Valuable Marine Biological Resources in Pacific Island Countries and Their Development Potential

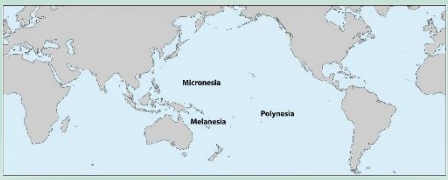
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Introduction

- Pacific Island Countries (PICs) in Melanesia, Micronesia, and Polynesia possess vast Exclusive Economic Zones (EEZs) but face limited resources and small economies that depend heavily on external support.
- Valuable marine biological resources—trochus, giant clams, black-lipped pearl oysters, coconut crabs, sea cucumbers, and sea grapes—are essential for food security, livelihoods, and export income.
- However, these resources now face serious threats from climate change, coastal development, and overexploitation, leading to ecosystem degradation and population decline. To overcome these challenges, a transition from traditional extractive fishing to sustainable aquaculture and integrated management systems is necessary.



Location of Pacific Island Countries

Rochia (=Trochus) nilotica



- Representative gastropod of Pacific Island Countries accounting for ~69% of global production. Inhabits shallow coral reefs at 0-20m depth with thick, cone-shaped shell and well-developed nacre.
- Populations declining due to overfishing and habitat loss.
- Used as food source and for shell crafts. Nacre is widely used for buttons, ornaments, and handicrafts, earning it the nickname "button mollusc."
- Sustainable aquaculture combined with local processing can generate 2-3x added value. Growing demand from natural materials and sustainable fashion industry.

Giant Clam



- Largest bivalve in the world, reaching up to 1 meter in length and over 200kg in weight. Inhabits coral reefs at 0-30m depth and grows rapidly through symbiotic zooxanthellae.
- Populations declining due to overfishing and habitat loss, with many species classified as Endangered (EN) or Vulnerable (VU).
- Used as food source and for shell crafts. Recently gaining attention in aquarium industry and coral restoration research as an important model organism.
- Aquaculture expansion is expected through aquarium market specialization and advanced technology development.

Black-lipped Pearl Oyster *(Pinctada margaritifera)*



- Pearl oyster distributed throughout the Indo-Pacific, inhabiting coral reef tidal zones. Asymmetrical shell with iridescent mother-of-pearl interior in silver, green, pink, and black.
- Historically used for button production, but shifted to black pearl production after Japanese pearl cultivation technology development in the early 1900s. Tahitian black pearl industry now accounts for approximately 95% of global black pearl production and is exported to luxury markets.
- Small-scale aquaculture projects are expanding in multiple Pacific Island Countries with eco-friendly farming practices. Future development requires disease management and luxury brand collaboration.

Coconut Crab (*Birgus latro*)



- World's largest land arthropod, weighing up to 4kg with leg span approximately 1 meter. Distributed throughout Indo-Pacific islands and coral atolls. Breathes air on land but drowns if submerged in seawater. Nocturnal scavenger feeding on coconuts, seeds, and fallen fruits.
- Traditionally used as food source and for ceremonial occasions. Shell and claws used as decoration and handicrafts. Recently gaining attention in ecotourism and aquarium industry.
- Populations declining due to habitat loss and overharvesting. Slow reproduction limits recovery, requiring habitat protection and harvesting restrictions.

Sea Cucumber



- Distributed worldwide with Indo-Pacific as center of species diversity. Inhabits sandy seafloor and coral reef areas at 1-50m depth. Soft-bodied, feeding on organic matter and fine sediment.
- Food and medicinal resource for centuries. Dried sea cucumber is premium ingredient in Asian markets (China, Hong Kong, Singapore) and studied for regenerative ability and immune-active substances for biotechnology.
- Over 60% of commercial species are overexploited. Fishing closures implemented in Pacific nations. Sustainable management requires artificial seedling production and community-based aquaculture.

Sea Grapes



- Edible green macroalga distributed widely in Pacific Island Countries. Inhabits tidal zones at 0-5m depth in lagoons and coral reef areas with gentle currents and sunlight. Grape-like leaflets with bright light green color.
- Traditional food in Philippines, Okinawa, Palau, and Micronesia used in salads and sushi. Called "Green Caviar" due to unique texture and rich minerals. Compatible with polyculture systems achieving water purification and resource recycling
- Industry growing in Philippines, Vietnam, and Japan. Low cost and fast regeneration ideal for small-scale fishers and women's groups. Sustainable production infrastructure and market development needed..

Conclusion

Item	Main Uses	Future Strategy	Industrialization Potential
Trochus	Shell crafts Natural buttons	Local processing Branding	High
Giant Clam	Food Ornamental	Aquaculture expansion Aquarium market specialization	Moderate
Black-lipped Pearl Oyster	Jewelry Ornaments	Luxury branding Disease management	Very High
Coconut Crab	Food Tourism resource	Eco-tourism Conservation management	Moderate
Sea Cucumber	Food Medicinal	Community-based aquaculture Processing	High
Sea Grapes	Food, bio Environment	Sustainable production Market/logistics infrastructure	Very High

- Pacific Island Countries' valuable marine biological resources are essential for food security, livelihoods, and high-value industries. The six major species (trochus, giant clams, black-lipped pearl oysters, coconut crabs, sea cucumbers, and sea grapes) possess high industrialization potential.
- However, resources are declining due to climate change and overexploitation. Sustainable aquaculture technology, local processing and branding, and community-based resource management are essential.
- Korea plans to double ODA to Pacific Island Countries by 2027. KIOST, with the only domestic research base in the Pacific region, can contribute to sustainable marine industry development through ecosystem conservation, technology transfer, and capacity building.