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Indian Ocean Rising:

Maritime Security and Policy Challenges

Edited by **David Michel**
and **Russell Sticklor**

JULY 2012

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Glossary

AAB	Abdullah Azzam Brigades
ABOT	Al Basra Oil Terminal
AMISOM	African Union Mission in Somalia
APEC	Asia-Pacific Economic Cooperation
APFIC	Asia-Pacific Fishery Commission
ASEAN	Association of Southeast Asian Nations
ATS	Amphetamine-type stimulants
AQ-AP	Al-Qaeda in the Arabian Peninsula
AQ-I	Al-Qaeda in Iraq
ArBL	Archipelagic base lines
BAB	Bab al-Mandeb
BIOT	British Indian Ocean Territory
BMP-4	Best Management Practices Version 4
BOBP-IGO	Bay of Bengal Programs Intergovernmental Organization
CBMs	Confidence-building measures
CENTCOM	United States Central Command
CS	Continental shelf
CTF-151	Combined Task Force 151
EEZ	Exclusive economic zone
EIA	Energy Information Administration (US)
E&P	Exploration and production
ESMR	Evolving strategic maritime regions
EU NAVFOR	European Union Naval Task Force
FAO	Food and Agriculture Organization
FDI	Foreign direct investment
FPDA	Five Power Defense Agreement
FSDS	Far Sea Defense Strategy
GCC	Gulf Cooperation Council
HMG	Heavy machine gun
HRA	High risk area
ICZM	Integrated coastal zone management
IMO	International Maritime Organization
IOC	International oil company
IOR	Indian Ocean Region

IRGCN	Iranian Revolutionary Guard Corps Navy
IRTC	Internationally Recognized Transit Corridor
ISA	International Seabed Authority
IUU	Illegal, unregulated, unreported
IWRM	Integrated water resources management
LNG	Liquid natural gas
LOS	Law of the Sea (also see UNCLOS)
MBD	Million barrels per day
MCEs	Maritime centers of excellence
MDA	Maritime domain awareness
MPA	Maritime patrol aircraft
MSC-HOA	Maritime Security Center – Horn of Africa
MSO	Maritime security operations
NATO	North Atlantic Treaty Organization
NOC	National oil company
P&I	Protection and Indemnity
PAG	Piracy attack groups
PCASP	Privately contracted armed security personnel
PLAN	People’s Liberation Army Navy (China)
PMSC	Private military security company
SALW	Small arms and light weapons
SIOFA	South Indian Ocean Fisheries Agreement
SNMG	Standing Naval Maritime Group
SOH	Strait of Hormuz
SOLAS	Convention on Safety of Life at Sea
SPM	Single point mooring
SSBN	Ballistic missile submarines
STS	Ship-to-ship transfer
SUA	Suppression of Unlawful Acts
SWIOFC	Southwest Indian Ocean Fisheries Commission
TFG	Transitional federal government
TS	Territorial sea
TSA	Technical sharing agreement
UAV	Unmanned aerial vehicle
UKMTO	United Kingdom Maritime Trade Operations
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
WBIED	Water-borne implemented explosive device
VBSS	Vessel boarding, search, and seizure
VLCC	Very-large crude carrier

Indian Ocean Rising: Maritime and Security Policy Challenges

David Michel and Russell Sticklor

The Indian Ocean represents an increasingly significant avenue for global trade and arena for global security. Rising prosperity in Asia, growing dependence on natural resource flows linking producers and consumers across the Middle East, Africa, and Asia, and globalized supply chains and distribution networks are knitting the region ever more closely together by sea. At the same time, emerging problems ranging from piracy and territorial disputes in the regional seas to global environmental pressures on coastal and marine resources pose significant governance challenges for maritime policymakers around the Indian Ocean region (IOR).

The Indian Ocean, the third largest ocean in the world (after the Pacific and the Atlantic), occupies approximately 20 percent of the Earth's sea surface, covering a total area of 73.56 million square miles. It is bounded to the north by the Indian subcontinent; to the west and northwest by the east African coast and Arabian Peninsula, respectively; to the east by Thailand, the Malay Peninsula, Indonesia, and Australia; and to the south by the oceanic margin with the Southern Ocean at latitude 60°S, the northern limit of the area covered by the original Antarctic Treaty (1959). The western extremity of the Indian Ocean is delineated from the Atlantic Ocean in two places—at the Suez Canal, and at the meridian running south from Cape Agulhas in South Africa. At its easternmost extremity, the Indian Ocean touches the Pacific Ocean at the 147°E meridian, running south from South East Cape on Tasmania to 60°S latitude. The northernmost extent of the Indian Ocean is the Iranian port of Bandar Imam Khomeini in the Persian Gulf. In addition, the Indian Ocean encompasses several regional seas and sea areas: the Andaman Sea, the Arabian Sea, the Bay of Bengal, the Great Australian Bight, the Gulf of Aden, the Gulf of Mannar, the Gulf of Oman, the Laccadive Sea, the Mozambique Channel, the Persian Gulf, and the Red Sea.

Travel across the Indian Ocean and passage from its waters into neighboring seas is both facilitated and potentially constrained by chokepoints. The seven key chokepoints in the IOR are the Mozambique Channel, the Bab el Mandeb, the Suez Canal, the Strait of Hormuz, the Malacca Straits, the Sunda Strait, and the Lombok Strait.

On land the IOR is bounded and variously influenced by 38 states: Australia, Bahrain, Bangladesh, Comoros, Djibouti, East Timor, Egypt, Eritrea, India, Indonesia, Iran, Iraq, Israel, Jordan, Kenya, Kuwait, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Qatar, Saudi Arabia, Seychelles, Singapore, Somalia, South Africa, Sri Lanka, Sudan, Tanzania, Thailand, United Arab Emirates, and Yemen. (France and the United Kingdom can also be counted among the Indian Ocean littoral states because

Figure 1.1: Maritime Chokepoints in the Indian Ocean Region

Source: Stimson

of their island territories). Combined, these countries make up almost 40 percent of the world's total coastline, dominated in order by Indonesia, Australia, India, Madagascar, Malaysia, Thailand, Somalia, South Africa, and Saudi Arabia.

All told, the IOR is inhabited by some 2.49 billion people, representing 35.7 percent of the world's population in 2010. By 2030, this population will have ballooned by more than 27 percent, adding another 689 million people. Yet with a collective gross domestic product in purchasing power parity (GDP-PPP) of \$10,131 (US) billion, the IOR represented only 10.3 percent of world GDP-PPP in 2010. Although sharing the same ocean, the IOR displays tremendous diversity and contrasts in the littoral countries' politics, culture, economics, and environment. In 2011, for instance, according to the human development index (HDI) formulated by the United Nations Development Program, Australia ranked second worldwide, while Mozambique fell fourth to last, ranked 184th. Most IOR nations, though, remain developing countries. Overall, the average HDI value for the IOR was only 0.597 (compared to a world average of 0.682). Thirteen IOR states exhibit HDI values below 0.522, falling in the UNDP's Low Human Development category, while only six states numbered in the Very High Human Development group showing values of 0.793 and above (see Figure 1.2, page 20).¹

Despite its significant geographic span and its large and growing population, the Indian Ocean has long suffered a relative neglect in world geopolitics. For most of the 20th century the region's role and importance were mostly overshadowed, considered subsidiary to super power rivalries largely enacted elsewhere and across other oceans. Today, however, the IOR has risen to the forefront of world geopolitics. Propelled by the world's continuing reliance on Persian Gulf hydrocarbon resources, the growing significance of the Indian Ocean's sea lanes of communication and chokepoints, as well as the turbulent regional socio-political environment (including America's ongoing military operations in Iraq and Afghanistan), and the rise of China and India as global powers, the region is increasingly considered an area of crucial geostrategic importance.

While the IOR now features more prominently in the geopolitical interests and commercial calculations of extra-regional powers such as the US, the European Union nations, Japan, and China, regional states and non-state actors also increasingly influence regional and global affairs. Indeed, regional developments now reverberate far beyond the Indian Ocean's shores. Overall, the IOR represents the most politically troubled and potentially combustible area of the world. In 2011, a total of 142 political conflicts were recorded in the IOR, representing more than a third of the 388 conflicts worldwide, including 12 of the world's 20 wars, as well as an additional eight limited wars.²

At the same time, rising flows of commerce, investment, and people are linking the Indian Ocean nations to each other—and the IOR to the rest of the world—more closely. The decades since the 1970s, for example, have long since established the Indian Ocean as the primordial artery carrying oil from the Persian Gulf out to power the engines of the global economy. More recently, however, the Indian Ocean has become the principal conveyor belt for the international coal trade. The expanding economies of China and India are now the top two importers, shipping in 10 times more coal in 2010 than 2003. Meanwhile, South Africa, Indonesia, and Australia together account for more than half the world's exports of thermal coal. Similarly, swelling labor flows and remittances are playing increasingly important parts in many regional economies. Migrant workers from South and Southeast Asia fill more than 90 percent of private sector jobs in most of the Gulf Cooperation Council Countries, while expatriates constitute 81 percent of the total population in the United Arab Emirates, 75 percent in Qatar, and 67 percent in Kuwait.³

History suggests that the Indian Ocean may be destined for substantially more intra-regional commercial connections. The IOR was once known as a "British lake." The empire's territorial possessions stretched from Cape Town to Calcutta, Singapore, and beyond. Studies tracing the economic implications of such socio-cultural legacies have found that two countries sharing a common language trade 42 percent more with each other than two otherwise identical nations lacking that linguistic tie. Countries that once shared an imperial bond trade with each other 188 percent more. Indeed, a common imperial heritage bolsters trade even more than sharing a common currency.⁴

For centuries past, the Indian Ocean was primarily an international through-route. It is now rapidly emerging as a major global intersection for geostrategic, economic, natural resource, and environmental issues. Multiple security, maritime policy, and governance challenges are driving regional and extra-regional players to focus increasing attention on

Indian Ocean issues within a complex geopolitical framework where foreign powers and local actors' interests and objectives inextricably intermingle. The papers assembled in this publication represent conceptual building blocks for analyzing this transformation. They sketch the emerging socio-economic, security, commercial, and environmental trends that will shape the region in the coming decades and examine their implications for decision-makers and stakeholders.

In this publication's second chapter, Rupert Herbert-Burns assesses the variety of sources of insecurity that afflict the region, ranging from insurgent conflict, terrorism, and political instability to illicit trafficking and piracy. These security threats exist within one of the world's most important strategic and commercial spaces, with the Persian Gulf serving as the world market's most significant source of crude oil and the northern Indian Ocean rim constituting a critical sector of the globe's east-west-east trading belt. Taken together, the myriad security threats facing the region may exceed the international and regional community's capacity to effectively manage such challenges. Indeed, without policy coherence, creative thinking, longevity of participation, and significant resources, there is a likelihood that the various security threats facing the region will further increase in 2012 and beyond, contributing to the area's geopolitical fragility.

Piracy and armed robbery at sea—particularly off the Somali coast—remain top maritime security concerns in the IOR. Despite the efforts of a multinational coalition to patrol the waters off east Africa, the area impacted by Somali piracy remains enormous at approximately 2.5 million square miles, with pirates' use of mother ships enabling Piracy Attack Groups (PAGs) to stage vessel hijackings at great distances from the coast. To date, even an international naval presence combining the resources of the European Union, NATO, and the US Navy has had great difficulty in securing such a wide swath of ocean. As a result, many merchant vessels transiting through the western Indian Ocean have implemented their own anti-piracy measures, including the hiring of private-armed security teams.

While piracy has earned the greatest share of headlines in terms of security threats in the Indian Ocean, other security issues abound. Trafficking of illicit narcotics, weapons, and people within and via the Indian Ocean will likely continue in the medium- to long term because there are numerous sources of high-volume supply for all three commodities, a sufficiently large number of points of export that suffer from chronic insecurity, and a wide array of sea transportation available to service all the necessary sites of demand and consumption.

Maritime terrorism also poses a potentially serious danger to the region. Although there has been little in the way of seaborne terrorist attacks in the IOR over the past decade, extremist groups affiliated with Al-Qaeda (particularly Al-Qaeda in the Arabian Peninsula) have expressed a continuing interest in closing down strategic maritime chokepoints, such as the Bab al-Mandeb that separates Yemen from Djibouti. While the ability of Al-Qaeda-affiliated groups to successfully execute attacks on commercial vessels in the area remains the source of much speculation, there exists little doubt about these groups' intentions.

Growing energy exploration in the western Indian Ocean provides an intriguing opportunity to bolster maritime security in the region, however. Oil experts increasingly view the waters off the eastern African coast as one of the world's last remaining major

petroleum frontiers, stretching from Somalia in the north to Mozambique in the south. As offshore surveying and drilling activity increases in the region, energy companies may likely utilize their considerable financial resources to deploy security personnel to protect drilling operations. It is conceivable that increasing numbers of private maritime security assets in the western Indian Ocean may potentially diminish PAGs' ability to stage vessel hijackings. This security-bolstering process could be accelerated with some international assistance for additional coastal patrol vessels and training for the Kenyan, Tanzanian, and Mozambican navies and/or coast guards.

In the third chapter, Herbert-Burns considers the ongoing shift of the Cold War-centric geopolitical gravity from the Atlantic and Pacific Oceans to the Indian Ocean, as more world naval powers turn their attention and resources to the IOR. This shift has been driven by the astonishing economic growth of China, the steady rise of India's trade and productivity, increasing exports of raw materials from developing countries, and rising exports of crude oil from the Middle East to Asia. When this economic and trade shift is fused with the reality of the numerous, serious ongoing security challenges in the IOR, it comes as no surprise that major naval powers and regional navies have placed the Indian Ocean as a priority area in current and future operations and strategic planning.

For the most part, the country with the biggest and more permanent presence in the IOR has been the United States. The very substantial US naval presence in the region has served several key purposes, including ensuring the freedom of navigation for vital crude exports from the region; conducting military operations during the wars in the Persian Gulf; monitoring Iranian military deployments and deterrence of aggression; and conducting maritime security operations (MSO), which include counter-terrorist, counter-trafficking, and counter-piracy missions. To a lesser extent, the larger European navies—principally the British Royal Navy and the French Navy—have maintained a presence in the IOR as well, and over the past three years, European Union navies have also provided a sustained contribution to the international effort to protect ships against attack from piracy in the Gulf of Aden and Horn of Africa. However, in light of deep spending cuts being made by some major EU states, there is growing concern that large-scale multilateral naval operations may not be sustainable through 2012 and beyond.

Maritime security in the IOR in the short-to-medium term is going to be founded upon the robust and sustained naval presence of the larger extra-regional navies and the large regional powers, with the latter group consisting primarily of Australia, Egypt, India, Indonesia, Iran, Israel, Malaysia, Pakistan, Singapore, and Thailand. However, in looking to the longer-term future security of this vital maritime space, the increased naval and/or coast guard capabilities of the smaller forces—such as the Gulf Cooperation Council (GCC) states, Kenya, Tanzania, the Comoros, Madagascar, the Maldives, Mauritius, Mozambique, and the Seychelles—will be crucial in the fight to counter piracy and armed robbery, illicit fishing, and trafficking by sea in high-risk areas.

Nevertheless, some commentators would argue that the rise of Indian and Chinese naval power and deployment in the Indian Ocean constitute the most important aspect of 21st century naval and maritime security developments in the IOR. For China, the primary concern is securing extensive sea lines of communication (SLOCs) that traverse the Indian

Ocean and western Pacific, linking the Persian Gulf crude exporters and China's main oil terminals and coastal refineries. Beijing is in the midst of several ambitious projects to expand its naval power projection capabilities well beyond its littoral—and indeed well beyond the South China Sea, over large parts of which China is claiming sovereign rights. Aside from the clear worry to India and other Asian states, the evolution of China's maritime power—or what Beijing has labelled its 'Far Sea Defense'—is also of increasing concern to the US.

Finally, for India, an increasing reliance on imported oil and natural gas to fuel its economic expansion has led the government to view the Indian Ocean as New Delhi's backyard, and as a maritime territory for the Indian navy to dominate and police. India's dependence on the security of the Indian Ocean, combined with its need to monitor and, if necessary, check the naval activity of other powers, means that the country is compelled to reach out deep into the ocean—far beyond its own littoral—to enable more expansive maritime domain awareness.

The Indian Ocean represents a significant commercial artery as well as a global security arena. The 2008-09 global economic crisis has left the world's maritime shipping industry in a fragile state, although signs of recovery abound. While world seaborne trade dropped by 4.5 percent in 2009, the sustained positive economic performance of China, India, Brazil, and other key developing economies during the crisis helped maintain some semblance of stability in the global shipping industry. Continuing economic activity in those countries has since fuelled the industry's ongoing recovery. However, slow economic recoveries in the European Union, United States, and Russia have continued to damper the industry's growth prospects in the short-term, as Herbert-Burns shows in the publication's fourth chapter.

The world's merchant fleet is comprised primarily of bulk carriers (36 percent), oil tankers (35 percent), container vessels (13 percent), and general cargo ships (9 percent). While the global fleet's cumulative deadweight tonnage (DWT) increased by 7 percent over the course of the crisis, such growth actually reflected the delivery of new ships ordered *prior* to the downturn. The resulting oversupply in world tonnage has meant that many ships have remained idle in major anchorages. There have not been any significant new orders for bulk carriers or tankers since 2008, although orders for new container vessels have rebounded impressively since 2010.

A survey of fleet ownership data in early 2010 revealed that while firms and individuals in Greece and Japan own the most world tonnage, China has surpassed Germany as the world's third-largest ship-owning company. This achievement speaks to Beijing's ongoing campaign to control and flag more shipping as a means of bolstering the country's economic security and improving growth prospects.

In terms of new vessel construction in recent years, activity has been concentrated primarily in South Korean, Chinese, and Japanese shipyards. Rising oil prices and ongoing concerns about the shipping industry's greenhouse gas emissions have combined to drive innovative ship design that prioritizes economy of scale, energy efficiency, and environmental sustainability. However, some of these new larger ships will be unable to use any port in the Americas, or pass through the Panama Canal. Instead, these vessels have been designed specifically to service trade routes connecting Europe with Asia via the Indian Ocean,

using the Suez Canal and Singapore Straits as key transit points. The industry trend of commissioning new ships customized to travel through waters of the IOR is based largely on the projected growth of exported Chinese manufactured goods over the coming years.

Although the international shipping industry continues a gradual recovery in the wake of the 2008-09 economic crisis, many of the world's primary container liner trades continued to struggle through 2011 to 2012. This situation has raised concerns that maritime trade could be hit hard in the event of a second major economic downturn. Still, despite the economic losses experienced by some container companies over the past year, shipping companies in general are faring far better in 2012 than in 2009.

For all of their interactions and exchange across the maritime space, the nations bordering the Indian Ocean and South China Sea rely upon international law and intergovernmental organizations to provide a fair and stable ocean regime that supports national security, economic development, and sustainable use of the maritime resources and services upon which their populations and industries depend. As Caitlin Antrim discusses in the fifth chapter, ocean governance in the Indian Ocean and South China Sea must address various groupings of countries, specialized agreements, and the diverse geologic and biologic resources of the region.

The Law of the Sea (LOS) Convention recognizes national authority over vast tracts of the sea and seafloor. With few exceptions, this national authority over sea- and seafloor resources has not been matched by the development of planning, administrative, regulatory, or enforcement capabilities to oversee the exploitation of this great increase in countries' patrimony. This problem is most apparent in the seas off Somalia, where piracy and armed robbery at sea have become serious threats to international commerce. Other problems are expected to surface as coastal states' efforts to extend their respective maritime jurisdictions—coupled with their failure to apply the resources needed to regulate activities in those jurisdictions—may increase the likelihood of resource-management issues, diplomatic disputes, or even outright conflict.

Over the coming decades, one of the most pressing issues will be that while the living resources of the sea will remain essential to regional economies and food security, few states have the capability, resources, and maritime infrastructure to manage these resources effectively. Increasing the capability of coastal states to manage and regulate fishing in their EEZs—and reduce illegal, unreported, and unregulated fishing on the high seas—will be a critical maritime issue for all states bordering the Indian Ocean and South China Sea.

A second key issue is that overlapping claims by China and several ASEAN states in the South China Sea—driven in part by the economic potential of oil and gas resources—could lead to serious armed conflict. While a protracted period of jurisdictional disputes punctuated by small confrontations seems most likely, China's designation of the South China Sea as a "core interest"—and the increasing prospects for the use of armed force to displace Vietnamese and Philippine presence in the islands of the South China Sea—raises the possibility of more serious armed conflict.

While not as attention-grabbing as the threat of armed conflict, the eroding balance between coastal state authority and foreign state freedom of navigation in the territorial sea and EEZ

is a serious concern for US naval mobility and civilian commerce. Coastal states' efforts to increase their maritime jurisdiction constitute a continuing and cumulative threat. For example, China's efforts to limit military activities in its EEZ, and India's requirements for permits before allowing repair and maintenance of submarine cables on the floor of its EEZ, could erode the military and civilian interests of maritime states if not contested both diplomatically and operationally.

As long as the US remains outside the LOS Convention, Antrim argues, its ability to demand respect for its rights as enumerated in the Convention will be weakened. Should the US fail to join the Convention, this situation can be expected to continue. Additionally, by staying outside the Convention, the US provides legitimacy should any state that feels constrained by the Convention—such as China—decide to reject the Convention's restrictions by leaving its membership. Given the recent efforts of China and India (among others) to expand coastal state jurisdiction over maritime activities off their coasts, US failure to join the LOS Convention will likely lead to increased regional maritime challenges and confrontations.

In the sixth chapter, Rupert Herbert-Burns turns from the international laws governing the sea to the energy resources lying under the ocean, distinguishing between three major sectors of the industry—upstream, midstream, and downstream. Within the IOR, the vital components of the three sectors are represented respectively by the existing primary and evolving secondary locations of oil and gas production; the transportation of crude, refined products, and liquefied gases via SLOCs and pipelines; and the primary refining, storage, and re-distribution nodes that are vital to the region's economic productivity.

In the upstream sector, one key area of focus in the IOR involves the planned expansion of oil production in Iraq. Although foreign petroleum companies have been denied access to many of the Persian Gulf's sizeable reserves due to long-standing nationalization of oil and gas deposits and industries, access to Iraq's upstream sector looks far more promising. However, the level of foreign participation will depend entirely on a stable symbiotic relationship between international oil companies (IOCs), national oil companies (NOCs), and the fledgling Iraqi government. Meanwhile, elsewhere in the IOR upstream sector, competition is heating up between China and India over access to Myanmar's offshore gas fields—an intriguing situation that could have potentially far-reaching implications for the energy security of Asia's two rising powers.

In the midstream sector of the IOR, there is no more important single factor (from the perspective of Asia's major oil-consuming powers) than the unimpeded export of crude oil from Iran, Iraq, Kuwait, Saudi Arabia, and the United Arab Emirates (UAE). However, continuing security issues involving petroleum shipping and the Persian Gulf's primary export terminals potentially threaten the eastward flow of energy supplies across the IOR. Such vulnerabilities are one of the reasons why a planned crude-oil pipeline across the UAE from Habshan to Fujairah could have a significant strategic impact, by offering an export alternative to tanker shipments through the Strait of Hormuz.

Finally, in the downstream sector of the IOR, Singapore appears poised to continue serving as a strategic petroleum gateway, given the country's location at the junction of the Indian and Pacific Oceans, amidst the seas that link Australasia with Southeast Asia. Nevertheless, Singapore's long-held and continued primacy as a strategic petroleum processing node and

conveyance gateway may be eroded in the future by the potential development of the Kra Isthmus Canal, which would effectively constitute a ‘Malacca by-pass’ for petroleum trade from the Indian Ocean to the Pacific.

In addition to its energy resources, the Indian Ocean also harbors an array of non-energy renewable and non-renewable resources. Various political, technological, and environmental factors affect the economic potential for developing these resources. Fisheries and minerals constitute the most commercially viable industries, though bio-prospecting the ocean’s genetic resources may lead to valuable new products and applications. However, as Michel, Fuller, and Dolan show in the seventh chapter, over-exploitation and environmental pressures risk undermining important ecosystem services—in the form of food security and biodiversity, for example—that the ocean provides.

Polymetallic nodules and polymetallic massive sulphides are the two mineral resources of primary interest to developers in the Indian Ocean. Polymetallic nodules are golf-tennis-ball-sized nodules containing nickel, cobalt, iron, and manganese that form over millions of years on the sediment of the seafloor. Polymetallic massive sulphides contain gold and greater copper, fueling more recent commercial efforts. Yet seafloor deposits tend to be much smaller and exhibit lesser mineral content than those onshore, while their local concentration makes finding them particularly difficult. Exploration for seabed minerals remains a major hurdle. Only 2-3 percent of the global sea floor has been properly mapped, and just 0.0001 percent has been scientifically investigated. Other minerals in the Indian Ocean include coastal sediments containing titanium and zirconium off South Africa and Mozambique, tin placer deposits off of Myanmar, Thailand, and Indonesia, and zinc and copper ore in heavy mud in the Red Sea.

Marine life arguably offers just as much, if not more, economic value than the mineral resources that surround these species. Indian Ocean countries account for a significant proportion of world fisheries. The east Indian Ocean alone is home to 45 percent of the world’s fishers and brings in 20 percent of the total world fish production. Total Indian Ocean fish production increased dramatically from 861,000 tons in 1950 to 10.2 million tons in 2006. The FAO judges that, in certain areas, the Indian Ocean’s resources could nevertheless sustain increased production.

Pollution and environmental stresses, however, increasingly threaten Indian Ocean biodiversity and marine resources. Fisheries are vulnerable to agricultural run-off, sewage, invasive species, and “ghost fishing” (fish ensnared by discarded fishing gear). Continued depletion of Indian Ocean fish stocks could compromise regional and global food security, given that more than a billion people worldwide rely on fish as their main source of protein. Yet one recent study has projected that the world’s fisheries will collapse by 2048 if catch rates continue unabated. Marine organisms also maintain the ocean ecosystem in ways that facilitate human use of ocean resources, generating nutrients that sustain fisheries, absorbing carbon during photosynthesis (which helps to regulate the climate), or assimilating waste materials that pollute the seas.

Several regional and international agreements exist to promote the sustainable management of the Indian Ocean’s resources, such as the FAO Code of Conduct for Responsible Fisheries. The effectiveness of fisheries legislation is limited by high levels of non-compliance,

however. The UN Convention on the Law of the Sea established an International Seabed Authority to oversee the prospecting, exploration, and mining of marine resources. Yet the lack of detailed scientific information on the environmental effects of ocean mining has delayed the development of certain legal mechanisms.

Indeed, the countries on the Indian Ocean rim are particularly susceptible to increasing environmental pressures, especially to the prospective repercussions of global climate change on coastal regions and marine resources, as David Michel explains in this publication's concluding paper. Projected impacts from global warming include rising sea levels, stronger tropical cyclones, larger storm surges, increasing sea surface temperatures, and—as the oceans absorb more of the carbon dioxide that human activities emit into the atmosphere—growing acidification of surface waters. For coastal ecosystems and communities, the potential consequences could be considerable, threatening the livelihoods, health, and welfare of millions of people. More frequent and severe storms can inundate low-lying coastal zones, destroying infrastructure, and displacing populations. Meanwhile, higher water levels and larger wave surges can contribute to accelerated shoreline erosion and retreat, while also exacerbating saltwater intrusion into the rivers and aquifers that furnish freshwater to coastal settlements. Finally, warmer water temperatures and acidifying oceans can degrade the ecology of coral reefs and threaten the artisanal and commercial fisheries that nourish many seaboard communities.

Indian Ocean nations represent six of the 10 most vulnerable states worldwide, ranked by total population living in low-lying coastal settlements. A 2009 World Bank paper examining the dangers to developing nations from potential storm-surge disasters concluded that Indian Ocean littoral states constitute five of the 10 countries with the greatest percentage of coastal population at risk; four of the 10 countries with the highest percentage of coastal GDP at risk; and six of the 10 countries with the highest proportion of coastal urban areas at risk. Climate pressures especially endanger small or low-lying islands like the Maldives, Mauritius, and Seychelles. Major infrastructure in these countries—including roads, airports, seaports, and towns—is situated almost exclusively along the coasts. With little space to retreat from rising seas, local populations might be forced to abandon certain islands, or even evacuate their territory altogether. Such population displacements would engender multiple and tangled questions for the countries of origin (including issues of sovereignty and control of EEZs), destination countries, and the migrants themselves.

Human exposure to such hazards will almost certainly increase with ongoing coastal development. Under Intergovernmental Panel on Climate Change (IPCC) scenarios, the world's coastal population could grow from 1.2 billion in 1990 to anywhere from 1.8 to 5.2 billion people by the 2080s. Yet policymakers across the region frequently lack the financial, institutional, and information resources necessary to devise and deploy effective national response strategies, much less targeted local measures. Worldwide, financing climate change adaptation measures in coastal zones could require additional annual investment flows of \$10-30 billion per year by 2030. In the end, all the countries of the Indian Ocean will have to take action to address global climate change. However, though the individual countries of the region struggle with many of the same issues, they lack a common regional policy framework for addressing their shared problems.

Like the seven straits and channels leading into the Indian Ocean from different points of the compass, the following seven chapters provide distinct vantages for viewing maritime and security policy challenges in the region from differing perspectives. However, as a whole, the chapters consistently illuminate both the specific contexts framing particular policy challenges and the complex overlaps and intersections between multiple issue areas, despite their various angles of approach. Combating piracy, for example, requires policymakers to consider a range of issues from naval power capabilities, private shipping practices and interests, international legal regimes, to coastal state development strategies and governance capacities, among other questions.

No longer relegated to the wings of global politics, the Indian Ocean has clearly moved to a more central position. Its strategic energy and natural resources, the growing importance of its ports and shipping lanes, the rise of China and India as significant regional and global players, the deep and broad engagement of the United States (and other Western powers) in the region, and the mounting environmental risks to coastal economies and communities across the Indian Ocean ensure that the IOR will continue to play a key role in global politics in the coming decades.

Notes

- 1 UNDP, *Human Development Report 2011 - Sustainability and Equity: A Better Future for All* (New York: UNDP, 2011).
- 2 Heidelberg Institute for International Conflict Research, *Conflict Barometer 2011* (Heidelberg, Germany: HIIK, 2011).
- 3 Two previous Stimson Center studies explored the growth of maritime commerce and international migration around the Indian Ocean in depth. See Amit Pandya and Rupert Herbert-Burns with Junko Kobayashi, *Maritime Commerce and Security: The Indian Ocean* (Washington, DC: Stimson, February 2011; Ellen Laipson and Amit Pandya eds., *On the Move: Migration Challenges in the Indian Ocean Littoral* (Washington, DC: Stimson, 2010).
- 4 Pankaj Ghemawat, *Redefining Global Strategy: Crossing Borders in a World Where Differences Still Matter* (Cambridge: Harvard Business School Publishing, 2007).

Figure 1.2: Economic and Development Indicators for Indian Ocean Littoral Countries

Country name	GDP*	GDP per capita*	GDP growth (annual %)	Human Development Index (2011)**	Environmental Performance Index*** (2010)	Total Population 2010 (in thousands)	Total Projected Population 2030 (in thousands)	Population within 100 km of coast as % of total population 2000	Length of coastline km	Area of claimed EEZ km ²
Australia	\$767,324,397,642.75	\$34,409.47	2.26	0.929	65.7	22268	27771	90	25,760	6,664,107
Bahrain	\$26,934,109,163.59	\$21,345.19	4.50	0.806	42	1262	1654	100	161	-
Bangladesh	\$221,296,537,496.72	\$1,488.29	6.07	0.5	44	148692	181863	55	580	39,868
Comoros	\$722,847,658.65	\$983.80	2.10	0.433	-	735	1160	100	340	161,993
Djibouti	-	-	-	0.43	60.5	889	1263	100	314	2,488
East Timor	\$1,481,161,247.50	\$1,296.42	9.47	0.495	-	1124	1989	-	706	-
Egypt	\$449,697,710,283.58	\$5,543.54	5.15	0.644	62	81121	106498	53	2,450	185,304
Eritrea	\$2,572,718,040.03	\$489.70	2.20	0.349	54.6	5254	8394	74	2,234	-
India	\$3,721,367,799,989.88	\$3,038.81	9.55	0.547	48.3	1224614	1523482	26	7,000	2,103,415
Indonesia	\$931,922,198,315.02	\$3,885.10	6.20	0.617	44.6	239871	279659	96	54,716	2,914,978
Iran	-	-	-	0.707	60	73974	84439	24	2,440	129,700
Iraq	\$102,336,834,739.57	\$3,194.95	0.84	0.573	41	31672	55257	6	58	-
Israel	\$198,171,958,854.62	\$25,994.54	4.85	0.888	62.4	7418	9816	97	273	-
Jordan	\$31,743,705,907.26	\$5,249.50	2.31	0.698	56.1	6187	8415	29	26	-
Kenya	\$60,007,205,250.74	\$1,481.20	5.55	0.509	51.4	40513	65928	8	536	104,056
Kuwait	\$124,857,154,626.07	\$45,622.72	3.41	0.76	51.1	2737	4012	100	499	-
Madagascar	\$17,998,751,072.44	\$868.92	1.57	0.48	49.2	20714	35333	55	4,828	1,079,672
Malaysia	\$375,288,126,656.33	\$13,213.90	7.19	0.761	65	28401	37266	98	4,675	198,173
Maldives	\$2,333,326,726.69	\$7,386.63	5.72	0.661	65.9	316	383	81	644	870,623
Mauritius	\$15,733,870,189.81	\$12,283.22	4.13	0.728	80.6	1299	1394	100	177	1,274,638
Mozambique	\$19,243,757,916.69	\$822.71	6.80	0.322	51.2	23391	35907	59	2,470	493,672
Myanmar	-	-	-	0.483	51.3	47963	54331	49	1,930	358,495
Oman	\$68,333,830,386.94	\$24,559.00	4.00	0.705	45.9	2782	3603	89	2,092	487,356
Pakistan	\$418,508,109,294.60	\$2,410.85	4.14	0.504	48	173593	234432	9	1,046	201,520

Country name	GDP*	GDP per capita*	GDP growth (annual %)	Human Development Index (2011)**	Environmental Performance Index*** (2010)	Total Population 2010 (in thousands)	Total Projected Population 2030 (in thousands)	Population within 100 km of coast as % of total population 2000	Length of coastline km	Area of claimed EEZ km ²
Qatar	\$122,760,129,623.75	\$69,797.94	16.60	0.831	48.9	1759	2371	100	563	-
Saudi Arabia	\$563,631,892,553.15	\$20,534.47	4.64	0.77	55.3	27448	38481	30	2,640	-
Seychelles	\$1,898,804,189.50	\$21,945.15	6.71	0.773	-	87	92	100	491	1,288,643
Singapore	\$264,851,231,244.99	\$52,169.96	14.76	0.866	69.6	5086	5978	100	193	-
Somalia	-	-	-	-	-	9331	16360	55	3,025	-
South Africa	\$474,761,314,373.16	\$9,496.88	2.89	0.619	50.8	50133	54711	39	2,798	-
Sri Lanka	\$95,021,830,684.39	\$4,600.87	8.02	0.691	63.7	20860	23094	100	1,340	500,750
Sudan	\$88,125,220,303.82	\$2,023.45	4.45	0.408	47.1	43552	66856	3	853	-
Tanzania	\$56,272,892,520.40	\$1,293.08	7.04	0.466	47.9	44841	81852	21	1,424	204,294
Thailand	\$530,367,086,844.91	\$7,672.89	7.81	0.682	62.2	69122	73321	39	3,219	176,540
United Arab Emirates	\$318,142,305,981.80	\$42,352.96	1.43	0.846	40.7	7512	10489	85	1,318	21,200
Yemen	\$57,076,171,503.55	\$2,372.98	7.70	0.462	48.3	24053	41342	64	1,906	464,966

Notes:

* GDP at Purchasing Power Parity in constant 2005 international US dollars for 2010

**The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three basic dimensions of human development: a long and healthy life (health), access to knowledge (education) and a decent standard of living (income). Data availability determines HDI country coverage. To enable cross-country comparisons, the HDI is, to the extent possible, calculated based on data from leading international data agencies and other credible data sources available at the time of writing.

***The Environmental Performance Index (EPI) ranks countries on 25 performance indicators tracked across 10 policy categories that cover both environmental public health and ecosystem vitality. These indicators provide a gauge at a national government scale of how close countries are to established environmental policy goals.

Source: World Bank, World Development Indicators; UNDP, Human Development Report 2011 - Sustainability and Equity: A Better Future for All (New York: UNDP, 2011); UN, World Population: The 2010 Revision Data Online; Don Hinrichsen, The Atlas of Coasts and Oceans: Ecosystems, Threatened Resources, Marine Conservation (Chicago: University of Chicago Press, 2011).

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