

1. Background

1.1. Coral Reefs

Coral reefs are some of the most productive ecosystems on the planet. They are also some of the most valuable ecosystems because of their biological diversity, economic value and the environmental services they provide. Coral reefs have an estimated global value of US\$375 billion each year, based on food security, coastal protection from waves and storms and tourism-related income.

Unfortunately, coral reefs around the globe are being threatened by human impacts. These impacts are both local, such as overfishing and pollution, as well as global, such as climate change. It is therefore of critical importance that coral reefs are managed in such a way that they can continue to benefit people that depend on them and sustain local economies.

1.2. Marine Protected Areas (MPAs)

Marine protected areas (MPAs) broadly describes areas where natural and/or cultural resources are given greater protection and management than the surrounding waters. The variety of uses for MPAs has led to confusion over what the term actually means. Some people interpret marine protected areas to mean areas closed to all human activities. This is not the case. MPAs can incorporate special areas established for conservation, but may also include recreational and limited fisheries areas. MPAs therefore create a framework for sustainable use and resource management that are designated to protect marine ecosystems. The most effective MPAs are those that are part of a holistic approach where MPAs protect coral reefs from a series of stressors, so they can recover faster from any single disturbance.

Scientific assessments can provide the information needed to guide the conservation and sustainable use of coral reefs. Together with stakeholders, a consensus can be reached to implement a zonation scheme as part of the MPA, thereby helping to protect critical habitats. Community involvement is widely accepted to be an integral part of any management plan. By engaging communities and other stakeholders throughout the consultation process, they take on a sense of ownership in their marine resources and the support for a management plan is significantly enhanced. An MPA that receives wider support has a much better chance of being effectively managed and protected. Without this consultation, MPAs can sometimes become 'paper parks', where the legislation is in place but there is no actual enforcement. Once this happens, it is very difficult to turn the tide. Therefore, the steps preceding MPA establishment are crucial for successful implementation and sustainability.

1.3. MPA Benefits

MPAs can be an effective management tool for protecting biodiversity as well as replenishing fish stocks from within 'no-take' zones to surrounding waters through a spillover of fish. By allowing fish to grow to an adult size, their reproductive capacity is increased, sometimes exponentially, providing a sustainable source of fish from the MPA.

A well-managed MPA can benefit a wide range of stakeholders. Local fisheries can benefit from no-take zones through increased fish catches. Communities benefit through improved quality of life and preservation of their customs and cultural heritage, increasing local income and providing food. The no-take areas within MPAs can be attractive dive sites, with healthy reefs and large fish. Divers are usually willing to pay to be able to visit these areas, generating income and increasing tourism numbers. This income can in turn be used to keep the MPA functioning effectively. Sustainable tourism is currently the most profitable sector of the tourism industry. In the Caribbean, travel and tourism alone contribute to a total of US\$105 billion annually.

2. Creating Effective MPAs

In 2005, the International Coral Reef Alliance listed a number of strategies that should be considered for incorporation in order for MPAs to be effective in meeting their goals. Those relevant to the Koh Rong and Koh Rong Samloem Islands have been listed here:

- ✓ **Set goals for coastal zone management.** Determine, through stakeholder consultations, the long and short-term goals required to create strategies that help ensure protection of coral reefs and related habitats.
 - ✓ **Develop a strong coastal management constituency.** This will require partnerships and an MPA steering committee at a local, regional and national level.
 - ✓ **Involve local stakeholders and consider their socio-economic needs.** MPAs are more successful when local communities are fully incorporated in the decision-making process. When they are educated about the financial and fisheries benefits of the designation of an MPA in local waters, the likelihood of success is even greater.
 - ✓ **Use local knowledge** by learning and sharing from local communities, using traditional knowledge to support marine conservation and sustainable fisheries.
 - ✓ **Develop a zonation plan** including several no-take and restricted use zones to help protect and sustainably manage the coastal resources of the islands.
 - ✓ **Develop a legal and institutional framework to support the MPA.** Create and enforce a strong legal and institutional framework, including economic incentives, to reinforce desired behaviours and outcomes.
 - ✓ **Assess and monitor the effectiveness of the MPA management plan once implemented.** This would include monitoring the health of coral reefs at several permanent monitoring stations within the MPA. Assessments of pollutants and sedimentation will allow for the development of control measures.
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3. Initial Recommendations

1. **An effective zonation plan should be implemented after consultations with all stakeholders**, including the island concession holders, tourism industry and island communities. Part of this process will require a local community engagement campaign whereby current perceptions are gauged, fisheries needs are assessed and several consultation rounds are conducted in order to reach a general consensus for the implementation of a zonation plan.
 2. Particularly **destructive and unsustainable fishing methods**, particularly nearshore trawling and bottom weighted gillnets, **should be prohibited** within all the MPA zones. Strict law enforcement and increased capacity through material and manpower are needed to ensure illegal activities are not threatening the MPA.
 3. **Continued scientific monitoring** at several permanent stations around the islands will allow us to assess the impact on coral reef health pre and post establishment of the MPA. Results from these assessments can help to adapt the management and zonation plan if needed.
 4. As the island continues to undergo significant development, the **environmental impact** of these **developments will need to be assessed and considered within the zonation plan**. Although the MPA will provide some level of protection, it cannot mitigate land-based impacts such as terrestrial runoff, sedimentation and sewage. These issues will need to be carefully considered and integrated into the management plan.
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4. Multiple-use zonation plan for an MPA

The zonation of MPAs is recommended as an effective management procedure whereby different zones within the MPA define what uses are limited, to what extent, and by what means. Particular zones help protect sensitive habitats from damaging activities, confine intensive use such as fishing to sites that can sustain it, and separate incompatible activities. Recreational tourist areas can be confined to specific zones, and if properly designed and controlled, can be significant assets to the MPA by facilitating education, scientific research and generating revenue whilst protecting particularly sensitive habitats. Several recommended zones are listed below. Table 1 on the next page summarises the restrictions for each zone.

- ***Limited Use Zones***

Limited non-destructive fishing activities may be undertaken. It is recommended that a cap on fishing gears is imposed in order to ensure the fisheries remains sustainable. Anchoring is allowed on sandy areas (but not on reefs); diving is made possible but snorkeling is forbidden for safety reasons.

- ***Tourism, Conservation and Fisheries Replenishment Zones***

No-take zones within which extractive practices are prohibited. This allows fish stocks within the zone to recover over time, eventually leading to a spillover of fish from the no-take zone to the adjacent areas where they can be caught by fishermen. These zones will be most effective, if placed in areas of relatively good reef health.

The zones also protect fragile coral reefs within them assuming other (land-based) disturbances such as pollution and sedimentation are addressed. Healthy reefs generally have a high aesthetic appeal, attracting divers and snorkelers to the area and thereby creating a sustainable source of revenue through a user-fee system. To minimize human impacts to the area, anchoring is strictly forbidden and mooring buoys should be installed at key dive sites.

- ***Special Purpose Zones***

These zones correlate to needs related to fishing activities: area where to anchor/moor, pier building, boat fixing, etc. Higher boat traffic shall need speed regulations for safety reasons. Fishing is very limited as it mostly concerns children fishing on paddle-boats whom we cannot deprive of their daily subsistence catch.

- ***Other zones to be considered***

- Buffer Zone - established around core zones in order to buffer the no-take zones from the adverse effects of damaging activities from the multiple-use zones. Fishing within these zones should be moderated Anchoring is forbidden while snorkeling and diving are allowed. As mentioned in reports by Marine Conservation Cambodia, the creation of buffer zones may also help to avoid potential conflict between subsistence fishing (traditional fishing with long lines) and commercial fishing (crab traps).
 - Reserve Zone - no human activities whatsoever allowed in order to preserve particularly vulnerable habitats and key biodiversity sites or spawning grounds.
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Scientific monitoring research should be allowed within the zone and this type of zone may be restricted for certain times of the year.

- o Preservation Zone - damaged reef areas closed to activities to allow regeneration of reefs. Preservation zones may be required for sites heavily degraded from human activities.

Table 1 Summary of activities allowed and restricted within the MPA zones

(Adopted from Marine Conservation Cambodia report)

ACTIVITIES		Limited Use Zone	Tourism, Conservation & Fisheries Replenishing Zone	Special Purpose Zone
Squid fishing	Troll line	✗	✗	✗
	Long line	✓	✗	✓
Traditional bait fishing*		✓	✗ **	✓
Collecting shells		✗	✗	✗
Net fishing		✗	✗	✗
Traps	Squid trap	✓	✗	✗
	Crab trap	✗	✗	✗
	Fish trap	✓	✗	✗
Anchoring		✓ ***	✗	✓
Diving		✓	✓	✗
Snorkeling		✓	✓	✗
Research and scientific activities		✓	✓	✓

* Traditional bait fishing stands for long lines with 1 to 3 simple hooks, sometimes one squid lure added, baited with squid

** Paddle-boats (small polystyrene rafts) are allowed for subsistence fishing only (family scale).

*** Only on sand substrates

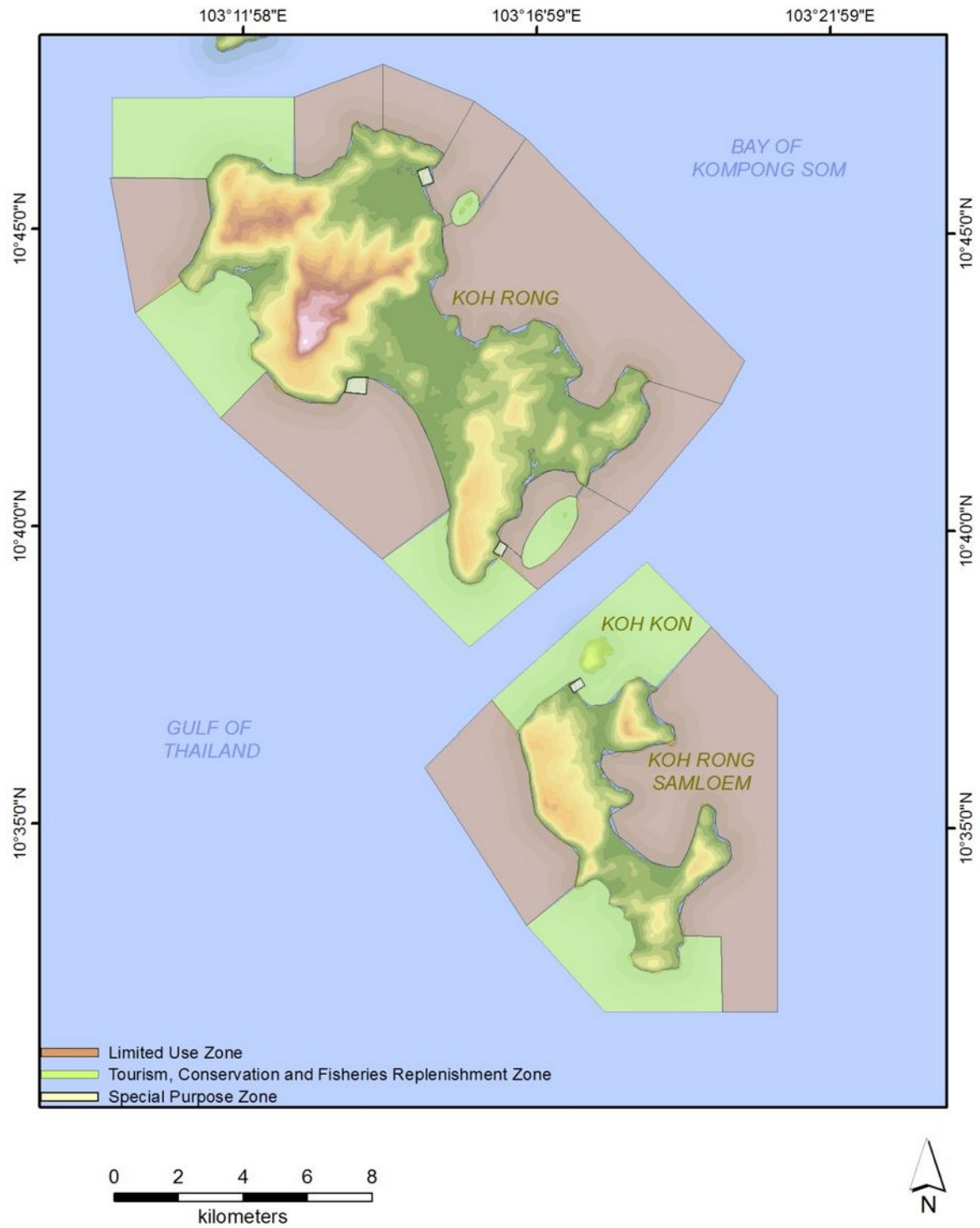


Figure 1 Proposed zonation plan for MPA, based on the scientific results.

Appendix B: Coral and Fish diversity and density maps for Koh Rong and Koh Rong Samloem

(details for how this information was collected can be found in the latest [CRCP project report](#) on the Coral Cay Conservation website: www.coralcay.org)

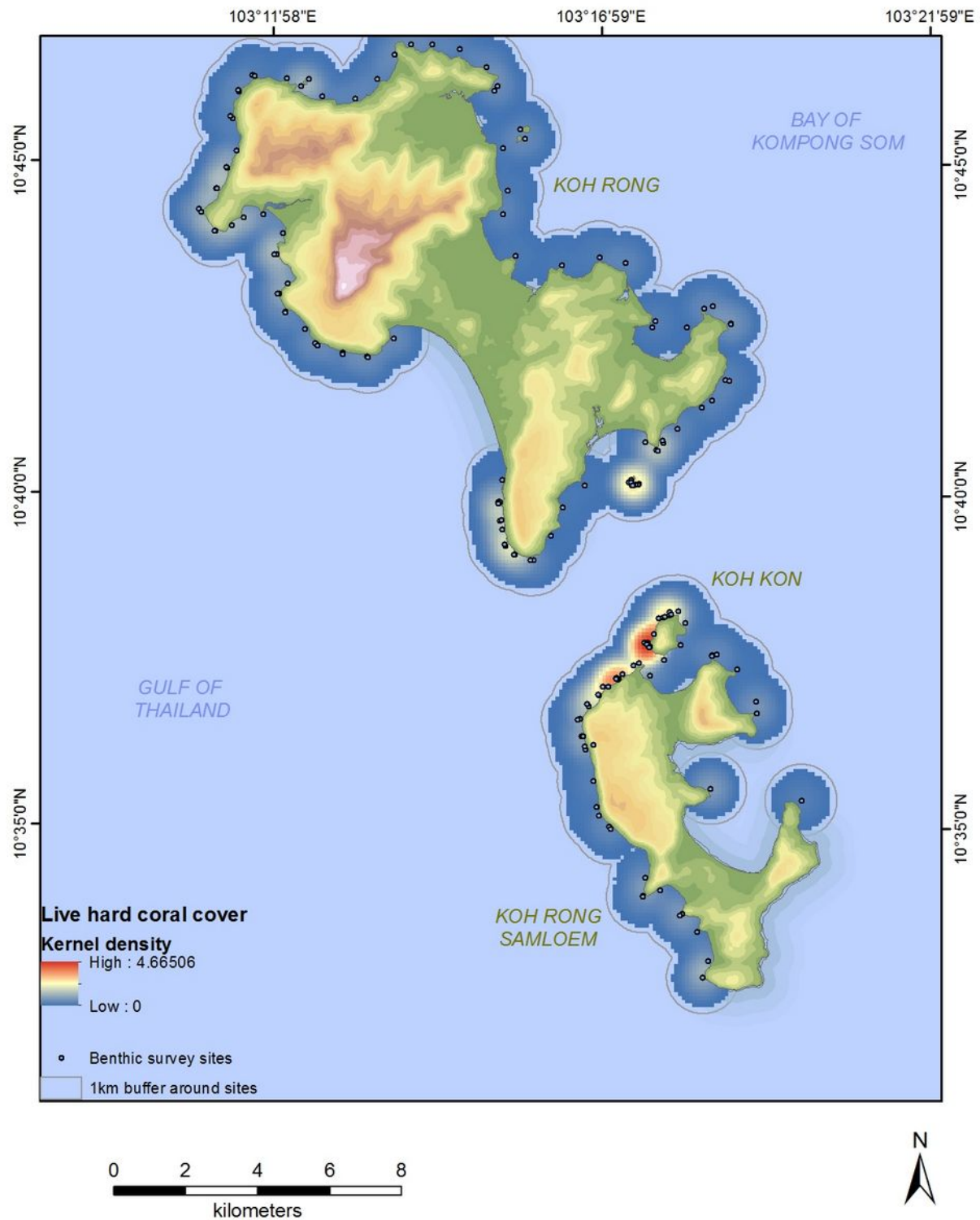


Figure 2 GIS map of kernel density of live hard coral cover around Koh Ron, Koh Kon and Koh Rong Samloem.

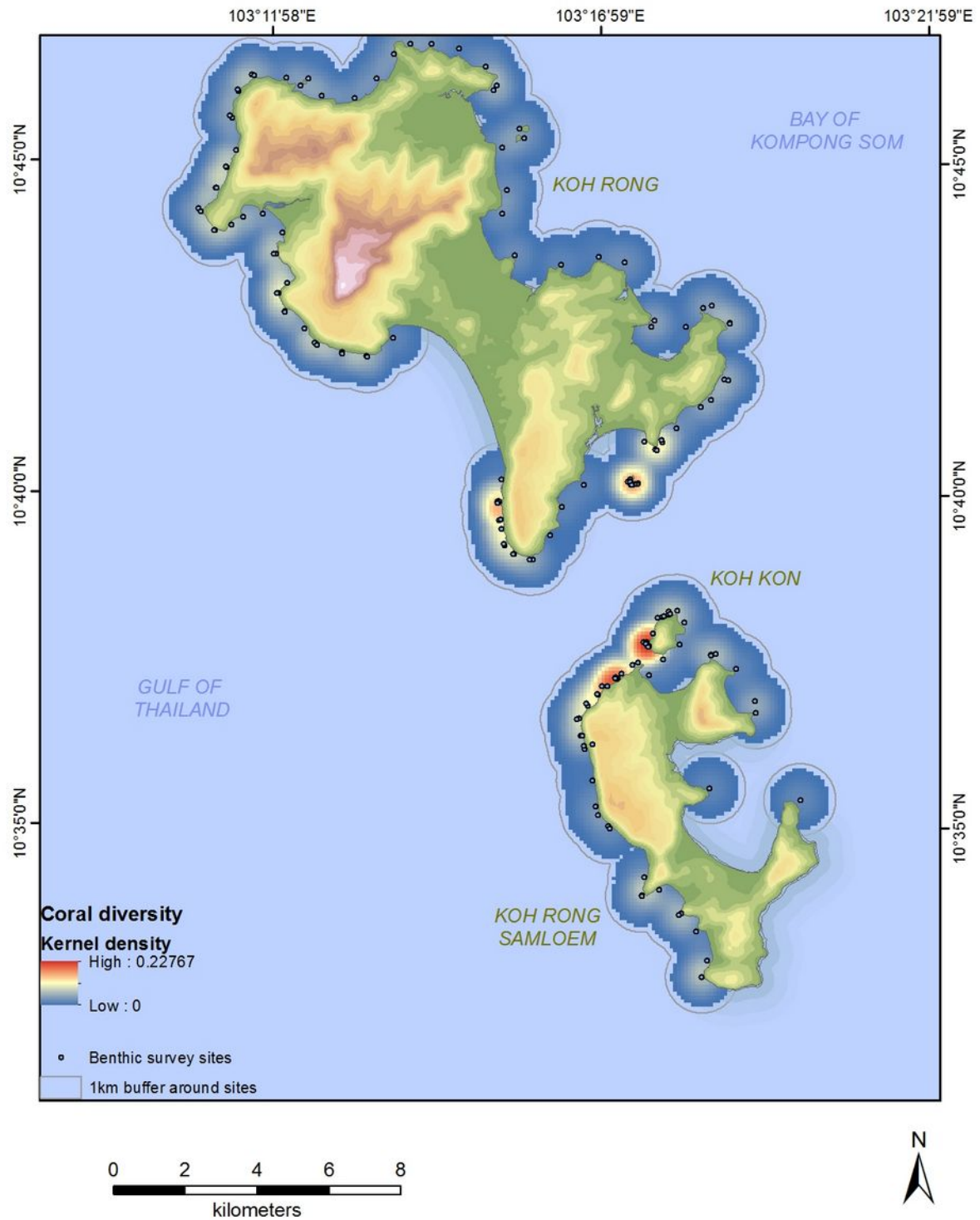


Figure 3 GIS map of kernel density of coral diversity ($H'(\log_e)$) around Koh Rong, Koh Kon and Koh Rong Samloem.

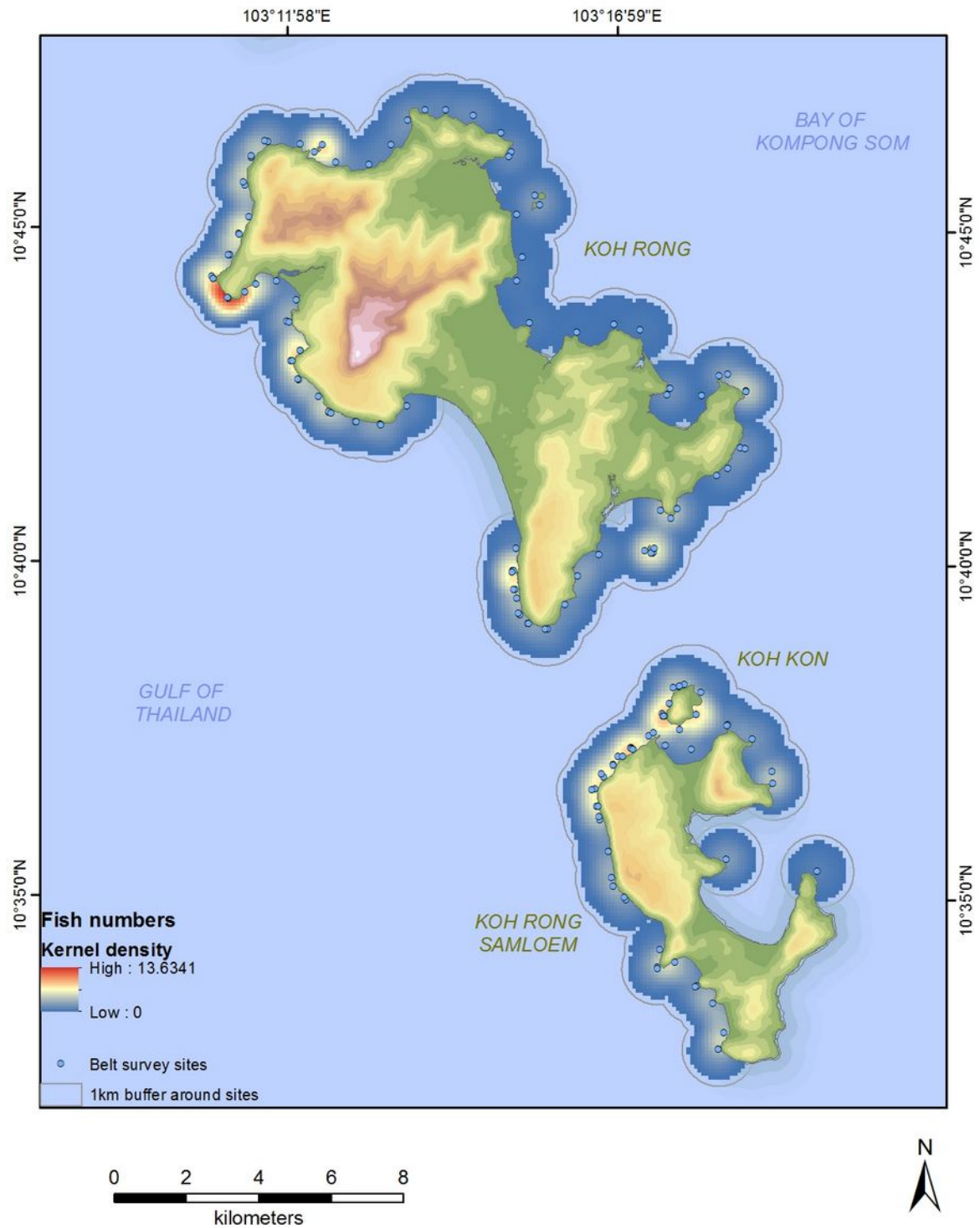


Figure 4 GIS map of kernel density of fish numbers around Koh Rong, Koh Kon and Koh Rong Samloem.

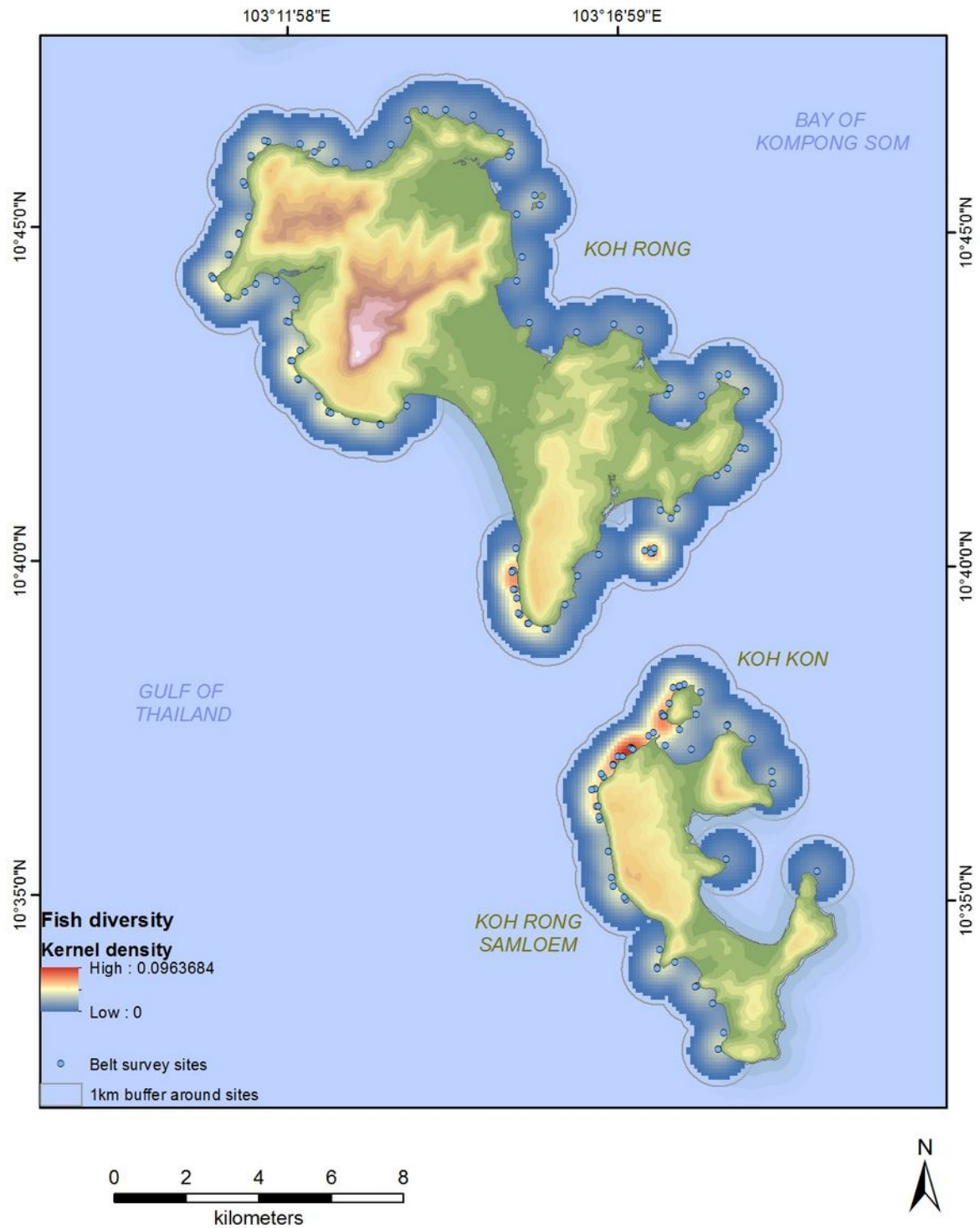


Figure 5 GIS map of kernel fish diversity ($H'(\log_e)$) around Koh Rong, Koh Kon and Koh Rong Samloem.