



WWF

REPORT

2015

THE GREAT BARRIER REEF

UNDER THREAT

A REPORT FOR WWF BY

Dalberg

WWF

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WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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WWF'S CALL FOR ACTION TO PROTECT THE GREAT BARRIER REEF

THE GREAT BARRIER REEF IS THE WORLD'S LARGEST CORAL REEF SYSTEM AND ONE OF THE PLANET'S MOST DIVERSE HABITATS. IT CREATES AN ECONOMIC VALUE OF NEARLY US\$5.8 BILLION ANNUALLY AND SUPPORTS ALMOST 69,000 FULL-TIME JOBS IN THE AUSTRALIAN STATE OF QUEENSLAND.

However, the Great Barrier Reef is under significant threat; more than half of the reef's coral cover has disappeared over the past 30 years due to a combination of factors, including climate change and water pollution.

Now a new threat is looming over this fragile World Heritage Site. If plans to continue expanding ports are allowed to advance, this already vulnerable ecosystem will come under unacceptable stress. Up to an estimated 51 million cubic metres of seabed could be dredged to enable thousands more ships to reach ports. Alarmingly, up to an estimated 39 million cubic metres of the dredge spoil could be dumped within the site's World Heritage waters. The process of dredging and dumping is known to destroy, damage and smother coral reefs, and can kill seagrass meadows that threatened species depend on for food. Plumes of dredge spoil, which may contain toxic contaminants, can drift up to 80 kilometres from where they were dumped.

Based on the findings of *The Great Barrier Reef Under Threat*, WWF urges the Australian government, World Heritage Committee members, financial institutions, the private sector and non-governmental organizations (NGOs) to take immediate steps to protect the Great Barrier Reef from the impacts of expanding industrialization.



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WWF CALLS ON THE AUSTRALIAN GOVERNMENT TO:

- Ban all dumping of dredge spoil in the Great Barrier Reef World Heritage Site.
- Avoid all unnecessary dredging in the Great Barrier Reef World Heritage Site and minimize the impact of maintenance dredging.
- Reverse the decline in water quality within the next decade by passing legal reforms and by making major new investments to reduce land-based pollution and to restore river catchments.
- Uphold its commitment as a state party to the World Heritage Convention to maintain the reef's *outstanding universal value* and to ensure full protection of the property.

WWF CALLS ON WORLD HERITAGE COMMITTEE MEMBERS TO:

- Hold the Australian government accountable for implementing World Heritage Committee decisions. Previous decisions have requested a comprehensive strategic assessment of the entire property and a long-term plan for the sustainable development of the Great Barrier Reef that is adequately financed and effectively managed.
- Encourage all state parties to the World Heritage Convention to adopt in their national legislation *no-go* and *no-impact* provisions related to mining, oil and gas exploration and exploitation in natural World Heritage Sites.

WWF CALLS ON FINANCIAL INSTITUTIONS AND PRIVATE SECTOR ENTITIES TO:

- Commit not to finance or participate in projects that could threaten the *outstanding universal value* of the Great Barrier Reef or any other World Heritage Site.
- Examine their portfolio holdings and projects through the lens of responsible business conduct and consider risks such as stranded assets, reputational, and operational – particularly in the case of World Heritage Sites.
- Publicly demonstrate commitment to adhering to the Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises and other best practice standards.

WWF CALLS ON ALL GOVERNMENTS TO:

- Publicly declare support for the protection of the Great Barrier Reef and other World Heritage Sites through official statements.
- Use appropriate policy mechanisms including the OECD Guidelines for Multinational Enterprises to ensure that companies respect all World Heritage Sites.
- Hold accountable those companies proven to circumvent national laws or international treaties in the pursuit of unsustainable financial gains.

WWF URGES ALL CONSERVATION GROUPS AND NGOS TO CONTINUE TO IMPROVE OUR COORDINATION TO ENSURE THAT THE GREAT BARRIER REEF AND ALL THE OTHER NATURAL WORLD HERITAGE SITES ARE PROTECTED FROM INDUSTRIAL DESTRUCTION.

EXECUTIVE SUMMARY

In the last 30 years, as a result of pressures including water pollution and climate change, more than half of the Great Barrier Reef's coral cover has disappeared.¹

The planned expansions of ports along the coast of the Australian state of Queensland, which would be used for coal and liquefied natural gas (LNG) exports as well as for other purposes, pose additional threats to the Great Barrier Reef. Several expansions have already been approved and are underway. The combination of existing pressures and new coastal infrastructure could result in the Great Barrier Reef, inscribed as a UNESCO World Heritage Site since 1981, being listed as "in danger."²

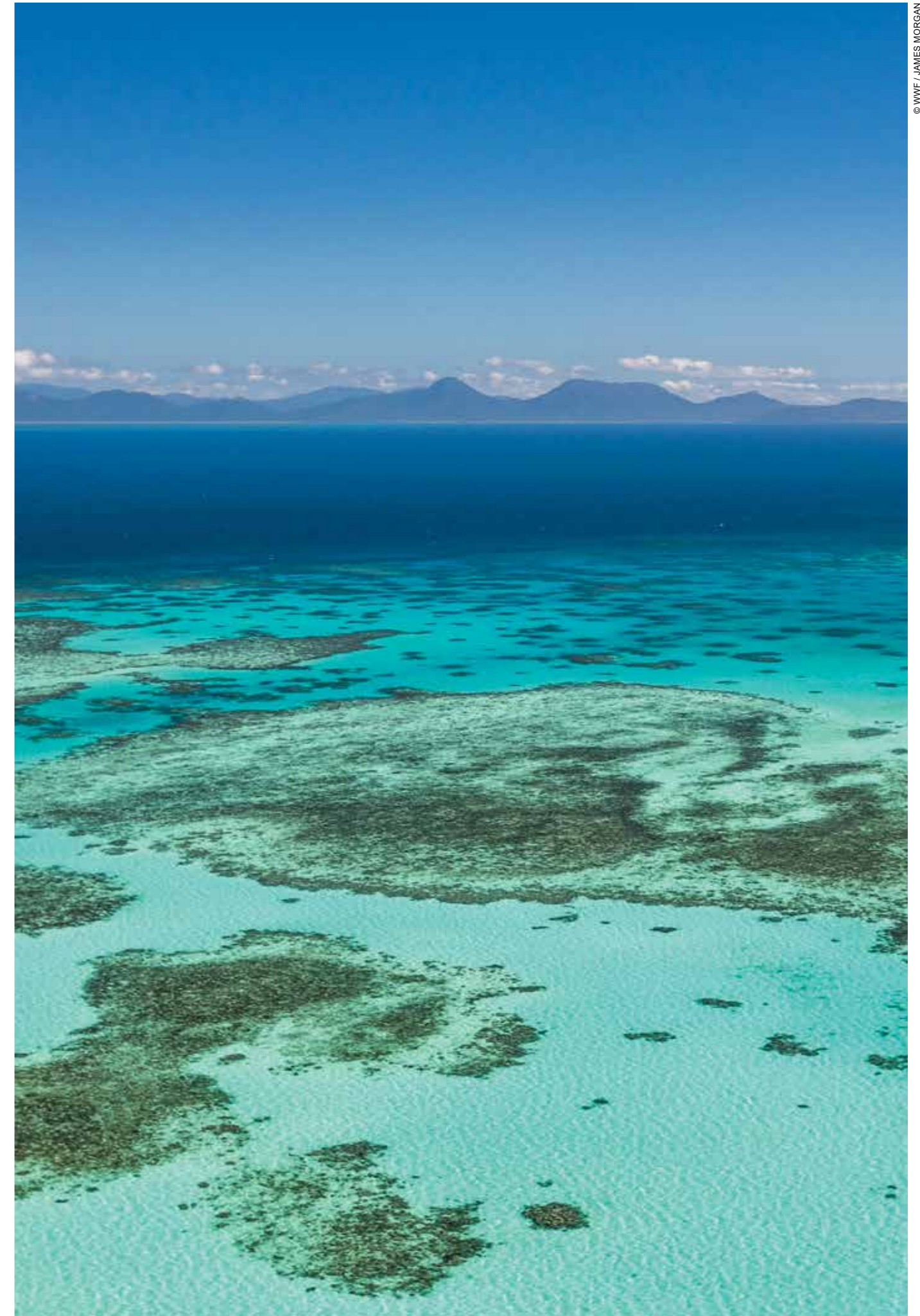
To build and expand these ports, up to an estimated 51 million cubic metres of the seabed could be dredged from Great Barrier Reef World Heritage Site.³ That is the equivalent of 49 times the volume of New York City's Empire State Building.⁴ Currently, there is no ban on the dumping of this material, referred to as dredge spoil, in the Great Barrier Reef World Heritage Site. As a result, up to an estimated 39 million cubic metres of dredge spoil could be dumped in the reef's World Heritage waters,⁵ in addition to the 28 million cubic metres dumped between 2001 and 2013.⁶

Dredging and the dumping of dredge spoil in the reef have devastating impacts on the marine ecosystem. Recent evidence has shown that dredging can more than double the level of coral disease in nearby reefs.⁷ When dumped offshore, dredge spoil can create plumes of fine sediment that can drift up to 80 kilometres from the dumping site. These plumes can interfere with the coral's ability to survive and reduce the light available to seagrass for photosynthesis.⁸ In view of the environmental risks associated with port expansions in the reef, many financial institutions have chosen not to participate.

Many of the new terminals proposed under the port expansion plans would be used to export coal. If realized, the ports would more than double the area's current coal export capacity.⁹ Up to an estimated 21 million cubic metres of the total proposed dredging could be linked to coal terminal expansions.¹⁰ However, these expansions may not be needed. The price of coal has fallen by 40 per cent since 2011, and forecasts from the International Monetary Fund predict the price of Australian coal to plateau at just under US\$75 per metric ton from 2015 until at least 2019.¹¹ With the decline in coal prices, forecasts for coal production and exports have also fallen. Some planned coal mine and coal port expansions have been cancelled as a result. Yet, both the Australian federal government and the Queensland state government continue to pursue the reef projects and are offering financial incentives to companies.

The Great Barrier Reef is worth protecting from the threats posed by port expansions. Annually, the reef generates an economic value of almost US\$5.8 billion¹² for Australia, and it also supports the equivalent of almost 69,000 full-time jobs.¹³ Moreover, the Great Barrier Reef is an international hub for scientific and tropical marine ecosystem research, directly generating over US\$100 million per year through its research activities.¹⁴ Worldwide research into coral reef organisms has contributed to the development of a wide range of treatments, including for diseases such as cancer and HIV.¹⁵

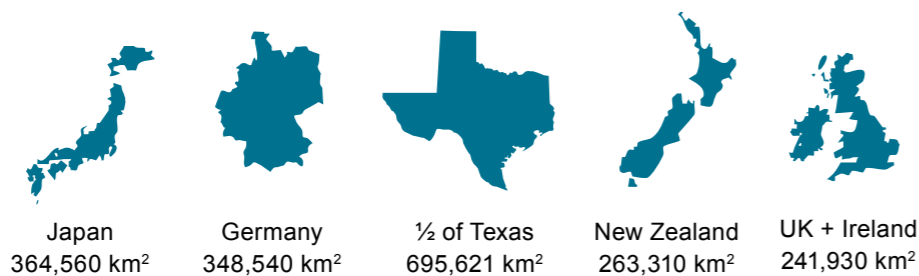
The Great Barrier Reef's unrivalled scale, unique biodiversity and cultural heritage make it a distinctive site of *outstanding universal value*, as recognized by UNESCO, which should be maintained for future generations.



THE GREAT BARRIER REEF IS DISAPPEARING

THE GREAT BARRIER REEF IS THE WORLD'S LARGEST CORAL REEF ECOSYSTEM.

Covering an area of 348,000 square kilometres,¹⁶ it is equal in size to Germany. The Great Barrier Reef World Heritage Site stretches 2,300 kilometres along the coast of the Australian state of Queensland and includes over 2,900 reefs and around 1,050 islands and cays.¹⁷ It is also comparable in size to Japan or half of the US state of Texas. The reef is substantially larger than New Zealand and bigger than the UK and Ireland combined.¹⁸



THE GREAT BARRIER REEF IS ONE OF THE PLANET'S MOST DIVERSE ECOSYSTEMS.

One-third of all soft coral varieties can be found there, along with 411 kinds of hard coral.¹⁹ It is a refuge for 25 marine species threatened with extinction, including one of the largest dugong populations and six species of marine turtles.²⁰ In fact, Raine Island is one of the world's largest nesting beaches for the endangered green turtle.²¹ The Great Barrier Reef also supports more than 30 species of marine mammals. It is home to more than 1,600 species of fish, about double the 747 species of fish found in the Mediterranean Sea.²² It also contains 136 species of sharks and rays, whereas just 34 species of sharks have been recorded off the entire Pacific coast of North America.²³ The reef is also the habitat of 3,000 molluscs, thousands of different sponges, worms and crustaceans, and 630 species of echinoderms, which include starfish and sea urchins.

HALF OF THE GREAT BARRIER REEF'S CORAL COVER HAS DISAPPEARED IN THE PAST 30 YEARS.

Between 1986 and 2012, the overall cover of hard coral in the Great Barrier Reef fell from 28 per cent to 13.8 per cent.²⁴ In the southern third of the reef, the rate of coral degradation has been the most severe. Between 2006 and 2012, coral cover in that area declined from about 35 per cent to just 8 per cent.²⁵ That's a loss of over three-quarters in just six years. The loss is due to a combination of factors, including tropical cyclones, coral bleaching and water pollution. While coral reefs have a natural ability to recover from periodic disturbances such as cyclones, exposure to chronic pressures, such as rising temperatures, poor water quality and elevated nutrient levels in the water, can reduce their resilience.

CLIMATE CHANGE PUTS THE FUTURE OF THE GREAT BARRIER REEF IN DOUBT.

The Great Barrier Reef Marine Park Authority warns that climate change is the most serious long-term threat to the Great Barrier Reef: "Climate change... is already affecting the reef and is likely to have far-reaching consequences in the decades to come."²⁶ Increased water temperature is the most common cause of a damaging process called coral bleaching, which often leads to the death of these fragile

animals. Bleaching occurs when an important marine algae, called zooxanthellae, separates from the coral.²⁷ This algae lives within the tissue of the coral and is a major source of its energy. As a result of the separation, the coral's fleshy tissue appears transparent revealing its white skeleton below. Once bleached, most corals begin to starve. Persistently high water temperatures can cause corals to die.²⁸ There have been a number of mass bleaching events in the Great Barrier Reef in recent years.²⁹ In 2002, the reef experienced the most extensive coral bleaching event on record: 60 per cent of its coral was bleached and another 5 per cent was severely damaged.³⁰ In addition, increased ocean acidity, due to the absorption of carbon dioxide, hinders coral growth, meaning that damaged corals struggle to recover.³¹

INCREASED WATER POLLUTION IN THE GREAT BARRIER REEF IS HAVING A MAJOR IMPACT ON ITS HEALTH AND RESILIENCE.

The amount of sediment flowing into the Great Barrier Reef has quadrupled over the past 150 years.³² This increase can be attributed largely to the expansion of grazing and farming in its water catchment. Rain and water from agricultural irrigation carry sediments, excess fertilizer and pesticides into rivers that empty into the reef.³³ About 15 per cent³⁴ of the Great Barrier Reef has been affected directly by this type of pollution, which disrupts the reef's natural balance. Sediments can smother coral reefs, and particles suspended in the water can reduce the amount of sunlight that gets through, which hinders the ecosystem's productivity.

When washed into the reef, fertilizer nutrients and nitrogen from animal waste can trigger a chain reaction with many negative effects. Run-off provides food to microscopic phytoplanktons, which themselves help crown-of-thorns starfish larvae to develop. Crown-of-thorns starfish are a major predator of coral³⁵ and have caused an estimated 42 per cent of all Great Barrier Reef coral deaths over the past three decades.³⁶ It is believed that pollution likely has led to the increased frequency of crown-of-thorns starfish outbreaks in recent years.³⁷

Additionally, even at low concentrations, pesticides make it more difficult for coral embryos to develop, which makes it harder for coral populations to grow back.³⁸ The Australian federal and Queensland state governments collectively have spent approximately US\$350 million³⁹ between 2009 and 2013 to improve the reef's water quality; this investment has resulted in annual improvements of 1-2 per cent.⁴⁰ Voluntary actions taken by farmers to cut their levels of pollution are commendable, but greater financial assistance is needed for the industry to achieve the reductions necessary.

"Coastal reefs have been obliterated by runoff of sediment, dredging, and pollution. Once-thriving corals have been replaced by mud and seaweed... We have affected their survival, growth, and reproduction, which is the real reason why coral cover has been declining for many decades."

Terry Hughes, head of the Australian Research Council Centre of Excellence for Coral Reef Studies in "Great Barrier Reef: World Heritage in Danger?" National Geographic. June 2013⁴¹

PLANNED PORT EXPANSIONS FURTHER THREATEN THE GREAT BARRIER REEF

THE GREAT BARRIER REEF IS UNDER THREAT FROM A SERIES OF PORT EXPANSIONS AND INFRASTRUCTURE PROJECTS ALONG THE QUEENSLAND COAST.

There are currently twelve ports in the World Heritage Site, including four major ports: Abbot Point, Gladstone, Hay Point and Townsville. In fiscal year 2011-2012, approximately 200 million tonnes of imports and exports were shipped through the twelve ports. Coal represented 63 per cent of the throughput volume, petroleum products made up 6 per cent, and metals and minerals accounted for 5 per cent.⁴² The remainder consisted of other cargo including agricultural products and other commodities.

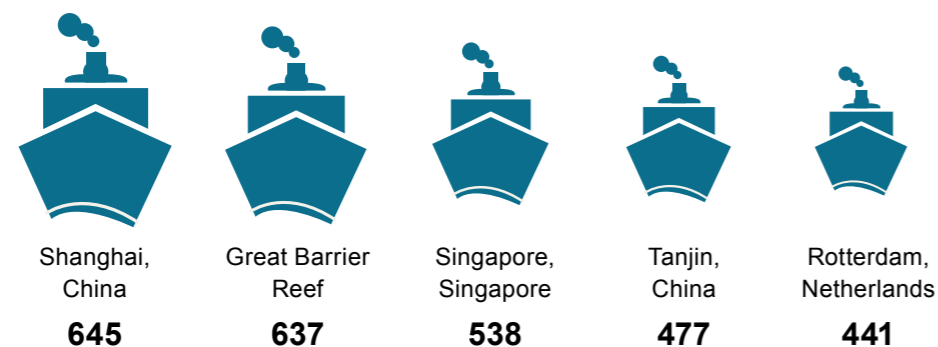
There are plans for major port expansions for coal, gas and other purposes, and several are approved and underway.

PLANNED COAL PORT EXPANSIONS COULD MORE THAN DOUBLE THE AMOUNT OF COAL CURRENTLY PASSING THROUGH THE GREAT BARRIER REEF.

In calendar year 2013, Australia was the world's second largest coal exporter.⁴³ In fiscal year 2013-2014, Australia produced 432 million tonnes of thermal and metallurgical coal, of which it exported 375 million tonnes.⁴⁴ Over the past few years, Australia has moved forward with plans to expand coal mining in the state of Queensland, including in the state's Galilee, Bowen, and Surat coal basins. The country's Bureau of Resources and Energy Economics forecasts that Australia's coal production could increase to 489 million tonnes by fiscal year 2018-2019, of which it could export 433 million tonnes.⁴⁵ That would be 15 per cent more than 2013-2014 levels.

Currently, coal is exported from five coal terminals located at three ports along the Great Barrier Reef: Abbot Point, Gladstone and Hay Point. To accommodate the expected increase in coal exports, there are plans to expand coal ports along the Queensland coastline adjacent to the Great Barrier Reef. If all the plans go ahead, these coal port expansions could increase the total coal port capacity of the region from 267 to 637 million tonnes per year (see Annex for a breakdown by port). The planned capacity is the equivalent of 2.4 times the total amount of maritime cargo that passed through all German ports in 2009, which was approximately 260 million tonnes.⁴⁶ This would make the total capacity of the Great Barrier Reef's coal ports just less than the overall capacity of the current largest port in the world: Shanghai, China.

Total coal throughput of Great Barrier Reef coal ports at full planned capacity versus the total throughput of all cargo for the world's largest ports in 2012 (millions of tonnes per year).⁴⁷



FOUR LARGE LIQUEFIED NATURAL GAS (LNG) TERMINALS ARE BEING DEVELOPED WITHIN THE GREAT BARRIER REEF WORLD HERITAGE SITE.

Australia is currently the world's fourth largest liquefied natural gas exporter, shipping 24 million tonnes in fiscal year 2013-2014.⁴⁸ The Australian petroleum industry aims to make Australia the world's largest liquefied natural gas exporter by 2020.⁴⁹ Three large liquefied natural gas terminals are being constructed on Curtis Island, which is within the Great Barrier Reef World Heritage Site. A fourth terminal on the island, the Arrow LNG terminal, has been approved, but construction has not started.⁵⁰ The Arrow LNG terminal plan includes the construction of a nine kilometre underwater gas pipeline between Curtis Island and the Australian mainland at Gladstone.⁵¹ The planned capacity for the four terminals could see a throughput of 54.5 million tonnes of liquefied natural gas each year, which is almost double the amount that is currently exported by Australia as a whole.

ADDITIONAL PORT EXPANSIONS ARE PLANNED TO ACCOMMODATE CRUISE SHIPS AND INCREASED SHIPPING OF OTHER CARGO.

Firstly, there are plans to widen the shipping channel at the Port of Cairns to accommodate larger cruise ships, which currently ferry passengers to shore on smaller vessels. The expansion would enable the port to accommodate a new class of cruise vessels known as mega class ships. It would have capacity for more than 60 ship visits per year by 2026.⁵² Secondly, there are several expansion projects planned for the port of Townsville, which is a large passenger, commodity and container port.⁵³ These plans call for the addition of several berths for cruise, defence and commercial cargo operations. Plans also include the widening and deepening of existing ocean channels to accommodate larger vessels and to allow more ships to pass through.⁵⁴

INCREASED SHIPPING WILL POSE SERIOUS RISKS TO THE REEF.

The Great Barrier Reef Marine Park Authority Outlook Report 2014 projects that the number of commercial vessels passing through the reef each year could increase from approximately 4,000 per year in 2012 to 7,500 ships in 2020, and 10,000 in 2032. More ships passing through the Great Barrier Reef will mean greater chances of accidents and groundings, oil or chemical spills, and damage from the dropping of anchors. Ships sometimes also discharge harmful waste, cause pollution from illegal dumping, and introduce invasive species. More traffic also ups the risk of wildlife ship strikes, and the noise ships make can cause displacement, hearing loss and the stranding of marine species.⁵⁵ Between June and September 2013, for example, more than 1,340 commercial vessels passed through critical reef habitat of the humpback whale, at an average speed of 12-14 knots (approximately 22-26 kilometres per hour). When hit by a ship travelling at this speed, a humpback whale has only a 30-50 per cent chance of survival.⁵⁶

Although improvements in shipping safety management have resulted in fewer major shipping incidents over the past ten years,⁵⁷ since 1993, there have been at least five vessel collisions and nine groundings by piloted ships in the Great Barrier Reef.⁵⁸ In addition, a survey of licensed pilots found that there were 45 near miss events in 2010 alone. That is nine times the number of incidents officially recorded as having a high risk of grounding or collision.⁵⁹ With planned increases in shipping traffic within the Great Barrier Reef, collisions, groundings and near misses can be expected to become more common.

DUMPING GROUND

Between 2001 and 2013, 28 million cubic metres of dredge spoil was dumped into the waters of the Great Barrier Reef World Heritage Site with devastating effects. Current plans could allow dumping of up to an estimated 39 million cubic metres more. Dredged up to create new shipping channels, the dumped spoil can smother corals and seagrass, which is food for threatened dugongs and marine turtles.



Shen Neng 1

In April 2010, the Shen Neng 1 coal carrier ran aground on Douglas Shoal in the Great Barrier Reef, after departing from the port of Gladstone. The impact ruptured the ship's fuel tanks, releasing approximately three to four tonnes of heavy fuel oil into the water.⁶⁰ That is the equivalent of approximately 25 barrels of oil.⁶¹ The subsequent impact assessment report noted that the oil spill and the grounding of the vessel caused "severe physical damage, to and destruction of, the shoal habitats and considerable contamination by toxic chemicals." It is estimated that 115,000 square metres of Douglas Shoal was severely damaged or completely destroyed, with patchy or moderate damage occurring over almost 400,000 square metres, which is the equivalent area of 56 football fields.^{62,63}

UP TO AN ESTIMATED 51 MILLION CUBIC METRES OF SEABED MATERIAL COULD BE DREDGED TO BUILD AND EXPAND PORTS IN THE REEF.⁶⁴

That is the equivalent of 49 times the volume of New York City's Empire State Building.⁶⁵ Dredging is the removal of material from the seafloor to create harbours and to deepen channels so that large ships can access ports and manoeuvre within them. Dredging can either be capital dredging, which creates new channels and berths, or maintenance dredging, which removes sediment from existing channels and berths and typically occurs every one to five years.⁶⁶ Under current plans, up to an estimated 21 million cubic metres of material could be dredged from the seafloor for coal port expansions (see Annex for a breakdown by port). In addition, 4.4 million cubic metres of material could be dredged to widen the shipping channel at the Port of Cairns to accommodate larger cruise ships,⁶⁷ and 9.9 million cubic metres for the expansion at the port of Townsville. Finally, 15.6 million cubic metres of material could be dredged to accommodate liquefied natural gas exports. One million cubic metres of material would be dredged from Port Curtis near Gladstone for the Arrow LNG terminal, and 14.6 million cubic metres to enable better access to the terminals.⁶⁸

THERE IS CURRENTLY NO BAN ON THE DUMPING OF DREDGE SPOIL IN THE GREAT BARRIER REEF WORLD HERITAGE SITE, AND UP TO AN ESTIMATED 39 MILLION CUBIC METRES OF DREDGED MATERIAL COULD BE DUMPED INTO WORLD HERITAGE WATERS.⁶⁹

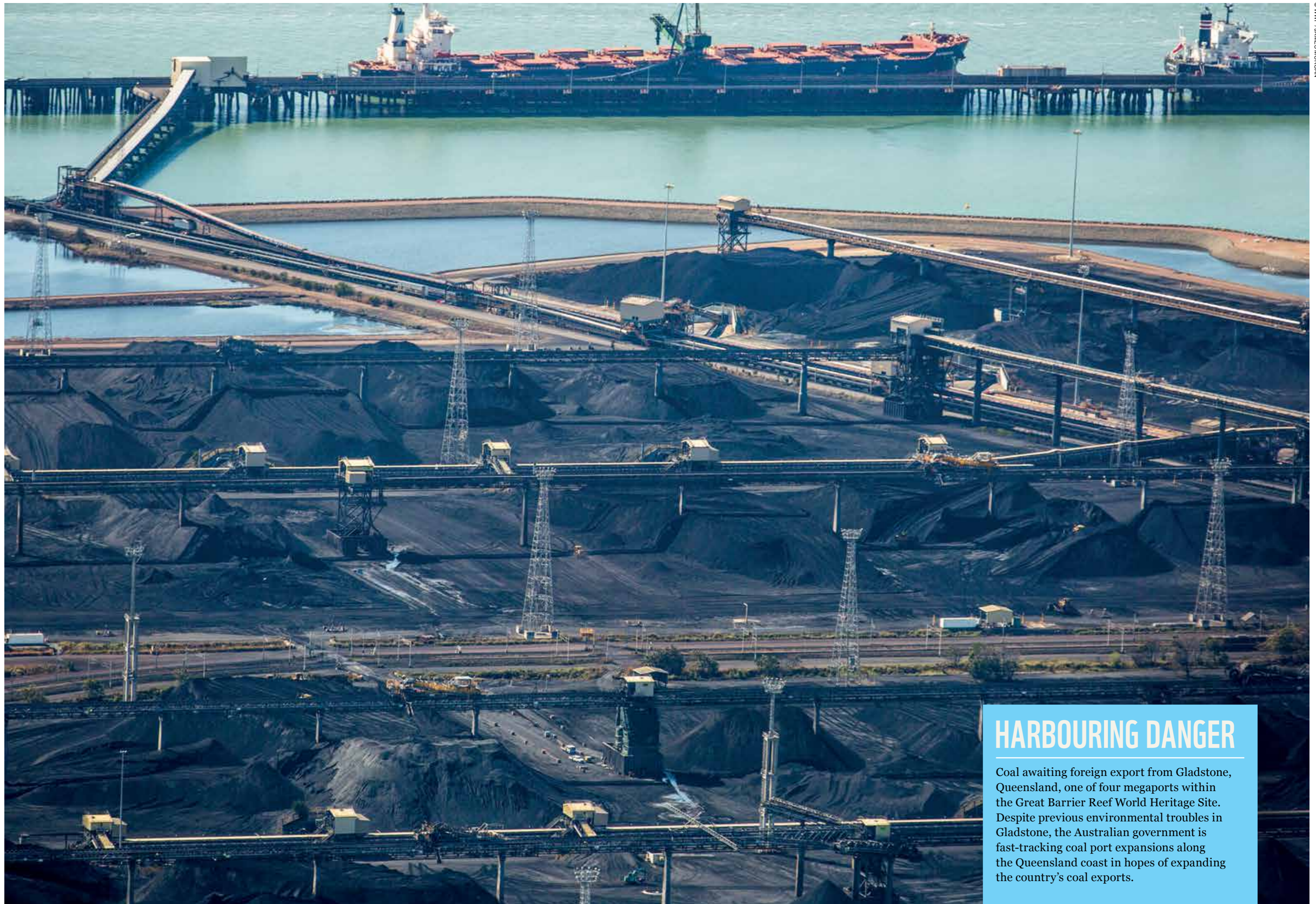
At present, the Australian government is considering a ban on the dumping of dredge spoil in the Great Barrier Reef Marine Park.⁷⁰ However, the marine park is slightly smaller than the World Heritage Site, and does not include most of the islands and waters around the ports. It is in these locations that 80 per cent of dumping has occurred since 2010.⁷¹ Plans for additional dumping off Gladstone and for new dumping off Townsville, for example, would not be covered by the proposed ban. Developers there intend to dump in areas included in the World Heritage Site but not in the marine park.⁷² The ban under consideration will have little impact on current dumping levels, and will provide very little additional protection to the Great Barrier Reef.

Dumping locations for the dredged material from some of the port expansions have not been decided yet (see Annex for a breakdown by port). As it stands, the Queensland government could allow up to an estimated 39 million cubic metres of dredged material to be dumped in the Great Barrier Reef's World Heritage waters; in addition to the 28 million cubic metres of dredge spoil that was dumped in the World Heritage waters between 2001 and 2013.⁷³

DREDGING AND DUMPING SPOIL IN THE GREAT BARRIER REEF HAVE DEVASTATING IMPACTS ON THE MARINE ECOSYSTEM.

Dredging and dumping of dredged material destroys corals, seagrass meadows, and ocean floor habitats. It disturbs the migration of aquatic species between inshore and outer reef areas and can change ocean currents. In addition, both dredging and dumping generate increased levels of sediment, which can fall onto coral and seagrass, interfering with their ability to survive. Sediments also increase cloudiness in the water, known as turbidity, which reduces the light available to algae and seagrass for photosynthesis.⁷⁴ A wide variety of plants and animals in the Great Barrier Reef rely on seagrass beds for food or shelter, including threatened animals such as dugongs and green turtles.⁷⁵ Therefore, damage to seagrass from dredging and dumping can have far-reaching consequences for marine life.

The water around Abbot Point where dredging is planned to take place, for example, is home to rare and endangered marine turtles, dugongs, snubfin dolphins. It is also part of the migratory path of humpback whales. Recent evidence has shown that dredging can more than double the level of coral disease in reefs, as the corals affected by sedimentation divert their energy reserves into cleaning the additional sediment from their surface.⁷⁶ This can lead to chronic stress, making the corals more susceptible to disease.



HARBOURING DANGER

Coal awaiting foreign export from Gladstone, Queensland, one of four megaports within the Great Barrier Reef World Heritage Site. Despite previous environmental troubles in Gladstone, the Australian government is fast-tracking coal port expansions along the Queensland coast in hopes of expanding the country's coal exports.

Gladstone Harbour

The development of liquefied natural gas (LNG) loading facilities in the Port of Gladstone has had serious negative impacts on the surrounding environment. A report published by James Cook University found that dredging in Gladstone Harbour caused metals to be dispersed from the seabed, contributing to “higher than usual mortality rates of sea turtles.”⁷⁷ The high number of green turtle fatalities in Gladstone Harbour in recent years has also been attributed to malnutrition, associated with the significant destruction and contamination of seagrass beds due to dredging and sedimentation, among other causes.⁷⁸

Leakage from a bund embankment wall in the harbour, which was designed to contain 25 million cubic metres of dredge spoil, also coincided with the deaths of a large number of fish in the harbour. An independent inquiry into the incident in 2011/2012 found that “aspects of the design and construction of the bund wall were not consistent with industry best practice.”⁷⁹ The lining used to prevent dredged sediment from being released into the ocean was not adequately secured, the inquiry found. This allowed substantial amounts of fine sediments to pass through the porous wall and into the water.⁸⁰ A report by Central Queensland University stated that increased sediment and algal blooms related to the dredging project could have been a contributing factor in the outbreaks of disease in fish within the area.⁸¹

THE MOST SEVERE EFFECTS ARE OBSERVED AT THE SITE OF DREDGING AND DUMPING, BUT IMPACTS CAN BE FELT SOME DISTANCE FROM THE SITE.

For example, when 8.3 million cubic metres of seabed was dredged by port operators at Hay Point Port in 2006, the dredge plume travelled at least 46 kilometres to the north. Some corals had up to 60 per cent of their surface covered by sediment from the plumes.⁸² The dumping of dredge spoil in offshore waters can create plumes of fine sediment that can drift up to 80 kilometres from the dumping site.⁸³ That is almost the same distance as the Bering Strait, which separates the continents of North America and Asia. If a sediment plume was to drift in all directions, it could have the potential to affect an area the size of Israel (21,640 square kilometres).⁸⁴

“The best available science including the recent report commissioned by the Great Barrier Reef Marine Park Authority on transport of disposed dredged sediment, makes it very clear that expansion of the port at Abbot Point will have detrimental effects on the Great Barrier Reef. Sediment from dredging can smother corals and seagrasses and expose them to poisons and elevated nutrients... In order to increase the resilience of the reef, we need to improve water quality as much as possible, rather than pollute the reef with further industrialization . . . Increasing ship movements through the Great Barrier Reef will increase the probability of ship groundings, oil spills, animal strikes and the introduction of marine pests.”

A joint letter signed by 240 concerned scientists in January 2014 to the Great Barrier Reef Marine Park Authority, regarding the agency’s decision to allow dumping of dredge spoil in the Great Barrier Reef World Heritage Site.⁸⁵

AFTER A PUBLIC OUTCRY, PLANS TO DUMP DREDGE SPOIL FOR ONE PORT EXPANSION HAVE BEEN MOVED ON LAND.

Following substantial public criticism, the Queensland government proposed dumping the dredged material from the Abbot Point port expansion on land in the Caley Valley wetland instead of offshore in Great Barrier Reef World Heritage waters.⁸⁶ The plans include the construction of a pipeline to transport material from the dredging site to the wetland, and a separate pipeline to dispose of wastewater from the wetland back into the reef’s waters.⁸⁷ The dredge spoil is expected to be dumped into several storage ponds in the wetland.

THE ALTERNATIVE DUMPING LOCATION WILL ALSO HAVE SUBSTANTIAL ENVIRONMENTAL IMPLICATIONS.

The proposed site for the dumping of Abbot Point port dredged material is part of the Caley Valley wetland,⁸⁸ a biologically diverse area that supports more than 40,000 birds from at least 154 species. The wetland is the habitat of a number of threatened bird species, including the Australian painted snipe and the sharp-tailed sandpiper.⁸⁹ Land-based dumping in such a sensitive location will have major environmental implications. The dumping of dredge spoil will affect directly 114.3 hectares of wetland habitat,⁹¹ the equivalent of 160 football fields.

The seabed in the Abbot Point area is known to contain potential acid sulphate, which can become very acidic when exposed to air,⁹² as well as levels of tributyltin, manganese and arsenic above recommended guidelines. The storage ponds for the dredge spoil are to be constructed on a low-lying coastal plain in a tropical area that is prone to cyclones. The ponds will be at high risk of damage and leakage from flooding and storms.

Studies commissioned by port managers showed that the Caley Valley wetland dumping site is the lowest cost option of the seven possible sites, but the worst choice from an environmental perspective.⁹³ Although it is standard procedure for a full environmental impact study to be required for projects of this size, the Australian government has waived it in this instance.⁹⁴ Instead, the project will be assessed using only “preliminary documentation.”⁹⁵

THE COMBINATION OF EXISTING PRESSURES AND NEW COASTAL INFRASTRUCTURE COULD RESULT IN THE GREAT BARRIER REEF BEING LISTED AS “IN DANGER” BY UNESCO.

The Great Barrier Reef was inscribed as a natural World Heritage Site in 1981 having met all four criteria for *outstanding universal value*.⁹⁶ These include containing the most important natural habitats for the conservation of biological diversity and threatened species, being outstanding examples of the major stages of earth’s history, being outstanding examples of the evolution of marine ecosystems, and containing areas of exceptional natural beauty.⁹⁷

However, substantial damage caused to the reef in recent years, in addition to concerns regarding “planned coastal developments, including development of ports,” has led the World Heritage Committee to reconsider the reef’s status.⁹⁸ A decision on whether to inscribe the Great Barrier Reef on the List of World Heritage in Danger⁹⁹ will be made at the 39th session of the World Heritage Committee to be held in Bonn, Germany in June and July 2015.¹⁰⁰

The Greater Fitzroy Delta

The Greater Fitzroy Delta is a nationally important wetland¹⁰¹ and one of the largest wetland areas in Australia, covering an area of 127,380 hectares.¹⁰² It lies just north of the Port of Gladstone and flows directly into the Great Barrier Reef World Heritage Site. The estuary is home to a number of rare species, including the southernmost population of snubfin dolphins, four species of marine turtles, and the critically endangered Capricorn yellow chat, of which there are fewer than 250 adult birds remaining.¹⁰³

The delta plays a key role in protecting the Great Barrier Reef, by acting as a giant filter to soak up nitrogen and to trap sediments that run off farms and into Fitzroy River. Every year, the delta prevents approximately 3.5 million tonnes of sediment, about half of the river's total sediment, from entering the Great Barrier Reef.¹⁰⁴ The area itself remains relatively undeveloped.

However in recent years, the Greater Fitzroy Delta has been threatened by extensive industrialization. There have been proposals for two coal ports in the delta, the Balaclava Island Coal Export Terminal and the Fitzroy Terminal Project, which would have a combined export capacity of 57 million tonnes each year.

A mission report from the UNESCO World Heritage Committee in 2012 expressed a high degree of concern over these proposed projects. In particular, the report highlighted the Balaclava Island and Fitzroy Terminal Projects as having “potentially serious impacts on one of three important populations of the endemic Australian snubfin dolphin,” in addition to affecting a wetland of “national significance.”¹⁰⁵

Both ports have since been cancelled. In May 2013, Glencore Xstrata withdrew from the Balaclava Island Coal Export Terminal, and in May 2014, the Mitchell Group let the application for the Fitzroy Terminal Project lapse. Despite this, the Greater Fitzroy Delta remains unprotected, so there is nothing to prevent new port proposals threatening this delicate area once again.¹⁰⁶

IN VIEW OF THE ENVIRONMENTAL RISKS, MANY FINANCIAL INSTITUTIONS HAVE CHOSEN NOT TO FUND THE ABBOT POINT PORT EXPANSION.

In recent months, nine international banks (JP Morgan Chase, Morgan Stanley, Citibank, RBS, Barclays, HSBC, Goldman Sachs, Deutsche Bank and Credit Agricole) have stated that they will not be involved in the funding of the Abbot Point port expansion.¹⁰⁷ Goldman Sachs declared that it would not finance any project that “would significantly convert or degrade a critical natural habitat.”¹⁰⁸ JP Morgan Chase and Deutsche Bank relinquished their involvement due to a lack of consensus between the Australian government and UNESCO regarding the impact the Abbot Point port expansion could have on the Great Barrier Reef and its *outstanding universal value*.¹⁰⁹ Such actions also appear to reflect the concerns of the general public. Deutsche Bank's withdrawal of funding has been linked to a public petition signed by 180,000 Germans urging the bank not to fund the expansion.¹¹⁰

THE RISK IS NOT WORTH TAKING: A STUDY ON THE COAL PORT EXPANSIONS

DREDGING AND DUMPING FOR COAL PORT EXPANSIONS MIGHT NOT BE NEEDED.

Many of the new terminals proposed under the port expansion plans would be used to export coal. These projects account for up to an estimated 21 million cubic metres of the total proposed dredging in the Great Barrier Reef. However, the price of coal has declined sharply over the past few years. With the decline of coal prices, forecasts of coal production and exports have also fallen. As a result, it is unlikely that all of the proposed coal ports will be needed. The damage to the reef, however, will have been made.

THE PRICE OF COAL HAS FALLEN BY 40 PER CENT SINCE 2011.

The price of Australian coal has dropped from a high of US\$130.12 per tonne in 2011 to just US\$77.73 per tonne in 2014.¹¹¹ Forecasts from the International Monetary Fund predict that the price of Australian coal will plateau at US\$74.72 per tonne from 2015 until at least 2019.¹¹² The structural health of the coal industry as a whole seems to be deteriorating. A Citigroup publication argues that “thermal coal demand is in structural decline as a result of both increasing environmental pressure and declining cost-competitiveness compared to alternatives.”¹¹³

Between August 2011 and August 2014, for example, the Bloomberg Global Coal Index, which measures the financial performance of 32 major publicly-traded coal companies, declined by 56 per cent.¹¹⁴ When the coal port expansions were designed, Australia was expecting to export between 511-567 million tonnes per year by 2020, of which Queensland was expecting to export 288-327 million tonnes.¹¹⁵ Recent revised forecasts however, predict that the whole of Australia will export approximately 433 million tonnes per year by fiscal year 2018-2019.¹¹⁶ As a result, it is likely that a proportion of the planned capacity of the new coal terminals will be unnecessary.

THE STRUCTURAL DECLINE OF THE COAL INDUSTRY IS CLOSELY LINKED TO THE RISING DEMAND FOR ALTERNATIVE SOURCES OF ENERGY, NOTABLY GREEN ENERGY.

Worldwide consumption of energy from wind, geothermal, solar, biomass and waste has increased eight-fold in the past 20 years.¹¹⁷ In the United States alone, the amount of electricity generated from renewable sources (excluding hydroelectricity) has tripled since 2004.¹¹⁸ As well as the absolute level of renewable energy consumption rising, its share of the total power generated worldwide has also increased. In 2013, renewable energy sources (excluding hydroelectricity) accounted for more than 5 per cent of global energy consumption for the first time, and 15 per cent of European Union power generation.¹¹⁹

These trends are often linked to national targets with legal implications for non-adherence, such as the European Union's 2020¹²⁰ targets and China's goal of having 20 per cent of total energy demand sourced from renewable energy by 2020.¹²¹ Moreover, Australia, and more than 190 other countries, agreed at UN climate talks in Lima, Peru in December 2014 to accelerate pre-2020 climate action and to set ambitious targets to cut emissions after 2020. As political and economic support for renewable energy gathers pace, the argument for investing in coal is becoming more obsolete.

THIS MAKES QUEENSLAND'S PLANNED COAL MINE AND COAL PORT EXPANSIONS LESS FINANCIALLY INTERESTING.

According to a report by the Centre for Policy Development, an independent Australian policy institute, the price of thermal coal needs to be above US\$120 for the “economics of mining to stack up” in the Galilee Basin.¹²² A recent financial analysis by the US-based Institute for Energy Economics and Financial Analysis, which conducts financial and economic research on issues related to energy and the environment, similarly concluded that the proposed Alpha Coal mining project in the Galilee Basin has “little prospect of financial viability,” with the “cost of coal production... likely to render the project uneconomic.”¹²³ This is likely to result in stranded assets.¹²⁴

AS A RESULT, SOME PLANNED COAL MINE AND COAL PORT EXPANSIONS HAVE BEEN CANCELLED.

Australia's largest rail freight operator, Aurizon, has stated that the company's planned expansion into Queensland's Galilee Basin will not start for several years due to weak thermal coal prices.¹²⁵ Moreover, a number of planned port projects have been cancelled. For example, BHP Billiton, Australia's biggest exporter of coal for steel mills, cancelled plans for a third coal terminal at Abbot Point due to falling coal prices and an associated cut in the company's capital spending.¹²⁶ Additionally, North Queensland Bulk Ports cancelled its plans for a terminal at Hay Point stating that “current and short-term forecast market demand for coal does not support an expansion to the capacity proposed.”¹²⁷

YET, THE AUSTRALIAN GOVERNMENT CONTINUES TO PURSUE COAL PORT EXPANSION PLANS.

Both the Australian federal government and the Queensland state government are helping to open up the Galilee Basin to mining. Also, as they seek to boost the Australian economy over the short term, they are supporting new and existing port expansion proposals. The Queensland government's so-called *ramp-up to full royalty* initiative allows mining companies to pay less money to the government for the right to extract coal during the initial period, thereby reducing up-front costs.¹²⁸

In 2014, the Queensland government also offered one of the mining companies still committed to the Abbot Point port expansion a subsidy for building a railway to connect the inland coal mine to the coast.¹²⁹ The exact value of this subsidy has not been disclosed, but indications are that it is worth a “significant amount,”¹³⁰ perhaps hundreds of millions of dollars.¹³¹

THE REEF SHOULD BE PROTECTED

THE GREAT BARRIER REEF CREATES AN ANNUAL ECONOMIC VALUE OF NEARLY US\$5.8 BILLION AND PROVIDES ALMOST 69,000 FULL-TIME EQUIVALENT JOBS.¹³²

Its contribution to the Australian economy comes from tourism and recreational activities, scientific and tropical marine ecosystem research, and commercial fishing.

TOURISM AND RECREATIONAL ACTIVITIES ARE THE MAJOR CONTRIBUTORS TO THE GREAT BARRIER REEF'S ECONOMIC VALUE, GENERATING MORE THAN US\$5.5 BILLION PER YEAR IN ADDED VALUE.¹³³

Tourism-related activities support 94 per cent of the jobs provided by the reef. Direct expenditure on tourism and recreational activities in the Great Barrier Reef is more than US\$6.9 billion,¹³⁴ which represents 7 per cent of the total tourism expenditure in Australia.¹³⁵ That is five times the direct annual contribution of travel and tourism in Cyprus (US\$1.4 billion), and approximately two thirds of that in the Philippines (US\$11.1 billion).¹³⁶ The Great Barrier Reef receives approximately 2.09 million domestic and international visitors every year,¹³⁷ which is comparable to the number of tourists that visit Cambodia's top tourist attraction, Angkor Wat, each year (approximately 2 million).¹³⁸

THE GREAT BARRIER REEF IS AN INTERNATIONAL HUB FOR SCIENTIFIC AND TROPICAL MARINE ECOSYSTEM RESEARCH, DIRECTLY GENERATING US\$100.1 MILLION FROM THESE ACTIVITIES.¹³⁹

The value of the world's coral reefs goes far beyond their economic value. Coral reef organisms are contributing to the development of a wide range of treatments, including for diseases such as cancer and HIV,¹⁴⁰ and are used in tissue engineering technologies.¹⁴¹ Natural substances found in marine sea sponges have been used to develop medicines used to treat heart disease, gastro-intestinal disease and cancers.¹⁴² Further, Dr Bruce Chabner, professor of medicine at Harvard Medical School and director of clinical research at Massachusetts General Hospital's cancer centre argues that marine-based medicines are showing “tremendous promise” in the treatment of strokes and Alzheimer's disease.¹⁴³ The potential of the Great Barrier Reef to be used in yet unforeseen ways carries substantial value.

WHEN INDIRECT VALUES ARE INCLUDED, THE TOTAL ECONOMIC VALUE OF THE GREAT BARRIER REEF SIGNIFICANTLY INCREASES.

In addition to its direct economic value, the Great Barrier Reef has numerous indirect values. As a World Heritage Site, the pure existence of such a remarkable natural place holds substantial value for many people around the world.¹⁴⁴ Most of this social significance stems from the extraordinary beauty, biodiversity and natural abundance of the region. It is the only living structure that can be seen with the naked eye from space,¹⁴⁵ and its diversity of species and habitats makes it one of the richest ecosystems on earth.¹⁴⁶

Additionally, the Great Barrier Reef is important to Aboriginal and Torres Strait Islander groups who have continuing social, cultural, economic and spiritual connections to their traditional “sea country.”¹⁴⁷ The reef also contains several sites of historical significance, including Endeavour Reef, where Captain Cook ran aground over two centuries ago, and six historic shipwrecks.¹⁴⁸ Importantly as well, the Great Barrier Reef offers coastal protection, acting as a natural breakwater to protect coastal communities from erosion that could threaten their land and homes.¹⁴⁹

THE TURTLES OF RAINE ISLAND

One tiny island in the Great Barrier Reef is particularly extraordinary. Each year on Raine Island, females from the world's largest nesting population of endangered green turtles lay their eggs.^{150,151} The island itself is a coral cay only approximately 27 hectares in size. That is just over a quarter square kilometre and smaller than 38 football fields. During the 2011-2012 season, about 17,000 turtles nested on Raine Island.¹⁵² The endangered animals can travel up to 2,400 kilometres across the ocean to reach the island's shore.¹⁵³ Some years the number of turtles nesting can climb to more than 130,000.¹⁵⁴ Considering that there are only about 200,000 nesting female green turtles remaining worldwide,¹⁵⁵ and that numbers are in decline,¹⁵⁶ Raine Island is a treasure in need of continued protection.



CONCLUSION: IMMINENT RISKS CAN BE CONTAINED

In order to contain the most immediate risks to the reef, port expansions should not be considered until existing facilities are at full capacity, thereby reducing the need for new port infrastructure.

Queensland coal ports are currently under-utilized; they are operating at an average of just 66 per cent of their overall capacity (see Annex for a breakdown by port). By using existing port facilities more efficiently, it is possible to reduce the demand for new ports. For example, third parties could be permitted to make use of unused capacity at existing port terminals. The government could facilitate this process by coordinating

the sharing of spare capacity within ports, which would require overcoming the current regulatory constraints on the exchange of contracted capacity.¹⁵⁷

These plans should all be subject to an analysis of safe shipping levels, particularly in high-risk areas such as the northern Inner Route and the Hydrographer's Passage. To coincide with increased shipping traffic into existing ports, the capacity of local authorities to respond to emergency shipping incidents should also be increased. Moreover, measures should be introduced to reduce the risk of shipping incidents, including restrictions on the size and number of ships allowed through high-risk areas, compulsory pilotage for the entire World Heritage Site, improved vessel tracking systems, and the prohibition of high-risk ships entering the reef area.

THE GOVERNMENT SHOULD MINIMIZE THE AMOUNT OF DREDGING IN THE GREAT BARRIER REEF WORLD HERITAGE SITE.

New dredging operations should be banned permanently outside of existing, long-established major ports, and avoided whenever possible within these existing areas. Maintenance dredging must be managed to minimize the impact on the Great Barrier Reef. Local and regional caps on dredging should reflect the receiving environment's assimilative capacity; that is, the ability of the water to receive waste material without damage to marine life. Additionally, any companies that continue to dredge material within existing major ports should be required to offset the damage. Offsetting could come through improvements to the water quality or to ecosystem health in the local catchment that delivers net environmental benefits.

THE GOVERNMENT SHOULD PROHIBIT ALL DUMPING OF DREDGE SPOIL IN THE GREAT BARRIER REEF WORLD HERITAGE SITE.

While the Australian government is considering a ban on the dumping of dredge spoil in the Great Barrier Reef Marine Park,¹⁵⁸ this does not include islands and waters around ports where most of the dumping has occurred in previous years. Dumping within the Great Barrier Reef's World Heritage waters should be prohibited completely. Dredge spoil should be disposed in alternative, suitable ways. Full environmental impact assessments should be conducted before dredge material is disposed of on land. Suitable onshore locations must be found to avoid redirecting environmental damage from the reef to other fragile ecosystems. The environmental impact statement conducted for each port expansion proposal should assess thoroughly all alternatives for disposing of dredge spoil in order to identify the safest land disposal or reuse option.

"The [Australian] Academy [of Science] also supports complementary federal and state legislation to permanently ban sea dumping of any dredge spoil within and adjoining the Great Barrier Reef World Heritage Area..."

The Australian Academy of Science. Response to the draft Reef 2050 long-term sustainability plan.¹⁵⁹

FINANCIAL INSTITUTIONS AND THE PRIVATE SECTOR SHOULD CONSIDER CAREFULLY THE BUSINESS CASE BEFORE INVESTING IN GREAT BARRIER REEF PORT EXPANSIONS.

Investment in the Galilee Basin coal mines began in 2011 when the price of Australian coal was high. Since then however, coal prices have declined by 40 per cent, and the outlook is poor. Responsible financial institutions and private sector entities should not invest or participate in any project with the potential to damage a World Heritage Site. In light of financial, environmental, and social concerns, many financial institutions have refused to provide financial services to Great Barrier Reef projects, and plans for some port expansions have been put on hold or cancelled.

SUBSTANTIAL DAMAGE HAS BEEN INFLICTED UPON THE GREAT BARRIER REEF IN RECENT YEARS. PLANNED PORT EXPANSIONS COULD BRING ABOUT ADDITIONAL DAMAGE AND CAUSE THE WORLD TO LOSE THIS PLACE OF OUTSTANDING UNIVERSAL NATURAL VALUE. THE RISK IS NOT WORTH TAKING. THERE ARE SIMPLE SOLUTIONS THAT THE AUSTRALIAN AND QUEENSLAND GOVERNMENTS, FINANCIAL INSTITUTIONS AND THE PRIVATE SECTOR CAN IMPLEMENT TO PROTECT THE REEF. AS THE UNESCO WORLD HERITAGE COMMITTEE CONSIDERS LISTING THE REEF AS "IN DANGER," NOW IS THE TIME FOR RESPONSIBLE ACTION.

Annex: Planned Port Expansions¹⁶¹

Port	Terminal	Current utilization	Current through put (Mtpa) ¹⁶²	Current capacity (Mtpa) ¹⁶³	Planned capacity (Mtpa) ¹⁶⁴	Dredging (million m ³)	Offshore dumping (million m ³)
(i) Coal ports							
Abbot Point		46%	22.9	50	300	3	≤1.3
	T1		22.9 ¹⁶⁵	50	50	0	0
	To		0	0	70	1.7 ¹⁶⁶	Caley Valley wetlands
	T3		0	0	60		
	T2 (on hold) ¹⁶⁷		0	0	60	1.3 ¹⁶⁸	N/A (≤1.3)
	AP-X Project ¹⁶⁹		0	0	60 ¹⁷⁰	N/A ¹⁷¹	N/A ¹⁷²
Hay Point		69%	96.6	140	170	N/A	N/A
	Dalrymple Bay Coal Terminal		62.4	85	85	0	0
	Hay Point Services Coal Terminal		34.2	55	55	0	0
	Bowen Basin		0	0	30 ¹⁷³	N/A	N/A
Gladstone		75%	58	77	157	18.3	12
	RG Tanna Terminal		58	70 ¹⁷⁴	73	0	0
	Barney Point			7 ¹⁷⁵	0 ¹⁷⁶	0	0
	Wiggins Island Export Terminal		0	0	84 ¹⁷⁷	6.3 ¹⁷⁸	0 ¹⁷⁹
	Gladstone Channel Duplication ¹⁸⁰					12 ¹⁸¹	12 ¹⁸²
Townsville			0	0	8¹⁸³	N/A	N/A
Cape York	Wongai Coal Terminal		0	0	1.5¹⁸⁴	N/A¹⁸⁵	N/A¹⁸⁶
Total Coal Ports		66%	177.5	267	636.5	21.3	≤13.3

Port	Terminal	Current utilization	Current through put (Mtpa) ¹⁶²	Current capacity (Mtpa) ¹⁶³	Planned capacity (Mtpa) ¹⁶⁴	Dredging (million m ³)	Offshore dumping (million m ³)
(ii) Liquefied natural gas ports							
Gladstone	LNG Terminals		0	8.5	54.5	15.6	≤15.6
	Australia Pacific LNG		0	0	18 ¹⁸⁷	Already completed	Already completed
	Santos LNG		0	0	10 ¹⁸⁸	Already completed	Already completed
	Queensland Curtis LNG		N/A	8.5 ¹⁸⁹	8.5 ¹⁹⁰	Already completed	Already completed
	Arrow LNG		0	0	18 ¹⁹¹	1 ¹⁹²	1 ¹⁹³
	Western Basin Dredging Stages 2/3/4 ¹⁹⁴					14.6 ¹⁹⁵	N/A (≤14.6) ¹⁹⁶
(iii) Other ports expansion plans							
Cairns	Cairns Shipping Development Project					4.4¹⁹⁷	N/A (≤4.4)¹⁹⁸
Townsville	Port expansion					9.95¹⁹⁹	5.6
TOTAL			177.5	275.5	691	51.25	≤38.9

¹ De'ath, G. et al. (2012) *The 27-year decline of coral cover on the Great Barrier Reef and its causes*. Proceedings of the National Academy of Sciences of the United States of America, 109 (44) 17995-17999. Available from: www.pnas.org/content/109/44/17995.full [Accessed January 2015]

² United Nations Educational, Scientific and Cultural Organization World Heritage Convention (2014) *Decision on status of Australia's Great Barrier Reef deferred until 2015*, 18 June 2014 [Online]. Available from: <http://whc.unesco.org/en/news/1149> [Accessed January 2015].

³ See Annex for a breakdown of proposed dredging by port.

⁴ The volume of the Empire State Building is 37 million cubic feet. When converted, this is equivalent to 1.04772 million cubic metres. Empire State Realty Trust. *Empire State Building Fact Sheet*. [Online] Available from: www.esbny.com/sites/default/files/esb_fact_sheet_4_9_14_4.pdf [Accessed January 2015].

⁵ See Annex for a breakdown of proposed offshore dumping by port.

⁶ Great Barrier Reef Marine Park Authority (2014) *Great Barrier Reef Outlook Report 2014*. GBRMPA, Townsville. p. 129.

⁷ Pollock, F.J. et al. (2014) *Sediment and turbidity associated with offshore dredging increase coral disease prevalence on nearby reefs*. PLoS ONE 9 (7) e102498. [Online] Available from: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0102498 [Accessed January 2015].

⁸ Australian Marine Conservation Society. *Dredging, dumping and the Great Barrier Reef*. [Online] Available from: www.marineconservation.org.au/data/REEF_DREDGE_Doc_Spreads.pdf [Accessed January 2015].

⁹ See Annex for a breakdown of proposed capacity by port.

¹⁰ See Annex for a breakdown of proposed dredging by port.

¹¹ International Monetary Fund (2014) *IMF Commodity Price Forecasts, Australian coal, export markets (Medium term commodity price baseline, US dollars)*. [Online] Available from: <http://knoema.com/IMFCPF2014Dec/imf-commodity-price-forecasts-december-2014> [Accessed 09 January 2015].

¹² For conversions from Australian to US dollars, we have used the exchange rates from 1 March 2013, the month of report publication. Available from: www.xe.com/currencytables/?from=AUD&date=2013-03-01; Deloitte Access Economics (2013) *Economic Contribution of the Great Barrier Reef*. Great Barrier Reef Marine Park Authority, Townsville.

¹³ For conversions from Australian to US dollars, we have used the exchange rates from 1 March 2013, the month of report publication. Available from: www.xe.com/currencytables/?from=AUD&date=2013-03-01; Deloitte Access Economics (2013) *Economic Contribution of the Great Barrier Reef*. Great Barrier Reef Marine Park Authority, Townsville.

¹⁴ For conversions from Australian to US dollars, we have used the exchange rates from 1 March 2013, the month of report publication. Available from: www.xe.com/currencytables/?from=AUD&date=2013-03-01. Deloitte Access Economics 2013, *Economic contribution of the Great Barrier Reef*, Great Barrier Reef Marine Park Authority, Townsville.

¹⁵ National Oceanic and Atmospheric Administration (2014). *What does coral have to do with medicine?*. [Online]. Available from: http://oceanservice.noaa.gov/facts/coral_medicine.html. [Accessed January 2015]; American Society for Biochemistry and Molecular Biology (2014). *Coral reefs provide potent new anti-HIV proteins*. [Online] ScienceDaily. ScienceDaily, 29 April 2014. Available at: www.sciencedaily.com/releases/2014/04/140429092649.htm. [Accessed January 2015].

¹⁶ United Nations Educational, Scientific and Cultural Organization World Heritage Convention. *Great Barrier Reef*. [Online]. Available from: <http://whc.unesco.org/en/list/154> [Accessed January 2015].

¹⁷ Great Barrier Reef Marine Park Authority (2014) *Great Barrier Reef Outlook Report 2014*. GBRMPA, Townsville. pp. 17-19.

¹⁸ The World Bank (2014) *World Development Indicators: Land area (sq. km)*. [Online] Available from: <http://data.worldbank.org/indicator/AG.LND.TOTL.K2> [Accessed January 2015]; United States Census Bureau (2014) *State & County Quick Facts: Texas*. [Online]. Available from: <http://quickfacts.census.gov/qfd/states/48000.html> [Accessed January 2015].

¹⁹ Great Barrier Reef Marine Park Authority (2014) *Great Barrier Reef Outlook Report 2014*. GBRMPA, Townsville. p. 23; The Honourable Greg Hunt MP Minister for the Environment (2014) *Celebrating 33 years of World Heritage status for the Great Barrier Reef*. [Online] Available from: www.environment.gov.au/minister/hunt/2014/mr20141026.html?utm_source=mins&utm_medium=rss&utm_campaign=feed [Accessed January 2015].

²⁰ Great Barrier Reef Marine Park Authority (2014) *Great Barrier Reef Outlook Report 2014*. GBRMPA, Townsville. p. 23; United Nations Educational, Scientific and Cultural Organization World Heritage Convention. *Great Barrier Reef*. [Online]. Available from: <http://whc.unesco.org/en/list/154> [Accessed January 2015].

²¹ The IUCN Red List of Threatened Species (2014) *Chelonia mydas (Green Turtle)*. [Online] Available from: www.iucnredlist.org/details/4615/0 [Accessed January 2015]; United Nations Educational, Scientific and Cultural Organization World Heritage Convention. *Great Barrier Reef*. [Online]. Available from: <http://whc.unesco.org/en/list/154> [Accessed January 2015].

²² Great Barrier Reef Marine Park Authority (2014) *Great*

Barrier Reef Outlook Report 2014. GBRMPA, Townsville. p. 23; FishBase. *Species in Mediterranean Sea*. [Online] Available from: www.fishbase.org/TrophicEco/FishEcoList.php?ve_code=13 [Accessed January 2015].

²³ Great Barrier Reef Marine Park Authority (2014) *Great Barrier Reef Outlook Report 2014*. GBRMPA, Townsville. p. 23; Shark Research Committee. *Sharks of the Pacific Coast of North America*. [Online] Available from: www.sharkresearchcommittee.com/indigenous.htm [Accessed January 2015].

²⁴ De'ath, G. et al. (2012) *The 27-year decline of coral cover on the Great Barrier Reef and its causes*. Proceedings of the National Academy of Sciences of the United States of America, 109 (44) 17995-17999. Available from: www.pnas.org/content/109/44/17995.full [Accessed January 2015].

²⁵ Great Barrier Reef Marine Park Authority (2014) *Great Barrier Reef Outlook Report 2014*. GBRMPA, Townsville. p. 20.

²⁶ Great Barrier Reef Marine Park Authority (2014) *Great Barrier Reef Outlook Report 2014*. GBRMPA, Townsville. Executive Summary, p. v.

²⁷ Hoegh-Guldberg, O. (1999) *Climate change, coral bleaching and the future of the world's coral reefs*. Marine and Freshwater Research, 50, 839-866. Available from: www.publish.csiro.au/?act=view_file&file_id=MF99078.pdf [Accessed January 2015].

²⁸ Great Barrier Reef Marine Park Authority. *Coral Bleaching*. [Online] Available from: www.gbrmpa.gov.au/managing-the-reef/threats-to-the-reef/climate-change/what-does-this-mean-for-species/corals/what-is-coral-bleaching [Accessed January 2015].

²⁹ The Great Barrier Reef has experienced eight mass bleaching events since records began in 1979. These occurred in 1980, 1982, 1987, 1992, 1994, 1998, 2002 and 2006. Parry, M.L., et al. (2007) *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007*. Cambridge University Press. [Online] Available from: www.ipcc.ch/publications_and_data/ar4/wg2/en/xccsc2.html [Accessed January 2015].

³⁰ Great Barrier Reef Marine Park Authority. *Coral Bleaching*. [Online] Available from: www.gbrmpa.gov.au/managing-the-reef/threats-to-the-reef/climate-change/what-does-this-mean-for-species/corals/what-is-coral-bleaching [Accessed January 2015].

³¹ Carnegie Institution (17 September 2014) *Effect of ocean acidification: Coral growth rate on Great Barrier Reef plummets in 30-year comparison*. ScienceDaily [Online] Available from: www.sciencedaily.com/releases/2014/09/140917121225.htm [Accessed January 2015].

³² Great Barrier Reef Marine Park Authority. *Water Quality in the Great Barrier Reef* [Online] Available from: www.gbrmpa.gov.au/managing-the-reef/how-the-reefs-managed/water-quality-in-the-great-barrier-reef [Accessed January 2015]

³³ Protect the Bush Alliance. *Why Is The Great Barrier Reef In Danger?* [Online] Available from: <http://ptba.org.au/why-is-the-great-barrier-reef-in-danger> [Accessed January 2015].

³⁴ De'ath, G. et al. (2012) *The 27-year decline of coral cover on the Great Barrier Reef and its causes*. Proceedings of the National Academy of Sciences of the United States of America, 109 (44) 17995-17999. Available from: www.pnas.org/content/109/44/17995.full [Accessed January 2015].

³⁵ Keesing, J.K. and Lucas, J.S. (1992) *Field measurement of feeding and movement rates of the crown-of-thorns starfish Acanthaster planci*. Journal of Experimental Marine Biology and Ecology, 156, 89-104.

³⁶ De'ath, G. et al. (2012) *The 27-year decline of coral cover on the Great Barrier Reef and its causes*. Proceedings of the National Academy of Sciences of the United States of America, 109 (44) 17995-17999. Available from: www.pnas.org/content/109/44/17995.full [Accessed January 2015].

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³⁹ Governments' collective investment from 2009 to 2013 was AU\$375 million. Queensland government (2014) *Great Barrier Reef Report Card 2012 and 2013: Reef Water Quality Protection Plan*. Note: Exchange rate as per 1 June 2014. Publication date was June 2014. Exchange rate accessed from www.xe.com/currencytables/?from=AUD&date=2014-06-01

⁴⁰ United Nations Environment Programme (2013) *The Environment in the News*. [Online] Available from: www.unep.org/cpi/briefs/2013August15.doc [Accessed January 2015]

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Design by Louise Clements

The Great Barrier Reef in numbers

US\$5.8 BILLION

The Great Barrier Reef generates US\$5.8 billion each year

69,000

The reef supports nearly 69,000 jobs




39 MILLION

Up to an estimated 39 million cubic metres of dredge spoil could be dumped in the reef's World Heritage waters

1,500

More than 1,500 different species of fish live in the Great Barrier Reef

	<p>Why we are here To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.</p> <p>panda.org</p>
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