The applicant's report addressing the Terms of Reference is circulated for public comment in compliance with section 303EF(2)(b) of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The views and opinions expressed in this report are those of the applicant and do not necessarily reflect those of the Australian Government or the Minister for the Environment and Water.

Acropora Granulosa

Preparing a draft assessment report and application to amend the List of Specimens taken to be Suitable for Live Import (Live Import List)

Figure 1 Acropora granulosa axial and radial corallites. (Curtesy of collectorscorals.com – permission to use.)

Terms of Reference

1. Taxonomy

- **Kingdom:** Animalia
- **Phylum:** Cnidaria
- **Class:** Anthozoa
- **Order:** Scleractinia
- **Family:** Acroporidae
- **Genus:** *Acropora*
- **Species:** *Acropora granulosa (Milne Edwards & Haime, 1860)*

This species is a type of stony coral commonly found in shallow reef environments throughout the Indo-Pacific region. It is known for its branching structure and is a key contributor to reef-building.

2. Identification

A. Colony Structure

Acropora granulosa forms flattened, plate-like colonies that are irregularly shaped and often extend horizontally. The colonies have short, slender, and widely spaced branchlets that emerge from the surface of the plate, giving it a delicate and sparse appearance.

B. Corallites (Skeletal Structure)

Axial Corallites: Large and tubular, located at the ends of branches. Radial Corallites: Small and pocket like.

C. Coloration

Common colours include cream, blue, purple, pink, green, or yellowish-brown.
Tips of branches may appear paler or have contrasting colours.
Colour can vary depending on depth, location, and presence of symbiotic zooxanthellae.

D. Surface Texture

Branch surfaces have a smooth appearance with evenly distributed corallites. The skeleton is made of aragonite (calcium carbonate), contributing to reef-building.

E. Growth Form & Habitat Preferences

Found in shallow reef environments (5–25 meters depth). Prefers clear waters with moderate to strong currents.

Tubular axial corallites with small, pocket like radial corallites. (Figure 2)

Figure 2 Acropora granulosa axial and radial corallites. (Curtesy of collectorscorals.com – permission to use.)

3. Conservation status

Listed on CITES as an appendix II species.

Listed on the IUCN Red List as an Vulnerable species.

Acropora granulosa is listed on in the CITES list as not currently threatened.

Acropora granulosa is listed on the IUCN Red List due to climate change, habitat loss and reef degradation.

4. Purpose and source of import

Acropora granulosa are a popular species for the aquaculture and aquarium industry. The use of Acropora granulosa can be for hobbyists, aquaculture, commercial aquariums, reef restoration and even research. Due to restrictions and limits of wild caught Acropora granulosa the species is highly aquacultured in the aquarium industry as a household pet.

5. Legislative controls

Commonwealth, State and Territory legislation on the harvesting of Acropora granulosa in the wild.

Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): Under this act, *Acropora granulosa* is protected as part of Australia's commitment to conserving biodiversity. Any activities involving this species, such as collection or trade, require assessment and approval to ensure they do not negatively impact the environment.

State and Territory legislation

- **Queensland**: The *Fisheries Act 1994* regulates the collection and trade of corals. A permit is required for any harvesting of corals from the wild.
- **Western Australia**: The *Fish Resources Management Act 1994* governs the taking of coral species. Collection is generally prohibited without appropriate authorization.
- **New South Wales**: Under the *Fisheries Management Act 1994*, all corals are protected, and collection from the wild is not permitted without a specific permit.

- **Victoria**: The *Fisheries Act 1995* includes provisions for the protection of marine invertebrates, including corals. Collection is regulated and typically requires a permit.
- **South Australia**: The *Fisheries Management Act 2007* regulates the collection of marine organisms. Specific regulations apply to corals, and permits are required for collection.
- **Tasmania**: The *Living Marine Resources Management Act 1995* governs the collection of marine species. Corals are protected, and collection is controlled through permits.
- **Northern Territory**: The *Fisheries Act 1988* regulates the taking of fish and aquatic life, including corals. Collection is subject to licensing and permits.
- **Australian Capital Territory**: Being landlocked, the ACT does not have specific legislation regarding marine species like corals.

6. **Has the species been the subject of domestication (or cultivation) for at least 20 generations, or is it easily reared in captivity?**

Acropora granulosa has been successfully propagated in captivity through coral aquaculture, including fragging and mariculture. However, it has not been subject to domestication in the traditional sense for at least 20 generations. While it can be reared in captivity, maintaining optimal conditions for long-term survival and reproduction requires specialized care, including stable water parameters, lighting, and nutrient levels.

7. **Is the taxon harvested in the wild and likely to be sold or used in its live form?**

Acropora granulosa is harvested in the wild and is commonly sold or used in its live form. It is a popular species in the marine aquarium trade, where it is collected for ornamental purposes. Additionally, it is sometimes sourced for reef restoration projects. However, wild collection is regulated in many regions to prevent overexploitation and support sustainable practices, with aquaculture and mariculture efforts helping to reduce pressure on natural populations.

8. **Are there any invasive races, subspecies, or varieties?**

There are no known invasive races, subspecies, or varieties of Acropora granulosa.

9. What is the country of origin and the natural distribution of this species?

Acropora granulosa is naturally distributed across the Indo-Pacific region, including the Red Sea, Indian Ocean, and the central and western Pacific Ocean. It is commonly found in the following regions:

- East Africa and the Red Sea
- Indian Ocean (including Madagascar, Seychelles, Maldives)
- Southeast Asia (Indonesia, Philippines, Thailand, Malaysia)
- Australia (Great Barrier Reef, Ningaloo Reef, Coral Sea)
- Pacific Ocean islands (Fiji, Palau, Solomon Islands, New Caledonia)
- Japan (Okinawa and surrounding waters)

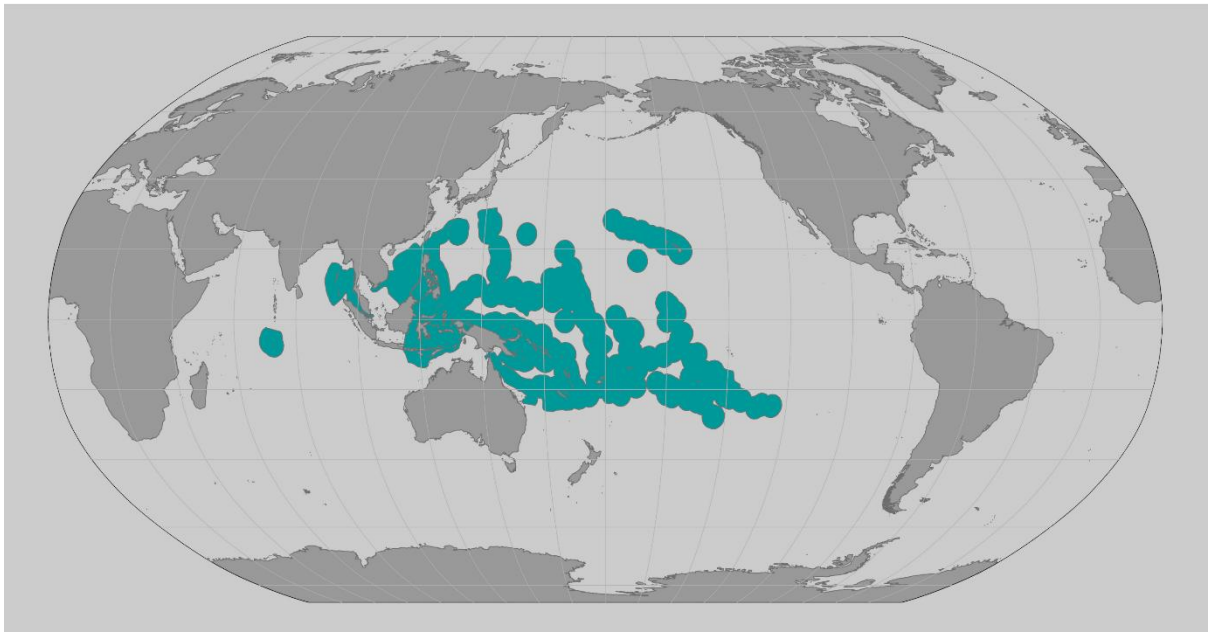

Figure 3 Acropora granulosa locations in the Indo-Pacific Region. (Courtesy of fisheries.noaa.gov – permission to use / public domain.)

10. **Are there areas in Australia that are climatically similar to the species' native range?**

Yes, northern Queensland, the Great Barrier Reef, Coral Sea, and parts of Western Australia and the Northern Territory have climates similar to the native range of Acropora granulosa. These areas provide suitable environmental conditions for its growth and natural distribution.

11. **Is the taxon already present outside of captivity anywhere in Australia?**

Yes, Acropora granulosa is already present outside of captivity in Australia, as it is a naturally occurring coral species found in Australian reef ecosystems. Including:

- Great Barrier Reef
- Ningaloo Reef
- Coral Sea Reefs

12. **How many potential pathways could the taxon use to enter the Australian environment?**

While Acropora granulosa is already present in Australian waters, potential pathways to enter the Australian environment include:

- Natural Dispersal (Larval Transport)
- Coral Mariculture & Restoration Projects
- Aquarium Trade & Accidental Releases
- Shipping & Hull Fouling

13. **Has the taxon become naturalised (established viable populations) outside its native range?**

No, Acropora granulosa has not been recorded as a naturalized species outside its native range. It is naturally distributed throughout the Indo-Pacific, including Australia, Southeast Asia, and the Pacific Islands. While it can spread through natural larval dispersal, there is no evidence of it establishing viable populations in completely non-native environments where it did not previously occur.

14. **In the species' introduced range, are there known adverse impacts to:**

- ☐ **wild stocks or commercial species**
- ☐ **aquaculture species**
- ☐ **ecosystem services?**
- ☐ **socio-economic impacts?**

15. **Does the species have any harmful characteristics (poisonous/venomous/spines/aggression), or pose any risks to human health?**

Acropora granulosa is generally harmless to humans but should be handled with care to avoid minor skin irritation or cuts.

16. **Is it likely that the species will sequester food resources from, or smother, one or more native species?**

Acropora granulosa is a native Australian species and does not pose a significant risk of outcompeting or smothering other native corals in its natural range.

17. **Are there threatened or protected taxa that the non-native species would consume or parasitise in Australia?**

Acropora granulosa is not a non-native species in Australia, as it is native to the region. Therefore, it does not pose a direct threat of consuming or parasitizing other threatened or protected taxa in its native habitat.

18. **Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?**

Acropora granulosa is relatively adaptable within its natural habitat range in terms of climatic and environmental conditions, which includes a range of factors such as water temperature, salinity, light levels, and water flow.

19. **Would the species disrupt food webs in ecosystems it has or is likely to invade?**

Acropora granulosa, being a native species in many parts of the Indo-Pacific, does not typically disrupt food webs in ecosystems where it naturally occurs.

20. **Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?**

Given that Acropora granulosa is a native species in many parts of the Indo-Pacific region, including Australia, it is unlikely to exert adverse impacts on ecosystem services in the areas where it is naturally found. In its native range, this species typically contributes positively to ecosystem functions such as reef building, habitat provision, and biodiversity support.

21. **Does the species host, and/or is it a vector, for one or more recognised infectious diseases/parasites that are endemic in Australia?**

Acropora granulosa does not serve as a primary host or vector for specific infectious diseases or parasites endemic to Australia. However, it, like many other coral species, can be affected by general coral diseases (e.g., white syndrome, coral bleaching) and predators, which can impact its health. Coral reef ecosystems in Australia face various disease threats, and A. granulosa is susceptible to those that affect corals in general.

22. **Does the species host, and/or is it a vector, for one or more recognised infectious diseases/parasites that are absent from Australia (not endemic)**

Acropora granulosa does not appear to be a recognized host or vector for any infectious diseases or parasites that are absent from Australia (i.e., non-endemic species). However, as a coral species, it could theoretically host or become affected by diseases or parasites that are present in other parts of the world and might spread to Australia if the environmental conditions change.

23. **What is the species' common and maximum body size?**

Acropora granulosa can vary from a small colony (A few centimetres to around 50 centimetres) to larger colonies that can grow upwards of 1-2 metres in favourable conditions.

Maximum size can be upwards of 3 metres in diameter with branches up to 30 centimetres in length.

24. **Is the species tolerant of a range of water velocity conditions?**

Acropora granulosa is somewhat tolerant of a range of water velocity conditions. They prefer moderate to strong water currents but can tolerate a range of water velocities.

25. What is the diet and feeding behaviour of the species?

Acropora granulosa, like other corals in the genus Acropora, has a mixed feeding strategy that combines both photosynthesis and heterotrophic feeding. The species' diet and feeding behaviour are influenced by its symbiotic relationship with zooxanthellae (photosynthetic algae) as well as its ability to capture food from the surrounding water. **They** also feed on small plankton, small zooplankton, and organic particles from the water column.

26. Does feeding or other behaviours of the species reduce habitat quality for native species?

Acropora granulosa generally enhances habitat quality for native species by contributing to the structural complexity of the reef and providing shelter for a variety of organisms. While competition for space with other corals or reef organisms may occur, its feeding behaviour does not directly reduce habitat quality for native species. Instead, it functions as a valuable component of the reef ecosystem, supporting biodiversity and promoting the health of the reef habitat.

27. Does the species exhibit parental care and/or reduce age-at-maturity in response to environmental conditions?

Acropora granulosa does not engage in parental care, as it relies on broadcast spawning for reproduction and the larvae develop without any direct nurturing. While it can respond to environmental conditions in terms of age-at-maturity (faster maturation in favourable conditions, slower in stressful environments), it does not have the ability to reduce age-at-maturity as a direct adaptive response to environmental change.

28. Is the species likely to produce viable gametes or propagules in Australia?

Yes, Acropora granulosa is highly likely to produce viable gametes and propagules in Australia, given that it is native to the region and adapted to the local environmental conditions. The species' reproductive processes, including broadcast spawning and planula settlement, are well-suited for success in Australian reef ecosystems.

29. **Does the species hybridise under natural conditions? Is the species likely to hybridize with native species in Australia?**

Acropora granulosa is capable of hybridizing with other Acropora species, and it is likely to hybridize with native Acropora species in Australia under natural conditions, especially if they share similar spawning times and reproductive compatibility. Hybridization events are more likely to occur in areas with multiple Acropora species co-existing, such as coral reefs, where reproductive synchronization happens.

30. **Is the species hermaphroditic, or it is capable of asexual reproduction or parthenogenesis?**

Acropora granulosa is hermaphroditic, meaning it has both male and female reproductive organs, but it primarily reproduces through sexual reproduction via broadcast spawning. It does not reproduce via asexual reproduction or parthenogenesis in the wild, though fragmentation may sometimes occur naturally as a form of vegetative propagation.

31. **Is the species dependent on the presence of another species or specific habitat features to complete its life cycle?**

Yes, Acropora granulosa is dependent on specific habitat features and environmental conditions to complete its life cycle. They require hard, stable substrates to settle and grow, which are typically found in healthy coral reef environments. This includes reef flats, slopes, and reef crests where hard surfaces are abundant.

32. **What is the fecundity of the species (number of eggs per spawn), and does it produce offspring multiple times in a lifecycle, or have an extended spawning season?**

Acropora granulosa has high fecundity, producing large numbers of eggs (potentially in the millions) during each spawning event. The species typically has a single or a few spawning events per year, often aligned with the lunar cycle and seasonal environmental cues. The fecundity and timing of reproduction ensure that the species has the potential for successful recruitment and colony establishment, particularly in healthy and stable reef environments.

33. What is the time from hatching/parturition to full maturity?

The time from hatching/parturition to full maturity in Acropora granulosa is approximately 3 to 4 years for sexual maturity). Full colony development may take 5 to 10 years, depending on environmental conditions. However, the species' reproductive success is highly dependent on maintaining favourable reef conditions that promote growth and health throughout this period.

34. Are life stages likely to be dispersed unintentionally?

Yes, the life stages of Acropora granulosa, particularly planulae and fragments, are likely to be dispersed unintentionally due to ocean currents, water movement, and fragmentation. These processes allow the species to spread to new areas, promoting genetic diversity and the potential for establishment in new habitats.

35. How many pathways (intentional and unintentional) could the species use to disperse? Will any of these pathways bring the taxon in close proximity to one or more protected areas (e.g., marine parks, Ramsar Wetlands sites, world heritage and national heritage listed areas)?

Acropora granulosa has multiple dispersal pathways, both natural and human-mediated, including ocean currents, tidal movements, shipping activities, and tourism. These pathways could potentially bring the species in close proximity to or into protected areas, such as marine parks, Ramsar Wetlands, or World Heritage-listed areas, where it might influence local reef dynamics.

36. Does the species have a means of actively attaching itself to hard substrata (e.g., ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?

While Acropora granulosa does not actively attach itself to hard substrates, it is still capable of settling on these surfaces through passive processes. The planulae (larvae) can settle on man-made structures like ship hulls, buoys, and pilings if they come into contact with them during their settlement phase.

37. Are eggs or larvae dispersed by water current, or can they move between water bodies via connections?

Yes, the eggs and larvae (specifically planulae) of Acropora granulosa are dispersed by water currents and these currents can move the larvae between different water bodies.

38. Are juveniles or adults of the species known to migrate (spawning, smolting, feeding)?

Acropora granulosa does not exhibit migratory behaviour in the sense of spawning migration, feeding migration, or smolting. While the larvae are dispersed by water currents, this is a passive process rather than an active migration. Both juveniles and adults are sessile and remain in one location after settlement, with movement occurring primarily through fragmentation (for adults) and passive dispersal of larvae.

39. Are eggs of the species known to be dispersed by other animals?

The eggs of Acropora granulosa are not directly dispersed by other animals.

40. Is dispersal along any of the above-mentioned pathways likely to be rapid?

Yes, dispersal of Acropora granulosa larvae along the above-mentioned pathways is likely to be rapid, depending on environmental conditions.

41. Is the species (at any life stage) able to withstand being out of water for extended periods (e.g. minimum of one or more hours)?

Acropora granulosa is not capable of withstanding being out of water for extended periods (such as one or more hours) and will likely experience significant stress, dehydration, and potential mortality if exposed to air for long durations.

42. What are the species environmental tolerances, including water quality, oxygen, pH and temperature extremes?

Acropora granulosa is adapted to the specific environmental conditions of tropical and subtropical coral reef ecosystems. It has relatively narrow tolerances for factors like temperature, pH, oxygen, and water quality. Exceeding these tolerances can result in stress, bleaching, or mortality. Summary of tolerances below:

- Temperature: 18°C to 32°C with optimal growth between 26°C to 30°C.
- pH: 7.8 to 8.4 (slightly alkaline conditions).
- Oxygen: Requires well-oxygenated waters.
- Water Quality: Low nutrients, low sedimentation, and low pollution are essential for survival.
- Salinity: 34-37 ppt.
- Light: Needs clear, shallow waters with adequate light for photosynthesis.

43. Can the species be controlled or eradicated in the wild with chemical, biological, or other agents/means?

Yes, Acropora granulosa can be controlled or eradicated in the wild with chemical, biological, or other agents.

44. Does the species tolerate or benefit from environmental disturbance?

Acropora granulosa is not a species that typically benefits from environmental disturbance. In fact, it is highly sensitive to disturbances like thermal stress, sedimentation, pollution, and physical damage. While it does have some resilience mechanisms (e.g., the ability to fragment and regrow), these disturbances generally have negative effects on the health and survival of the species.

45. Does the species have a wide salinity tolerance at any stage of its life cycle?

Acropora granulosa does not have a wide salinity tolerance. It prefers and thrives in stable, normal marine salinity ranges (32 to 37 PSU), which is typical of tropical reef environments. Sudden drops in salinity (such as during freshwater influx) or elevated salinity can cause significant stress and negatively affect the coral, particularly during its larval and juvenile stages.

46. Are there effective natural enemies of the species present in Australia?

Yes, Acropora granulosa faces a variety of natural enemies that can harm the species, including:

A. Herbivores:

- Herbivorous fish and sea urchins can damage corals indirectly by grazing on the algae that cover coral colonies, or by feeding on the zooxanthellae living within the coral tissue. While they typically don't directly consume coral tissue, their grazing can stress the coral and make it more vulnerable to other threats.
- Some species of parrotfish and surgeonfish are known to feed on algae and can indirectly harm corals by disrupting the algal balance on the reef.

B. Coral Predators:

- Crown-of-thorns starfish outbreaks have been known to cause large-scale coral damage on the Great Barrier Reef and other parts of Australia, devastating entire coral colonies and reducing biodiversity.

C. Coral Diseases:

- White syndrome: A group of bacterial infections that cause tissue loss and bleaching in corals, including A. granulosa. This disease can lead to significant mortality in coral populations. Some species of parrotfish and surgeonfish are known to feed on algae and can indirectly harm corals by disrupting the algal balance on the reef.
- Black band disease: Caused by a combination of cyanobacteria and other microorganisms, this disease can rapidly infect coral colonies, leading to tissue death.

D. Coral-Digesting Snails:

- Coralliophilid snails (e.g., Coralliophila violacea) are marine gastropods that feed on coral tissue. These snails often target Acropora species and can cause localized damage to coral colonies.

E. Parasitic Infestation:

- Parasites such as ectoparasitic copepods and barnacles can infest corals, including A. granulosa. These parasites typically attach to coral colonies, feeding on their tissue and causing stress.

F. Environmental Stressors:

- Sedimentation can smother coral colonies, reducing the amount of sunlight available for photosynthesis by the zooxanthellae and lowering the coral's energy levels.

- Ocean acidification affects coral skeleton development, reducing their ability to build robust calcium carbonate structures and weakening them in the face of natural enemies.

G. Human Impacts:

- Human activities, such as pollution, overfishing, coastal development, and reef tourism, can exacerbate the impacts of natural enemies by stressing coral reefs and promoting conditions that favour the spread of predators and diseases.

47. Under the predicted future climatic conditions, are the risks of entry, establishment and dispersal into the Australian environment posed by the species likely to increase, decrease or not change?

The risks of entry, establishment, and dispersal of Acropora granulosa into Australian environments are likely to increase under predicted future climatic conditions. The main drivers for this increased risk include:

- Warmer temperatures creating more favourable conditions for expansion.
- Potential shifts in ocean currents and habitat availability.
- Changes in predator-prey dynamics and the increased spread of coral diseases.

However, this increased risk may also be tempered by challenges such as ocean acidification and salinity shifts, which could limit the species' ability to thrive in certain areas.

48. Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity, ecosystems and socio-economic factors?

The likely magnitude of the future potential impacts of Acropora granulosa on biodiversity, ecosystems, and socio-economic factors in Australia under predicted future climatic conditions is high. The combined effects of rising sea temperatures, ocean acidification, and increased storm intensity will likely exacerbate the vulnerabilities of coral reefs, including A. granulosa, to bleaching, disease, and habitat loss. This will lead to significant biodiversity loss, reduced ecosystem services, and socio-economic disruption, particularly in coastal communities dependent on fisheries and tourism.

49. Is there the potential for any habitat or ecological community changes resulting from establishment?

Yes, there is potential for habitat or ecological community changes resulting from the establishment of Acropora granulosa in areas outside its native range. Given that A. granulosa is a coral species that contributes to the formation of reef habitats, its presence could cause shifts in the structure and dynamics of marine ecosystems in both positive and negative ways.

50. In the event of establishment, are there any potential social or cultural impacts?

No, Acropora granulosa is already an Australian native species and is already established on the Great Barrier Reef, Ningaloo reef and Coral Sea Reefs.

51. In the event of establishment, are there any potential economic impacts?

No, Acropora granulosa is already an Australian native species and is already established on the Great Barrier Reef, Ningaloo reef and Coral Sea Reefs.

52. What control/eradication programs could be applied in Australia if the species was released or escaped?

Since Acropora granulosa is native to Australia, control or eradication programs would not typically be necessary.

53. What conditions or restrictions could be applied to the import of the species to reduce any potential negative environmental impacts?

Since Acropora granulosa is native to Australia, its import would typically be regulated under existing biosecurity and environmental protection laws to prevent risks such as disease introduction, genetic contamination, or accidental release into non-native ecosystems.

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