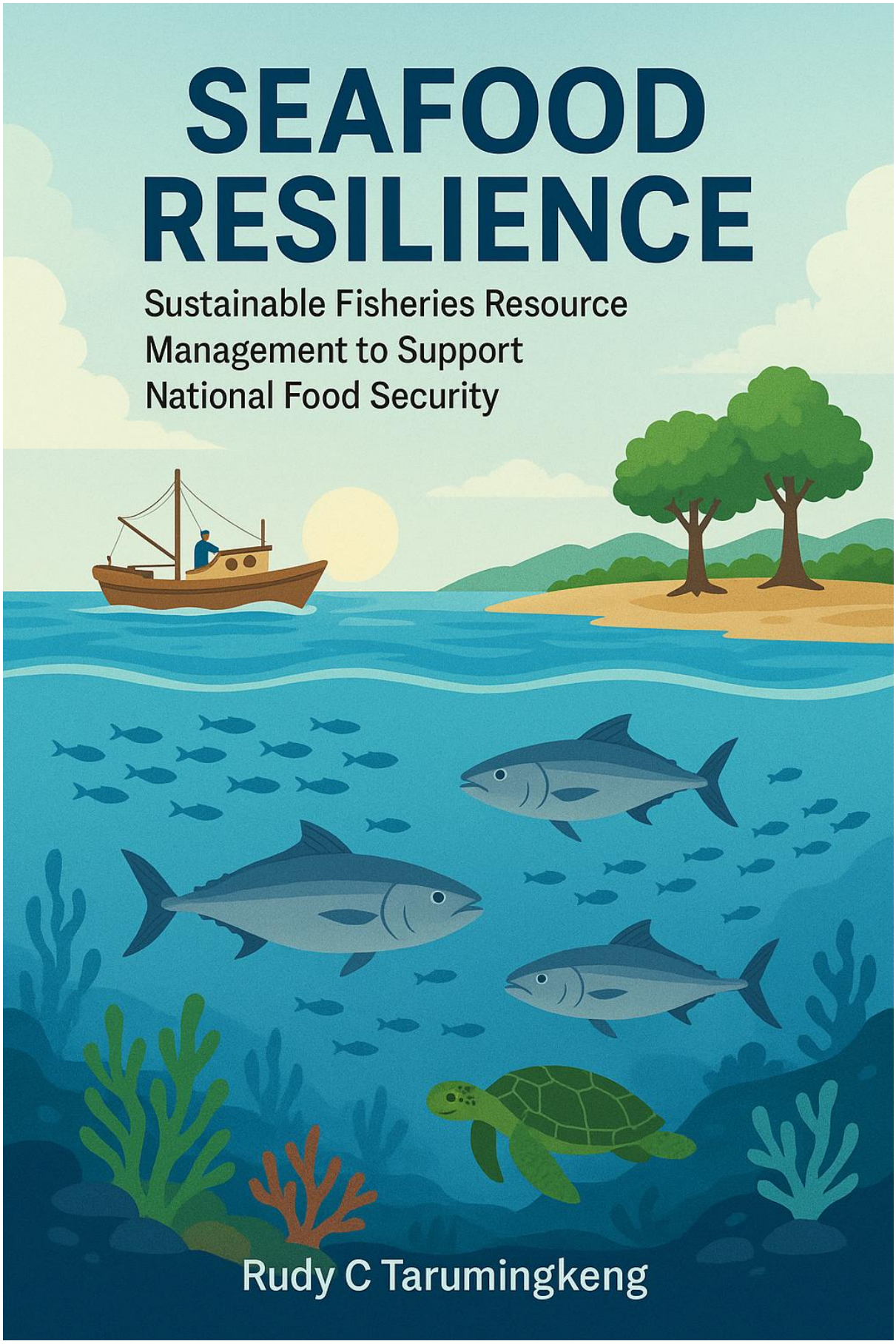
SEAFOOD
RESILIENCE
Sustainable Fisheries Resource
Management to Support
National Food Security
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MARINE FOOD RESILIENCE: SUSTAINABLE FISHERIES MANAGEMENT TO SUPPORT NATIONAL FOOD SECURITY

- *RudyCT Academic Series*

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1. Introduction: Why Marine Food Resilience Matters

When we speak about **food security**, we often picture rice fields, corn, or livestock. Yet for hundreds of millions of people, especially in archipelagic countries like Indonesia, **fish and other aquatic foods** are the real backbone of daily nutrition and local economies. Globally, aquatic foods (from both capture fisheries and aquaculture) reached around **223 million tonnes** of production in 2022, a new record that underlines their growing role in the world food system. (FAOHome)

In Indonesia, the picture is even more striking. The country is an **archipelago of more than 16,000 islands**, with about **6.4 million km² of marine area**—almost 80% of its territory. (IISD) Indonesia is the **second-largest marine capture producer in the world** (after China), contributing roughly **8% of global marine capture** in recent

years. (IISD) Marine fisheries and aquaculture supply animal protein, jobs, export revenue, and livelihoods for millions of coastal households.

However, this marine food base is under pressure. Globally, **35.5% of assessed fish stocks are overfished**, while 64.5% are used within biologically sustainable levels. (FAOHome) Climate change, habitat degradation, pollution, and illegal fishing further threaten marine ecosystems. If these pressures are not managed, the foundation of **marine food resilience**—the ability of marine food systems to absorb shocks, adapt, and continue providing nutritious food—will erode.

This is why **"Resiliensi Pangan Laut" (Marine Food Resilience)** is not just an environmental issue; it is a **strategic pillar of national food security**, especially for Indonesia. The central question becomes: *How can Indonesia manage its marine and fisheries resources sustainably so that seafood continues to support national food security, today and towards 2045 and beyond?*

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2. Conceptual Framework: From Food Security to Marine Food Resilience

2.1 Food Security and Its Four Dimensions

The classic definition of **food security** emphasizes four key dimensions:

1. **Availability** – sufficient quantities of food available on a consistent basis.
2. **Access** – adequate resources to obtain appropriate foods for a nutritious diet.
3. **Utilization** – proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, plus safe water and adequate sanitation.

4. **Stability** – the other three dimensions are stable over time and not easily disrupted by shocks (economic, climatic, political, etc.).

Applied to seafood, this means we ask:

- Is there **enough fish and aquatic food** in the sea and in markets (availability)?
- Can **coastal and inland communities afford and physically access** these products (access)?
- Are fish and seafood being used in ways that **improve nutrition**, especially micronutrients (utilization)?
- Can this system continue functioning under climate change, economic crises, and political shocks (stability)?

2.2 What is Marine Food Resilience?

Marine food resilience can be understood as:

The capacity of marine ecosystems, fisheries, value chains, and dependent communities to maintain and improve the contribution of aquatic foods to national nutrition and livelihoods, despite environmental and socio-economic disturbances.

It implies a **socio-ecological systems** perspective:

- **Ecological resilience**: healthy fish stocks, intact habitats (coral reefs, mangroves, seagrass), and biodiversity.
- **Economic and social resilience**: diversified livelihoods, fair markets, strong community institutions, social protection for fishers.
- **Governance resilience**: flexible, science-based management that can adapt to new information and changing conditions.

2.3 The Blue Economy Lens

Marine food resilience is also closely linked to the idea of a **blue economy**—an economic approach that seeks to derive economic growth and livelihoods from oceans and coasts **while maintaining**

ecological integrity. In Indonesia, fisheries and marine resources are seen as central pillars of the blue economy, connecting **national food security**, **poverty reduction**, and **sustainable growth**. (Smujo)

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3. Indonesia's Marine and Fisheries Endowment

3.1 Biophysical and Economic Context

Indonesia's marine endowment includes:

- About **6.4 million km^2 of marine area**
- Over **16,000 islands**, many of them inhabited by coastal communities
- Some of the world's richest **coral reef, mangrove, and seagrass ecosystems**

Marine and fisheries resources play a critical role in **national food security**, economic growth, employment, and coastal welfare. (Smujo) The fisheries sector (capture + aquaculture) contributes around **2.5–3% of Indonesia's GDP**, with significant indirect contributions through upstream and downstream activities.

3.2 Capture Fisheries and Aquaculture

1. **Capture Fisheries**
    - Indonesia is the **second-largest marine capture producer** globally. (IISD)
    - Small-scale coastal fishers still dominate in terms of employment, using small boats and traditional gears (gillnets, handlines, small purse seines).
    - Key species include tuna and tuna-like species, small pelagics (e.g., sardines, anchovies), demersal fish, and crustaceans.
2. **Aquaculture**

- Marine and brackish aquaculture (milkfish, shrimp, seaweed, grouper, etc.) is expanding and offers an important avenue for **diversifying supply** and reducing pressure on wild stocks. (ScienceDirect)
- Seaweed farming in areas like South Sulawesi and Nusa Tenggara has become a major livelihood strategy and export earner, especially for women and smallholders.

3.3 Fisheries, Nutrition, and National Food Security

Fish is one of the **most efficient converters of feed into high-quality food** and is rich in essential nutrients such as omega-3 fatty acids, vitamins (A, D, B12), iodine, and other minerals. (FAOHome) In many Indonesian coastal and island regions, fish provides **the majority of animal protein intake** and is more affordable than meat or dairy.

Recent research highlights that Indonesia's fisheries sector plays a crucial role in national food security by providing sustainable animal protein and supporting livelihoods that enable households to purchase other foods. (ResearchGate) Thus, the **health of marine ecosystems** directly affects the **health of Indonesian people**, particularly poorer coastal households.

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4. Global and National Challenges to Marine Food Resilience

Despite these strengths, several structural challenges must be addressed.

4.1 Overfishing and Illegal, Unreported, and Unregulated (IUU) Fishing

Globally, **overfishing remains a chronic problem**: about **35.5% of stocks** are classified as overfished, while the share of sustainably fished stocks has been declining over decades in many regions. (FAOHome) IUU fishing exacerbates this, especially in areas with weak monitoring and enforcement.

In Indonesia, reforms in the last decade—such as **crackdowns on illegal foreign fishing** and stricter enforcement—have improved some indicators. Yet challenges remain, especially in:

- Monitoring thousands of small-scale vessels
- Controlling fishing effort in heavily exploited coastal areas
- Preventing destructive practices such as blast fishing or cyanide fishing in some regions

4.2 Habitat Degradation and Pollution

Marine food resilience depends on **critical habitats**:

- **Mangroves**: nurseries for many fish and crustaceans, coastal protection
- **Seagrass beds**: feeding grounds and nursery habitats
- **Coral reefs**: high biodiversity and key fishing grounds for small-scale fishers

Coastal development, pollution, sedimentation, and destructive fishing have degraded many of these habitats. Climate change has driven **coral bleaching**, more intense storms, and sea-level rise. These processes reduce fish productivity, thus limiting future food supply.

4.3 Climate Change and Ocean Stress

Climate change affects marine food security through:

- **Shifts in species distributions** (fish moving poleward or deeper)
- **Changes in productivity** of upwelling systems and coastal ecosystems
- **Increased frequency of extreme events** that disrupt fishing and aquaculture (storms, floods, marine heatwaves)
- **Ocean acidification** affecting shellfish and coral reefs

For Indonesia, climate change means that **traditional fishing grounds may become less productive**, and coastal communities may face more frequent disasters, undermining their food security and livelihoods.

4.4 Socio-economic Vulnerability of Coastal Communities

Coastal fishing communities often face:

- High rates of **poverty and limited access to health and education**
- Exposure to **market volatility** (price shocks, fuel price increases)
- Limited bargaining power in value chains
- Gender inequalities: women often engaged in post-harvest processing and marketing but with **less recognition, lower pay, and limited voice** in decision-making

Without deliberate policy, such vulnerabilities can offset any ecological improvements. Food resilience is not only about fish stocks; it is also about **people's capacity to adapt**.

4.5 Subsidies and Policy Distortions

A detailed review of central and provincial government support to marine fisheries in Indonesia has shown that significant public funds go into **fuel subsidies, vessel construction and modernization, and other input-based support** that may unintentionally encourage higher fishing effort. (IISD) If not carefully designed, such subsidies can:

- Promote overcapacity and overfishing
- Favor larger, capital-intensive operations over small-scale fishers
- Undermine long-term sustainability and food resilience

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5. Pillars of Sustainable Marine Fisheries Management for Food Resilience

To strengthen marine food resilience, Indonesia and other coastal nations must build on several key pillars.

5.1 Science-Based Stock Assessment and Harvest Control

Resilient fisheries require **good data and science**:

- Regular **stock assessments** to estimate biomass and fishing mortality
- Setting **total allowable catch (TAC)** or effort limits based on biological reference points
- Implementing **harvest control rules**—pre-agreed responses when indicators show stock decline

Global assessments show that where **effective fisheries management** is in place (including science-based quotas and enforcement), the share of sustainably fished stocks is much higher than the global average. (FAOHome)

For Indonesia, strengthening **data collection, scientific capacity, and transparency**—including through digital tools, electronic logbooks, and partnerships with universities—will be central to aligning exploitation with ecological limits.

5.2 Ecosystem Approach to Fisheries (EAF)

The **Ecosystem Approach to Fisheries** integrates ecological, socio-economic, and governance dimensions, aiming to maintain ecosystem health while meeting human needs. FAO and its High-Level Panel of Experts highlight EAF as essential for ensuring long-term contributions of fisheries and aquaculture to food security and nutrition. (FAOHome)

In practice, EAF means:

- Considering **bycatch**, species interactions, and habitat impacts
- Integrating **marine protected areas (MPAs)** and gear restrictions into management

- Balancing **short-term catches** with **long-term ecosystem productivity**

5.3 Rights-Based and Community-Based Management

Many successful fisheries systems use some form of **rights-based management** (e.g., individual or community quotas, territorial use rights in fisheries – TURFs) and **co-management** (shared decision-making between government and communities).

For Indonesia, this could involve:

- Legally recognizing **community fishing territories** and customary rules (e.g., *sasi* in Maluku)
- Allocating **quota shares** to small-scale fishers, ensuring they have secure access to resources
- Establishing local **fisheries management councils** with strong representation of women and youth

The recently launched **National Plan of Action for Small-Scale Fisheries (NPOA-SSF)** aligns Indonesia with FAO's Voluntary Guidelines on small-scale fisheries and emphasizes protection and empowerment of fishers, fish farmers, and salt farmers. (FAOHome) This is a major step towards rights-based, community-centered governance.

5.4 Combating IUU Fishing

Reducing IUU fishing is critical for marine food resilience:

- Strengthening **monitoring, control, and surveillance (MCS)** systems, including vessel monitoring systems (VMS), automatic identification systems (AIS), and patrols
- Improving **port state controls**, catch documentation, and traceability
- Enhancing **regional cooperation** with neighboring countries to address transboundary IUU issues

By reducing IUU fishing, legitimate fishers gain **higher and more stable catches**, which directly supports their livelihoods and food supplies.

5.5 Habitat Protection and Restoration

Protecting and restoring key habitats amplifies resilience:

- **Mangrove restoration** for nursery habitats and coastal defense
- **Coral reef rehabilitation** (e.g., assisted regrowth, reef-friendly tourism policies)
- **Seagrass protection** against destructive anchoring and coastal development

These efforts provide **ecological insurance**: diverse and healthy ecosystems are better able to absorb shocks (such as climate impacts) and maintain fish productivity.

5.6 Sustainable Aquaculture and Integration

Sustainable aquaculture can complement capture fisheries by:

- Providing **additional supply** of fish and seafood
- Enabling **local production** close to markets (important for inland provinces)
- Offering **alternative livelihoods** for fishers when wild stocks are under pressure

However, aquaculture must be designed to avoid new problems such as pollution, disease, and conflicts over land and water. Integrated **multi-trophic aquaculture**, low-trophic species (like seaweed or bivalves), and robust environmental standards are key.

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6. Indonesia's Policy Landscape and Reform Agenda

6.1 National Policies for Sustainable Fisheries and Food Security

Indonesia is making efforts to link **fisheries policy** with **food security** objectives. Recent initiatives include:

- The **Quota-Based Sustainable Fisheries Policy**, which aims to regulate fishing effort through scientifically informed quotas and licensing systems. (World Bank Blogs)
- The **Oceans for Prosperity (Lautan Sejahtera – LAUTRA) Project**, supported by the World Bank, which promotes community-based fisheries management and expansion of marine protected areas while enhancing local livelihoods. (World Bank Blogs)
- The **NPOA-SSF**, aligning national policy with FAO SSF Guidelines and recognizing the rights and needs of small-scale fishers. (FAOHome)

These policies show a strategic movement from a purely **production-oriented** approach towards a **sustainability- and resilience-oriented** framework.

6.2 Subsidy Reform and Public Support Realignment

Government support to marine fisheries has historically included **fuel subsidies, vessel modernization, and infrastructure development**. A detailed review indicates that, at both central and some provincial levels (Aceh, Maluku, North Sulawesi), fixed-cost input support such as vessel construction can dominate budgets. (IISD)

For food resilience, public spending should be realigned towards:

- **Resource management** (data collection, stock assessment, enforcement)
- **Fishing community support** (social protection, training, diversification of livelihoods)
- **Infrastructure that reduces post-harvest losses** (cold chain, landing sites, processing)

- **Innovation and R&D** (selective gears, low-impact methods, value-added processing)

Subsidy reform is politically sensitive but crucial to shift incentives towards **long-term sustainability**.

6.3 Blue Economy and Scenario-Planning Toward 2045

Studies within Indonesia's **blue economy framework** highlight that marine resource development can significantly contribute to national food security, growth, and welfare if sustainability principles are respected. (Smujo)

Scenario analysis for Indonesian capture fisheries towards **2045** suggests multiple possible futures, ranging from outward-looking export-driven strategies to more balanced scenarios that emphasize domestic food supply, ecosystem conservation, and community welfare. (Bioflux) The choices made in the next decade will largely determine which path becomes reality.

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7. Community-Level Strategies and Local Narratives

Policies only become real when implemented in **villages, landing sites, and coastal communities**.

7.1 Small-Scale Fisheries at the Heart of Marine Food Resilience

Small-scale fisheries:

- Provide the **bulk of local fish supply** for coastal markets
- Employ a large share of the fisheries workforce, including women in processing and trade
- Are often embedded in **customary institutions** and local cultural practices

For example, in parts of Maluku and Papua, traditional systems such as **sasi** regulate when and where communities can harvest certain marine resources. When revitalized and integrated with formal

regulations, such practices can **enhance ecological sustainability and social legitimacy**.

7.2 Illustrative Narrative: A Coastal Village in Maluku

Consider a hypothetical coastal village in the Maluku Islands:

- **Past**: Fishers targeted reef fish near shore with little regulation. Over time, catches declined, and conflicts emerged between local fishers and outside fleets.
- **Intervention**: With support from government and NGOs, the village established a **community-managed no-take zone**, revived *sasi* rules, and adopted more selective gears. Women organized a cooperative to improve processing and marketing, reducing post-harvest losses.
- **Outcome**: After several years, fish biomass and catch per unit effort increased near the protected area. Household incomes became more stable, and the village negotiated better prices through the cooperative.

This kind of narrative illustrates how **local institutions, community leadership, and supportive policy** can translate national strategies into tangible improvements in marine food resilience.

7.3 Gender and Social Inclusion

Effective management must also address **gender dynamics and social inclusion**:

- Recognizing women's role in **post-harvest processing, trade, and household nutrition decisions**
- Ensuring women's and youth's participation in **fisheries governance bodies**
- Providing **education, training, and access to finance** to marginalized groups

More inclusive governance structures are not only **ethical** but also **pragmatic**, enriching decision-making with diverse knowledge and perspectives.

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8. Innovation, Data, and Technology for Resilient Marine Food Systems

8.1 Digital Tools and Monitoring

Emerging technologies can greatly enhance management:

- **Electronic logbooks** and smartphone apps for recording catch data
- **Vessel monitoring systems (VMS)** and **AIS** for tracking vessel positions
- **Remote sensing** and drones for monitoring coastal habitats and illegal activities
- **Blockchain-based traceability** systems, which help certify that seafood is sustainably sourced

These tools improve **data quality**, **enforcement**, and **market transparency**, enabling managers to make timely, evidence-based decisions and allowing consumers to reward sustainable practices.

8.2 Reducing Losses and Improving Value Chains

One of the most direct ways to enhance marine food resilience is to **reduce post-harvest losses** and **improve value chains**:

- Investments in **cold storage, ice production, and insulated transport**
- Training in **hygiene, processing, and packaging**
- Development of **value-added products** (e.g., fish fillets, ready-to-cook meals, fish powder for school feeding, by-product utilization)

FAO's most recent global assessments highlight the untapped potential of using whole fish and processing by-products to enhance food supply and nutrition, especially for vulnerable populations. (Open Knowledge FAO) For Indonesia, developing small-scale processing and distribution hubs in coastal areas could significantly increase the effective contribution of marine resources to national food security.

8.3 Climate-Smart Fisheries and Aquaculture

Climate-smart strategies include:

- Adjusting **fishing seasons and areas** as species distributions shift
- Diversifying target species and livelihood options
- Adopting **resilient aquaculture systems** (e.g., species tolerant to higher temperatures or salinity changes)
- Integrating **mangrove rehabilitation** with aquaculture (e.g., silvo-fishery)

These measures help ensure that marine food systems remain functional under changing climatic conditions.

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9. Linking Marine Food Resilience to Broader National Food Policy

Marine food resilience cannot be isolated from **national food policy**. A holistic strategy needs to connect fisheries with agriculture, health, social protection, and trade.

9.1 Complementarity with Land-Based Food Systems

Rather than focusing solely on **rice self-sufficiency**, Indonesia can enhance food security by:

- Promoting fish and aquatic foods as **central elements of a diverse, nutritious diet**

- Using fish products (including small pelagics and by-products) in **school feeding programs**, maternal and child nutrition initiatives, and emergency food distributions
- Integrating fisheries into **regional food system planning**, ensuring that inland populations also benefit from marine resources through cold chains and distribution networks

Fish is often more **climate-efficient** than other animal proteins; a more prominent role for seafood in diets can thus support both food security and **emissions reduction goals**.

9.2 Social Protection and Risk Management

Marine food resilience is strengthened when fishers and coastal households have access to:

- **Health insurance, unemployment protection, and disaster relief**
- **Micro-finance and savings schemes**, to manage income variability
- **Education and upskilling opportunities**, enabling diversification beyond fishing if needed

Without such social safety nets, even well-managed fisheries may not prevent **acute food insecurity** when shocks hit, such as pandemics, extreme weather, or price spikes.

9.3 Regional and International Cooperation

Because fish are mobile and many stocks are **transboundary**, Indonesia must collaborate with neighboring countries and international bodies on:

- **Stock assessments and data sharing**
- **Joint enforcement** against IUU fishing
- **Harmonization of standards** for sustainable seafood in regional markets

FAO's work on sustainable fisheries and aquaculture for food security and nutrition underscores that food security is increasingly **transnational** and requires cooperative governance. (FAOHome)

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10. Strategic Roadmap: Towards Marine Food Resilience 2045

To operationalize "Resiliensi Pangan Laut" as a pillar of national food security, a forward-looking roadmap could emphasize the following strategic directions:

1. **Strengthen Science and Data Systems**
    - Invest in **stock assessment capacity**, data collection, and research on climate impacts.
    - Expand partnerships with universities, research institutes, and community monitoring programs.
2. **Reform Subsidies and Align Public Spending**
    - Gradually shift from **input-based subsidies** (e.g., fuel, vessel construction) towards **public goods**: resource management, monitoring, infrastructure, and social services. (IISD)
    - Ensure transparency and public accountability in fisheries budgets.
3. **Scale Up Ecosystem-Based and Rights-Based Management**
    - Implement the **Ecosystem Approach to Fisheries** across major fisheries management areas. (FAOHome)
    - Strengthen **community-based and co-management** arrangements, recognizing customary rights and enhancing local enforcement.
4. **Empower Small-Scale Fishers through the NPOA-SSF**
    - Implement the NPOA-SSF with clear **targets, budget, and monitoring**. (FAOHome)

- Prioritize gender equality, youth participation, and protection of vulnerable groups.

5. **Expand Marine Protected and Conserved Areas with Food Security Objectives**
    - Design MPAs and other area-based measures not only for biodiversity but explicitly for **long-term food provision**, ensuring fish spillover benefits local communities. (WRI Indonesia)
6. **Develop Climate-Smart Fisheries and Aquaculture**
    - Integrate climate projections into fisheries management plans and aquaculture zoning.
    - Promote **resilient species and systems**, early warning systems, and disaster risk reduction in coastal zones.
7. **Modernize Value Chains and Reduce Losses**
    - Invest in **cold chains, processing facilities, and transport** in coastal and island regions.
    - Promote **value-added processing** and use of by-products to enhance nutrition and incomes. (Open Knowledge FAO)
8. **Enhance Governance, Participation, and Accountability**
    - Create **multi-stakeholder platforms** (government, fishers, industry, civil society, researchers) for policy dialogue.
    - Strengthen monitoring of policy outcomes, including **nutritional indicators** and **livelihood indicators**, not just production volumes.
9. **Integrate Marine Food in National Food and Nutrition Strategies**
    - Include clear **targets for aquatic food consumption**, especially for children and vulnerable groups.

- Coordinate between ministries of marine affairs, agriculture, health, social affairs, and education.

10. **Mobilize Sustainable Finance for Marine Food Resilience**
    - Explore **blue bonds, blended finance, and climate funds** to support conservation, sustainable fisheries, and resilient aquaculture.
    - Ensure that financial instruments are accessible to **small-scale actors**, not only large corporations.

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11. Conclusion: From Exploitation to Stewardship

"Resiliensi Pangan Laut" is ultimately about **choosing a path of stewardship** rather than exploitation. The oceans and seas are not an inexhaustible pantry; they are living systems whose ability to feed us depends on how we treat them.

For Indonesia, with its vast marine area and culturally rich coastal communities, sustainable management of fisheries and marine resources is not a luxury but a **strategic necessity**:

- It underpins **national food security** by providing affordable, nutrient-rich food.
- It supports **employment and livelihoods** for millions in coastal and island regions.
- It contributes to **economic growth and export earnings** within a blue economy framework.
- It strengthens resilience in the face of **global crises**—from climate change to geopolitical instability in food and energy markets. (Smujo)

Yet this resilience will not emerge automatically. It requires deliberate choices: reorienting subsidies, embracing ecosystem-based and rights-based management, empowering small-scale

fishers, investing in data and innovation, and embedding marine food into broader nutrition and social protection strategies.

If these steps are taken seriously, **marine food resilience** can become one of Indonesia's most powerful levers for achieving **sustainable, inclusive, and secure national development**—ensuring that the richness of the seas today translates into **healthy, well-nourished generations** tomorrow.

Reflection and Discussions

"Marine Food Resilience: Sustainable Fisheries Management to Support National Food Security"

This section is meant to invite deeper thinking, critical debate, and dialogue among students, policymakers, practitioners, and coastal communities. Rather than repeating the main arguments, it highlights **tensions, dilemmas, and open questions** that emerge when we try to operationalize marine food resilience in the real world.

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1. Rethinking "Food Security": Is More Fish Always Better?

A first reflection concerns the way we often measure success. National policy documents tend to highlight:

- Total fish production (in tonnes)
- Export value and foreign exchange earnings
- Contribution of fisheries to GDP

These are important indicators, but **marine food resilience** demands a broader perspective.

1. **Quantity vs Quality of Nutrition**
   More fish caught does not automatically mean better nutrition for poor households. Export-oriented shrimp or tuna industries can grow impressively while coastal communities themselves still face **undernutrition or micronutrient deficiencies**. The core question is:

Does the current structure of fisheries and aquaculture genuinely improve the diets of the most vulnerable, or does it mainly serve export markets and urban consumers?

2. **Short-Term Harvest vs Long-Term Productivity**
   Exploiting stocks at or beyond their biological limits can boost production in the short term, but undermines future yields. Resilience is about the **capacity to endure**, not only about hitting production targets this year.

Here, the moral challenge appears:

- How should policymakers balance **short-term political demands** (e.g., "increase fish production now") with the **long-term responsibility** to maintain healthy ecosystems for future generations?

3. **Aggregate Numbers vs Distribution**
   National fish supply might look sufficient in aggregate, but access is very unequal between regions, and between rich and poor families. Reflection:

Is our concern about "marine food resilience" focused enough on **who benefits** from marine resources?

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2. Justice, Rights, and the Place of Small-Scale Fishers

Another deep issue is **justice**. Marine policies often treat fishers as a homogeneous group, but in reality there are sharp differences:

- Large-scale industrial fleets vs small-scale artisanal fishers

- Urban-based capital owners vs rural coastal communities
- Men on boats vs women in post-harvest and marketing
- Long-established local communities vs new entrants backed by investors

2.1 Whose Ocean Is It?

When the state allocates fishing rights, licenses, or quotas, it effectively decides **who gets to benefit** from the ocean:

- If quotas or licenses are captured by large companies, small-scale fishers may be pushed into marginal areas or into illegal status.
- If fuel subsidies and modernization programs mainly support larger vessels, small-scale actors are indirectly disadvantaged.

Here the **ethical dimension** becomes clear:

Shouldn't small-scale fishers — who depend on the sea for subsistence and whose cultural identity is closely tied to marine resources — be given priority in access and decision-making?

Marine food resilience, viewed through a justice lens, is not only about ecological sustainability but also about **correcting historical and structural imbalances**.

2.2 Gendered Dimensions

Women are often invisible in marine policy narratives, even though:

- They dominate many **post-harvest activities** (drying, smoking, fermentation).
- They play a central role in **household nutrition decisions**.
- They may be the first to feel the impact of income fluctuation and food price increases.

Reflective question:

How can marine food resilience strategies be designed so that women are not only "beneficiaries" but recognized as **key agents of**

change, with a voice in governance and fair access to resources, training, and finance?

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3. Trade-Offs: Conservation, Livelihoods, and National Development

Policies that promote marine protected areas (MPAs), fishing bans, or gear restrictions can generate conflicts when local communities feel they **bear the costs** of conservation while others enjoy the benefits.

3.1 Conservation vs Livelihood – A False Dichotomy?

From an ecological standpoint, **no-take zones** and protection of mangroves, seagrass, and coral reefs are essential for resilience. However, short-term local impacts include:

- Reduced access to traditional fishing grounds
- Possible decline in immediate household income

This raises uncomfortable but honest questions:

- Who compensates fishers when access is restricted?
- Are alternative livelihoods realistically offered, or only promised on paper?
- How is the **transition period** managed when new regulations are enforced?

The long-term idea is that better-managed ecosystems will yield **higher and more stable catches**, but families still need to eat **this month**. Marine food resilience must therefore incorporate **social safety nets and transition support**, not just ecological ideals.

3.2 Blue Economy: Growth for Whom?

The "blue economy" is often promoted as a new frontier for national growth: more ports, more aquaculture, more tourism, more

maritime logistics, more offshore energy. These can create jobs and revenue, but can also:

- Crowd out traditional small-scale fisheries
- Intensify competition for coastal space
- Increase pollution and habitat loss if not well regulated

Reflections:

- How do we ensure that the blue economy does not become just a **"blue extractive economy"**, where powerful actors capture the lion's share of benefits?
- What governance mechanisms can guarantee that local communities are involved in **marine spatial planning** and actually share in the value created?

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4. Climate Change: Adaptation, Uncertainty, and Moral Responsibility

Climate change fundamentally reshapes the seascape: species distribution shifts, productivity changes, extreme events become more frequent, and coastal erosion threatens villages.

4.1 Uncertainty and the Limits of Prediction

Scientific models can project trends, but uncertainties remain high. Fishers, especially small-scale ones, **live inside that uncertainty**:

- Traditional knowledge about seasons and migration patterns may become less reliable.
- Storms can destroy boats, gears, and coastal infrastructure.
- Coral bleaching and mangrove loss reduce fish nursery functions.

Marine food resilience in a climate-changed world requires **flexibility**, **early warning systems**, and **adaptation pathways**. Yet adaptation often requires investments (new gears, safer boats,

alternative livelihoods, insurance), which poor communities struggle to afford.

Reflection:

When we speak of "resilience," are we sometimes placing the burden on communities to "be resilient" without simultaneously transforming the structural conditions that make them vulnerable?

4.2 Intergenerational Ethics

Climate change also raises intergenerational questions:

- Today's policy choices regarding fossil fuel use, land use, and emission trajectories will shape ocean conditions for decades.
- Overfishing combined with climate stress could push some stocks beyond recovery.

From an ethical standpoint, marine food resilience is linked to the principle of **intergenerational justice**:

What moral responsibility do we have to ensure that children and grandchildren of today's fishers will still inherit seas capable of feeding them?

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5. Governance, Participation, and Trust

Policies can only work if there is **trust** between government authorities and coastal communities. Distrust grows when:

- Regulations are perceived as top-down, inconsistent, or politically motivated.
- Enforcement targets small fishers while larger violators go untouched.
- Data are not shared transparently, and decisions are not explained clearly.

5.1 Co-Management as a Learning Process

Co-management and community-based approaches are often presented as solutions, but they require:

- Time and resources to build **local institutions**
- Capacity development, not only for communities but also for officials
- Willingness to treat local knowledge as **co-equal** with scientific knowledge in many contexts

Reflection:

Are our governance systems truly open to **power-sharing** with coastal communities, or are we just "consulting" them without giving real influence?

5.2 Transparency and Accountability

Sustainable and resilient marine food systems need **transparent data** on:

- Stock status and catch levels
- Public spending and subsidies
- Licensing, access rights, and allocation of quotas

Without transparency and independent oversight, even well-designed policies risk being undermined by **corruption, elite capture, or short-term political cycles**.

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6. Practical Discussion Questions for Classrooms and Policy Forums

Below are some guiding questions that can be used in seminars, workshops, or community dialogues.

6.1 Conceptual and Ethical Questions

1. How does the concept of **marine food resilience** expand or challenge traditional understandings of **food security** that focus mainly on land-based agriculture?
2. In your view, what is the **primary moral obligation** of the state in managing marine resources: maximizing production, protecting ecosystems, or ensuring justice for vulnerable communities? Can these goals be balanced?
3. When we invest in large-scale export-oriented fisheries or aquaculture, under what conditions can this be aligned with **national nutrition goals**?

6.2 Policy and Governance Questions

4. If you were designing a national program for "Resilient Marine Food Systems 2045", what **three priorities** would you set, and why?
5. Should small-scale fishers receive **priority access rights** to nearshore fisheries? If yes, how would you operationalize this in law and practice?
6. How can subsidy reform be designed so that it **reduces overfishing** but does not push poor fishers deeper into poverty or force them into illegal activities?

6.3 Community and Local Practice Questions

7. Think of a specific coastal community you know (or have studied). What are the main **barriers** they face in achieving marine food resilience? (e.g., lack of cold chain, weak market power, habitat degradation, climate risks).
8. How might **women's organizations, youth groups, and local religious or customary institutions** be mobilized to support sustainable marine resource management and improved nutrition?

9. Are there local traditional practices (similar to *sasi*, seasonal closures, or taboos) that could be **revitalized or adapted** as part of modern co-management systems?

6.4 Innovation and Technology Questions

10. What role can **digital technologies** (e.g., mobile apps, satellite monitoring, blockchain traceability) realistically play in supporting small-scale fishers and marine food resilience? What are the risks (e.g., exclusion, surveillance, concentration of power)?

11. How should we evaluate new aquaculture models: what criteria should be used to judge whether a project is truly **"sustainable" and "pro-resilience"** rather than just profitable?

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7. Closing Reflection: From "Using the Sea" to "Living with the Sea"

At the deepest level, marine food resilience invites a transformation in the way we **imagine our relationship with the ocean**.

For a long time, policy language has framed the sea as:

- A **resource** to be exploited
- A **frontier** for economic expansion
- A **warehouse** of fish waiting to be harvested

But the resilience perspective suggests a different narrative: The ocean is a **living partner** in our national story. Coastal communities do not simply "use" the sea; they **live with** it. Their songs, myths, and daily practices reflect an understanding that the sea gives and takes, nurtures and demands respect.

To speak of "Resiliensi Pangan Laut" is therefore to make a **normative choice**:

- To move from a mindset of **extraction** to a mindset of **stewardship**

- To accept that true food security requires **restraint, knowledge, and justice**
- To recognize that **national prosperity** is inseparable from the well-being of mangroves, coral reefs, small pelagics, coastal women, and young fishers who still dream of a future on the water

The discussions, dilemmas, and questions above are not meant to discourage, but to **deepen commitment**. If Indonesia and other coastal nations can confront these challenges honestly—combining science, local wisdom, ethical reflection, and inclusive governance—then the vision of resilient marine food systems will not remain a slogan. It will become a **living reality**, where the seas continue to feed both bodies and hopes for generations to come.

Below is a **compact academic-style Glossary** followed by a **Reference list** you can attach at the end of your article *"Marine Food Resilience: Sustainable Fisheries Management to Support National Food Security"*.

A. Glossary

1. **Food Security**
   A condition in which all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. It includes four dimensions: availability, access, utilization, and stability.
2. **Food System**
   The entire set of activities and relationships involved in the production, processing, distribution, marketing, consumption,

and disposal of food, as well as their socio-economic and environmental outcomes.

3. **Marine Food Resilience**
   The capacity of marine ecosystems, fisheries, aquaculture, value chains, and coastal communities to maintain and enhance the contribution of aquatic foods to nutrition and livelihoods in the face of environmental, economic, and social shocks and stresses (e.g., climate change, market volatility, disasters).

4. **Aquatic Foods**
   All edible animals, plants, and microorganisms that live in water—marine, brackish, and freshwater— including fish, crustaceans, mollusks, seaweeds, and microalgae. Aquatic foods provide key proteins and micronutrients for human nutrition. (Open Knowledge FAO)

5. **Blue Economy**
   An economic development framework that seeks to harness the potential of oceans, seas, and coasts for growth, jobs, and innovation while maintaining the long-term health and productivity of marine ecosystems. In Indonesia, the blue economy includes fisheries, aquaculture, tourism, marine transport, and coastal industries. (OECD)

6. **Capture Fisheries**
   The harvesting of naturally occurring living resources in marine or freshwater environments, as opposed to farming. Marine capture fisheries include both small-scale artisanal operations and industrial fleets.

7. **Aquaculture**
   The farming of aquatic organisms, including fish, crustaceans, mollusks, and aquatic plants, in controlled or semi-controlled conditions (e.g., ponds, cages, pens). It can be inland, brackish, or marine (mariculture). Aquaculture is a major growth sector in global aquatic food production. (Open Knowledge FAO)

8. **Mariculture**
   A subset of aquaculture involving the farming of marine organisms in the open ocean or in coastal environments (e.g., sea cages, coastal ponds, seaweed longlines).

9. **Fish Stock**
   A self-replenishing population of a fish species within a defined geographic area that is managed as a unit. Stock assessments estimate biomass and fishing mortality to guide management.

10. **Overfishing**
    A level of fishing effort or catch that exceeds the capacity of the stock to replenish itself, leading to declining biomass over time. Globally, about one-third of assessed stocks are overfished, and the share of overfished stocks has risen from around 10% in 1974 to 35.5% in 2021. (Open Knowledge FAO)

11. **Biologically Sustainable Fishing**
    Fishing at a level that maintains fish stocks at or above biological reference points (e.g., maximum sustainable yield), so that the population can reproduce and remain productive in the long term.

12. **Illegal, Unreported and Unregulated (IUU) Fishing**
    Fishing activities that violate national laws, regional or international rules, or occur in areas or for stocks where no proper management framework exists. IUU fishing undermines stock sustainability, distorts markets, and threatens the livelihoods of legitimate fishers. (The Economic Times)

13. **Ecosystem Approach to Fisheries (EAF/EAFM)**
    A management paradigm that seeks to balance diverse societal objectives by taking into account biotic, abiotic, and human components of ecosystems, rather than focusing only on a single target species. It integrates ecological, social, and economic dimensions in fisheries management. (Open Knowledge FAO)

14. **Small-Scale Fisheries (SSF)**
    Fisheries that are typically labor-intensive, using small vessels or non-motorized craft, and are usually family- or community-based.

SSF provide a large share of aquatic food for domestic markets and are critical for coastal livelihoods and welfare in Indonesia and globally. (FAOHome)

15. **FAO SSF Guidelines**
The *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* adopted by the FAO Committee on Fisheries (COFI). They provide an international framework to recognize, protect, and support the rights and contributions of small-scale fishers and fish workers. (Open Knowledge FAO)

16. **National Plan of Action for Small-Scale Fisheries (NPOA-SSF – Indonesia)**
Indonesia's strategic framework for implementing the FAO SSF Guidelines at national level, aiming to protect and empower small-scale fishers, foster collaborative governance, enhance supply-chain value, and integrate ecosystem-based management, decent work, and social protection. (FAOHome)

17. **Marine Protected Area (MPA)**
A clearly defined marine or coastal space recognized and managed through legal or other effective means to achieve the long-term conservation of nature, associated ecosystem services, and cultural values. Well-designed MPAs can help rebuild fish biomass and contribute to spillover effects that support surrounding fisheries.

18. **Co-Management**
A governance arrangement in which responsibilities and decision-making powers are shared between government authorities and user groups (e.g., fishing communities). Co-management often includes local rules, joint monitoring, and participatory planning.

19. **Rights-Based Fisheries / Territorial Use Rights in Fisheries (TURFs)**
Management approaches that allocate specific access or harvesting rights to individuals, groups, or communities, such as

quotas, exclusive zones, or territorial use rights, with the aim of creating stewardship incentives and reducing the "tragedy of the commons".

20. **Post-Harvest Losses**
Quantitative and qualitative losses of fish and aquatic foods that occur between harvest and consumption (e.g., spoilage, trimming losses, damage during handling). Reducing post-harvest losses increases effective food supply and income without increasing fishing pressure. (Open Knowledge FAO)

21. **Value Chain (Rantai Nilai)**
The full sequence of activities and actors involved in moving aquatic foods from capture or farm to final consumers, including landing, trade, processing, distribution, retail, and consumption, as well as the flows of information and finance along the chain.

22. **Blue Transformation**
FAO's strategic vision for transforming global aquatic food systems to achieve sustainable growth in aquaculture, effective management of capture fisheries, and upgrading of value chains to improve nutrition, livelihoods, and ecosystem health. (Open Knowledge FAO)

23. **Climate-Smart Fisheries and Aquaculture**
Approaches that integrate climate change adaptation, mitigation (where relevant), and food security objectives in fisheries and aquaculture planning and practice. Examples include adjusting fishing seasons, diversifying species, adopting resilient aquaculture systems, and protecting blue carbon ecosystems (e.g., mangroves).

24. **Mangroves, Seagrass, and Coral Reefs**
Key coastal habitats that provide nursery grounds, feeding areas, and shelter for many marine species. They underpin fish productivity, coastal protection, and carbon storage, and are thus central to long-term marine food resilience. (WRI Indonesia)

25. **Marine Spatial Planning (MSP)**
A public process that organizes human activities in marine and coastal areas to achieve ecological, economic, and social objectives, typically by balancing fisheries, conservation, tourism, shipping, energy, and other uses.

26. **LAUTRA – Oceans for Prosperity Project (Indonesia)**
A World Bank–supported project implemented by the Ministry of Marine Affairs and Fisheries (KKP) and Bappenas, aiming to enhance the sustainable management of marine protected areas and coral reef fisheries while improving local livelihoods in selected coastal areas. (World Bank)

27. **Sustainable Ocean Economy**
An ocean-based economy that provides social and economic benefits for current and future generations, restores and protects ocean health, and is based on effective governance and evidence-based decision-making. (OECD)

28. **Harmful Fisheries Subsidies**
Public support measures (e.g., fuel subsidies, vessel construction aid) that lower the cost of fishing or increase capacity in ways that encourage overfishing or IUU fishing. The WTO Fisheries Subsidies Agreement seeks to discipline such subsidies globally. (IISD)

B. References

(You can format these in APA, Chicago, or any preferred style. Below is a neutral academic style with sufficient details.)

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