2021). Sediment acts as a sink for persistent pollutants, such as trace elements (including legacy metals), which have shown increasing concentrations since the 1920s due to industrial, agricultural, and urban development (Townsend *et al.*, 2019). During flood events or when water quality is disturbed, these sediment-bound pollutants can be liberated and become toxic to marine life, including fish (Townsend *et al.*, 2019).

Grinham *et al.* (2024) describe the increase in sedimentation in the Bay in recent decades and note that:

- During major flood events, surface water nutrient and turbidity levels are elevated to 10 times above background.
- Fine sediment deposition has now impacted 98% of Moreton Bay.
- Porewater ammonium concentration can be elevated to 1000 times higher than surface waters.
- Annual sediment ammonium flux can be elevated to 180 times larger than the region's point source inputs.
- The 'clean sand' sediment class has been reduced in Moreton Bay from 442 km² to 30 km² in 50 years.

The elevated turbidity and sediment loads, particularly in the western and southern parts of the Bay, have substantially altered the composition and abundance of fish assemblages (Diggles, 2013). For example, Gilby *et al.* (2021) have shown that the effects of sedimentation and related disease have severely reduced shellfish reefs' biomass in the Bay, substantially reducing the overall carrying capacity for fish (production) in large areas of the Bay. This has now been shown in virtually all habitats in the bay (C. Henderson, pers. comm.). This west-to-east gradient in sedimentation and water quality is reflected in the corresponding decrease in fish diversity and abundance, which typically occurs along this gradient (Olds *et al.*, 2019). Increased

sedimentation and turbidity can also lead to reductions in food availability and overall environmental quality, directly affecting fish growth, recruitment, and mortality rates across various trophic levels (Henly *et al.*, 2000).

Overall, Moreton Bay's fish populations, although still diverse, have undergone significant modification. Furthermore, pressures on fish populations in the Bay are likely to be increasing, along with a trend of increasing large floods and their associated sediment loads (Ball *et al.*, 2019; Olds *et al.*, 2019; Henderson *et al.*, 2024).

Furthermore, the negative consequences of flooding, such as habitat destruction, water quality degradation, and increased water velocity, can persist for periods of up to several years or more (Henderson *et al.*, 2024). Effective conservation strategies require addressing broad catchment management to reduce sediment and nutrient loads (Diggles, 2013; Gilby *et al.*, 2016). However, achieving significant, scientifically recommended reductions and associated synergistic benefits may face considerable financial and political challenges (Gilby *et al.*, 2016).

Recommendations

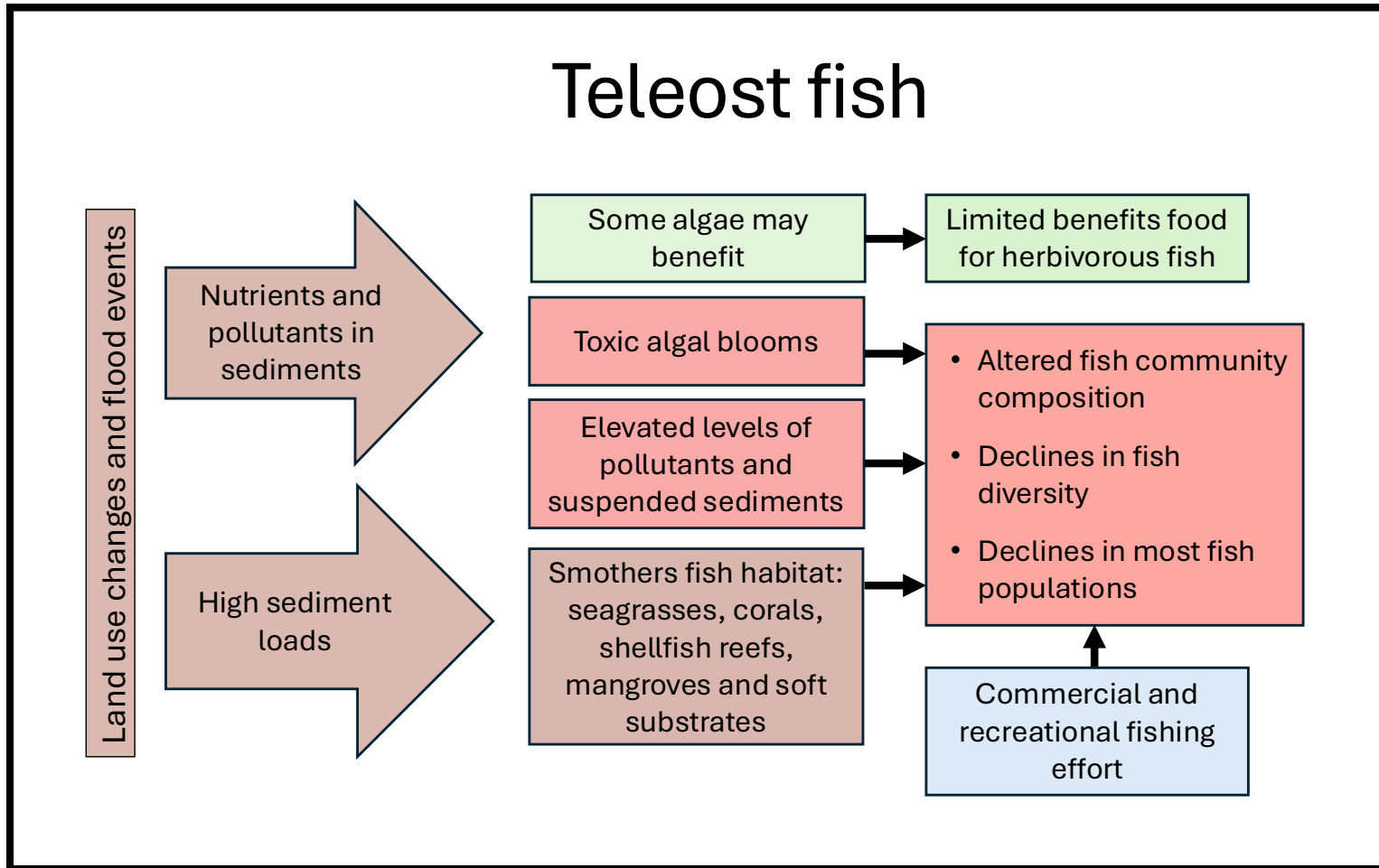
1. A broader "land-to-sea" integrated catchment management framework is necessary to manage the full suite of impacts from catchment-borne sedimentation and water quality degradation that affects coastal ecosystems and has negative impacts on fish yields (Gilby *et al.*, 2018b).
2. Substantially reduce terrestrial runoff to reduce the impacts of sedimentation, eutrophication and hypoxia on key benthic habitats (Gilby *et al.*, 2018b).
3. Place reserves in resilient areas of Moreton Bay where flood impacts, which often bring increased sedimentation, are lower (Gilby *et al.*, 2019a).
4. Prioritising restoration and managing estuarine habitats closer to the mouth of estuaries should be a key target. These areas are frequent transition zones for many fish species and are more likely to recover quickly from disturbances, such as floods, which increase sediment runoff (Henderson *et al.*, 2024).
5. Maximise the extent of natural habitats across estuaries for mediating the effects of floods and maintaining biodiversity and fisheries productivity (Henderson *et al.*, 2024). Maintaining or restoring natural habitats, such as mangrove forests, especially those closer to the estuary mouth, can help mitigate the deleterious effects of nutrient and sediment runoff from urbanised areas. These habitats can buffer waves and absorb nutrients during flood events (Henderson *et al.*, 2024).

Expert review

Dr Christopher (Chris) Henderson (Senior Lecturer in Animal Ecology, University of the Sunshine Coast) kindly provided an expert review of the Teleost fish: Sedimentation Impact Statement.

Conceptual model - impacts of sedimentation on teleost fish

Figure 2. Conceptual model that qualitatively describes the major impacts of sedimentation on fish communities in Moreton Bay. Brown boxes signify sedimentation-related processes; blue boxes signify other relevant and interacting consequential inputs or impacts; red boxes signify adverse impacts/outcomes; green boxes indicate likely positive or neutral impacts/outcomes.



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This impact statement is drawn from
***Sedimentation Impacts in Moreton Bay,
a priority knowledge-synthesis***

The report was commissioned by The Moreton Bay Foundation in 2025 to summarise key evidence on how sedimentation affects Moreton Bay's coastal and marine ecosystems, and the ecological and cultural values they support. The report brings together published and grey literature, conceptual models, and expert review to provide a clear, high-level understanding of sedimentation pressures, their impacts, and remaining knowledge gaps.

This standalone document corresponds to **Section 5.11** of the full report. A full list of external citations, data sources, and methods used in this document is included in the complete report, available at

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