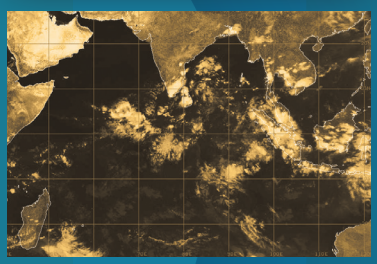

STIMSON

Indian Ocean Rising:

Maritime Security and Policy Challenges

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

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Preface

The Indian Ocean Rising project began in early 2011 as a research initiative exploring the many policy challenges and opportunities facing the Indian Ocean and the South China Sea as these areas emerge as central theaters of 21st century geopolitics. In particular, the project has sought to understand the role that emerging military, commercial, environmental, and technological trends will play in shaping relationships between major regional and extra-regional powers—among them China, the European Union, India, Iran, and the United States—in the Indian Ocean Region (IOR), while also examining the various ways that the intertwining forces of economic growth, natural resource development, and climate change will impact coastal communities of the Indian Ocean littoral in the coming years and decades.

Under the sponsorship of the National Intelligence Council, the Environmental Security program at Stimson has helmed the Indian Ocean Rising initiative, building upon a large body of previous research on Indian Ocean maritime issues conducted as part of Stimson's Regional Voices: Transnational Challenges project. As with Regional Voices, the Indian Ocean Rising project has drawn on the expertise of the Stimson Center's extended family of in-house experts and field consultants, who together analyzed various facets of maritime- and coastal-zone security.

In October 2011, Stimson convened a day-long workshop that brought together experts from a broad range of disciplines and backgrounds to assess the current and emerging security trends in the IOR. Participants hailed from the United States, Europe, Africa, and the Middle East, and included energy industry analysts, maritime security professionals, military officials, environmental experts, shipping industry executives, government policymakers, maritime law specialists, and academics, among others.

They engaged in wide-ranging discussions on a variety of topics, sharing valuable insights on subjects including: the implications of ongoing piracy to commercial shipping throughout the IOR; the development of the IOR's vast resource wealth, including oil, natural gas, mineral deposits, and fisheries; the political and economic implications of new deepwater port construction throughout the Indian Ocean littoral; the projection of naval might in IOR waters by both regional and extra-regional powers, and the attendant maritime-security impacts; the effects of heightened storm surges, rising sea levels, and other climate-change impacts on populations living in vulnerable low-lying coastal regions; the evolution of maritime boundary disputes, with a specific focus on the contentious waters of the South China Sea; and, the governance capacity of local and international institutions to understand and respond effectively to the various policy challenges and security threats currently facing the IOR. The conversations emanating from this workshop helped frame the final papers contained in the *Indian Ocean Rising* publication.

Stimson is indebted to Rupert Herbert-Burns, Caitlyn Antrim, David Michel, Halae Fuller, Lindsay Dolan, and Russell Sticklor for their contributions to this volume. Stimson is also grateful to the communications staff, including Crystal Chiu, Rebecca Rand, April Umminger, Shawn Woodley, and Alison Yost, for their assistance throughout this project, and to program manager Kerri West. Finally, invaluable research support was provided by interns Amna Ali, Lindsay Hartley, Sreya Panuganti, and Zachary Weiss.

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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

Chapter One

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-to-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 km²
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 km²
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).

Chapter Two

Countering Piracy, Trafficking, and Terrorism: Ensuring Maritime Security in the Indian Ocean

Rupert Herbert-Burns

Multiple sources of insecurity afflict many of the countries that rim the Indian Ocean. These challenges include simmering conflicts between Persian Gulf states; terrorism in Pakistan, Sri Lanka, India, and Saudi Arabia; insurgency in Yemen and Iraq; state failure, civil war, and famine in Somalia; high-volume trafficking of drugs from Afghanistan via Pakistan and Iran; and piracy and armed robbery at sea. Not all of these security concerns have occurred at peak intensity at the same time, and thus it is arguable that they have been addressed 'sufficiently' on an 'if and when' basis. Even so, these risks threaten one of the most critical strategic and trading spaces in the world. The Persian Gulf remains the global market's most important source of crude oil, while the northern Indian Ocean constitutes a key sector of the globe's east-west-east trading belt. For this reason, it is all the more remarkable that these issues have not previously caused a greater holistic security breakdown in the Indian Ocean Region (IOR).

As trends that have particularly worrisome security implications continue to evolve, it is conceivable that the conflated pressures of insurgent conflict, terrorism, political insecurity, illicit trafficking of all kinds, and piracy and vessel hijacking will outstrip the international and regional community's ability to effectively respond to those issues in a sustained fashion. Decision-makers must now confront the logic of adopting a 'management' approach to these challenges. However, successful management of a security challenge of this magnitude, complexity, and interconnectedness requires policy coherence, imagination, longevity of participation, and considerable resources. Amidst the existential pressures of geopolitical fragility, internal political upheaval, insurgency, famine, and inter-state tensions, there is now a growing danger that the specific threats from terrorism, trafficking, and piracy will not get the resources and policy attention they require, and could therefore increase further in the near term and beyond.

The purpose of this paper is to offer a concise appraisal of the current state of the primary maritime security challenges in the IOR, explore in greater detail the evolution of some key trends, and offer some pointers for policymakers and stakeholders as to what solutions and strategy adaptations might be worth considering going forward.

Current Security Situation

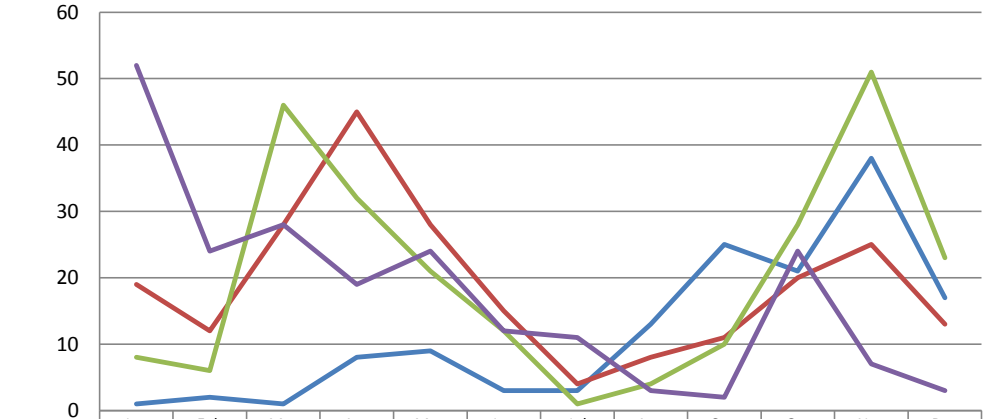
Piracy and Armed Robbery in the Indian Ocean

In the third quarter of 2011, maritime security concerns in the Indian Ocean continued to be dominated by piracy and armed robbery at sea, specifically the hijacking of merchant vessels by well-armed Somalia-based pirates. By the end of 2011, 214 vessels had been attacked, 31 hijacked (a 14-percent success rate), while eight vessels remained under capture awaiting release and of payment of ransoms, 497 seafarers had been held captive, and 10 seafarers had died. Piracy Attack Groups (PAGs) are increasingly well armed, highly motivated by the prospect of very large ransom payments (average payment is currently $5.4 million), and many are using captured merchant vessels as motherships to stage further attacks.

During 2011, there were typically 35-45 warships and auxiliaries deployed in the Indian Ocean on counter-piracy operations drawn from some 28 states, and there remain three dedicated counter-piracy coalition forces—the EU's counter-piracy task force EU NAVAL FORCE (otherwise referred to as EU NAVFOR or Operation Atalanta), NATO's Standing Naval Maritime Group (SNMG) 1 and 2, and Combined Task Force 151 (CTF-151). Due to the operational necessity of concentrating these clearly limited resources in the most vital areas, the great majority of naval assets are deployed in the Internationally Recognized Transit Corridor (IRTC), and off the eastern Somali coast. Nevertheless, the area affected by Somali piracy remains vast—approximately 2.5 million square miles, encompassing all parts of the Arabian Sea, Gulf of Aden, Gulf of Oman, and the southern Red Sea. The operational inability of even a vastly increased naval presence to secure this oceanic-sized space has meant that merchant vessels transiting or operating in the affected areas must implement their own anti-piracy measures, which are characterized by risk avoidance, and anti-boarding and hardening measures as set forth in the latest Best Management Practices version 4 (BMP-4)—a set of shipping industry guidelines for merchant vessel crews that give detailed information on the optimum practical and operational measures that should be implemented to deter and prevent attack and boarding by Somali pirates in the high risk area (HRA). Furthermore, the hiring of armed private security teams is now becoming the norm rather than the exception. This serious risk-mitigating measure is being increasingly driven by the realization that naval forces cannot provide sufficient protection, and because hull insurance underwriters and Protection and Indemnity (P&I) clubs are refusing to offer acceptable war risk premiums unless armed security teams are embarked.

In the beginning of 2012, piracy activity in the Indian Ocean HRA was modest compared to the same period in 2011. By mid-January 2012, for instance, there had been only two hijackings—one of a large dhow 60 nautical miles north of Bosasso in Puntland, and a second of an Italian-flagged product tanker, the *M/T Enrico Levoli*, which was hijacked some 50 nautical miles south of Ras al Madraka, Oman. Meanwhile, seven ships were attacked in the first half of January, with most of the attacks occurring in the Gulf of Aden. However, one ship was also attacked off the Omani coast, while another was attacked approximately 50 nautical miles east of Mogadishu in the Somali Basin. There were no attacks or hijackings in the deep ocean during this same time period. As shown in Figure 2.1, aside from the first two months of 2011, piracy attacks in the Indian Ocean during 2011 were for the most part in decline over those in 2009 and 2010.

Figure 2.1: Piracy Attacks, 2008–2011



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	1	2	1	8	9	3	3	13	25	21	38	17
2009	19	12	28	45	28	15	4	8	11	20	25	13
2010	8	6	46	32	21	12	1	4	10	28	51	23
2011	52	24	28	19	24	12	11	3	2	24	7	3

Source: Risk Intelligence

Apart from the impact of seasonal variations on PAGs' ability to sortie in large numbers and with sufficient frequency during the monsoon months, the decline in the number of attacks (and in particular the incidents of successful hijackings) is attributed to both the greatly increased number of armed vessel protection teams on merchant vessels in the HRA, as well as the reduced numbers of large motherships deployed (a result of the limited numbers of merchant vessels in captivity). While there have been incidents of exchanges of fire between pirates and armed security teams, to date there has not been a successful hijacking of a merchant vessel with an armed team embarked. This reality has had an important deterrent effect on PAGs that once used to hijack vessels successfully with little or no resistance from crews.

At the moment, it is too early to tell whether Somali pirates will be willing, or indeed able, to regain the offensive initiative in 2012 and beyond. Currently, three outcomes are plausible:

› The better-equipped, better-armed, and more experienced PAGs will make concerted moves to attack ships with embarked armed security personnel, using tactical acumen and far greater weight of fire (including the use of heavy machine guns if available) to defeat vessel defenders in a protracted fire-fight. Such hijacking attempts would necessitate that pirates overcome BMP defences. But successful seizures would boost captured vessel inventory and supply more motherships for attacking operations, which could better yield further successful hijackings.

› The steady proliferation of privately contracted armed security personnel on vessels operating in the HRA, coupled with the limited numbers of decent motherships, will cement the current deterrent effect, and will dilute PAG operational capacity to the extent that attacks and successful hijackings further decline in 2012 and beyond.

› The current status quo will be maintained. There will be an ebb and flow of attacking rates during the monsoon cycles, and a scattering of successful hijackings of vessels that are either insufficiently prepared with full BMP-4 and/or do not have an armed security team on board.

Illicit Trafficking by Sea

The sustained trafficking of illicit narcotics, weapons, and people within, and via, the Indian Ocean will persist for the medium- to long- term for several key reasons. There are numerous sources of high-volume supply for all three commodities; there are a sufficiently large number of points of export located in key countries that suffer from chronic insecurity and/or corrupt officials; there is a massive array of sea transportation available (liner and tramp) servicing all of the necessary sites of demand and consumption; and, the environment within which this activity occurs is vast and, for all intents and purposes, largely insecure, including lengthy tracts of unpatrolled coastline. While the trafficking of narcotics, weapons, and people continue to be of greatest concern, the smuggling of oil, cigarettes, charcoal, khat, endangered species, and other contraband is also commonplace.

Narcotics Trafficking

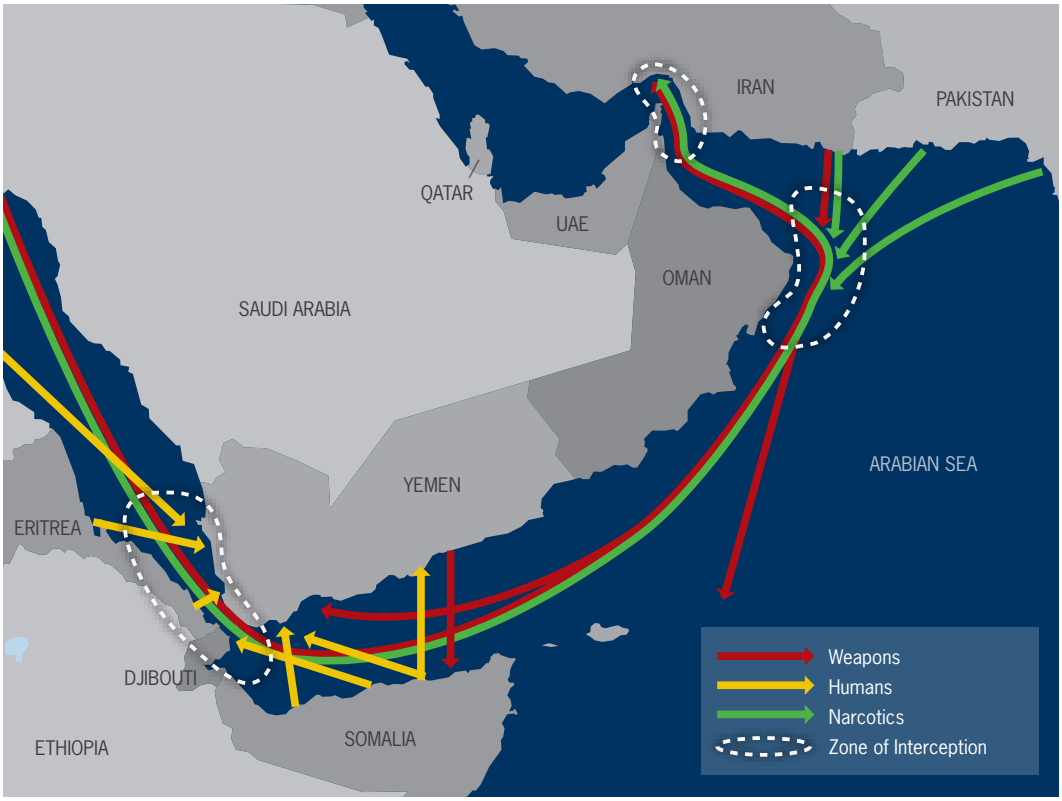
Three types of illicit narcotics dominate trafficking in the Indian Ocean—heroin/opiates, amphetamine-type stimulants (ATS), and cannabis. In terms of volume, the majority of narcotics are trafficked by land, most notably Afghani heroin bound for Russia and Europe via Central Asia, the Caucasus, Turkey, and the Balkans. Nevertheless, sea conveyance of narcotics remains substantial. A more detailed breakdown of producing countries, key ports, routes, and destinations is given in Figures 2.2 and 2.3. The flows of greatest concern are the Afghan heroin/opiate trafficking to Europe via Iran/Pakistan/United Arab Emirates (UAE), and via the Arabian Sea/Red Sea/Suez Canal shipping route.

Small Arms and Light Weapons Trafficking

Flows of illicit weapons and ammunition in this region follow the familiar logic of supply and demand, moving from source (or surplus) to areas of conflict, where they can fuel insurgency or, to a lesser extent, terrorist activity. Details are provided in Figure 2.3. The linkages of greatest concern are flows of small arms and light weapons (SALW) from Iran to Yemen and onwards to the Eastern Mediterranean via the Suez Canal, and between the Arabian Peninsula (Yemen) and the Horn of Africa (Somalia).

Across the IOR, the most common types of weapons trafficked fall into the SALW category. Trafficked weapons in this category include anti-aircraft guns (e.g., ZU-23-2); anti-personnel mines; anti-tank guided missiles (e.g., Malyutka AT-3 Sagger); anti-tank mines (e.g., TMA-5, YM-III); assault rifles (e.g., AK-47, AK-74, G-3s, FN FAL, M-16); C-4 plastic explosives; hand grenades; handguns/side arms; heavy machine guns (e.g., DShK); man-portable air defence systems (MANPADS) (e.g., SA-7,& Strela-2); man-portable machine guns (e.g., PKM, RPK); mortars (e.g., 60mm, 80mm, and 120mm variants); rocket-propelled grenades (e.g., RPG-7, RPG-18); sniper rifles (e.g., 7.62mm SVD); surface-to-surface rockets (e.g., 122mm and 107mm Katyusha and Grad); TNT; and, ammunition for all of the above.

Figure 2.2: Smuggling Routes and Zones of Interception



Source: Stimson

The map above illustrates the sea pathways for drugs, SALW, and human trafficking. There are other maritime pathways outside the scope of this view, notably SALW bound for the southern Somali ports from the Makran coast of Iran and Pakistan, and opiates and cannabis bound for the major Kenyan, Tanzanian, and Mozambican ports from the Makran and southern Iranian coast. The map shows likely and forced areas of trafficking convergence, which offer potential zones of interception concentration for security forces.

Human Trafficking

There are numerous source countries for illicitly trafficked people in the IOR with the associated dangers of loss of life at sea and abuses of trafficked persons by organized criminals. Two main maritime flows stand out:

› From the southern Red Sea and Horn of Africa to the southern Arabian Peninsula.

› From the Asian subcontinent to the eastern Arabian Peninsula and Persian Gulf.

The sea area of greatest concern remains the Gulf of Aden and southern Red Sea, where high-volume trafficking persists between Bosasso and Berbera in Somalia and Yemen. Currently, the largest numbers of refugees in Yemen are Somali nationals. This is ironic given that Yemen is in a state of virtual civil war, and indicative that the situation in Somalia is so bad that thousands of people each year are compelled to travel to another conflict-torn country to escape their own. Trafficked persons also cross to Yemen from Eritrea

Figure 2.3: Maritime Trafficking in the Indian Ocean Region

	Narcotics			Small arms & light weapons	Human
	Opiates	ATS	Cannabis		
Key source countries	Afghanistan, Laos, Myanmar, Pakistan, Thailand, Vietnam	Australia, Bangladesh, India, Indonesia, Iran, Malaysia, Myanmar, South Africa, Thailand	Afghanistan, India, Philippines, South Africa, Sri Lanka	Ethiopia, India, Iran, Iraq, Mozambique, Myanmar, Pakistan, Somalia, South Africa, Sri Lanka, Sudan, Thailand, Yemen	Afghanistan, Bangladesh, Comoros, Egypt, Eritrea, Ethiopia, India, Iraq, Madagascar, Malaysia, Maldives, Myanmar, Sudan, Tanzania, Thailand, Yemen
Potential points of sea export/ departure	Pakistan (Karachi, Gwadar, Port MBQ); Iran (Bandar Abbas, Charbahar, Jask)	Bangladesh (Chittagong); India (Mumbai, Chennai), Indonesia (Jakarta); Iran (Bandar Abbas, Charbahar, Jask); South Africa (Durban)	Pakistan (Karachi, Gwadar, Port MBQ); Iran (Bandar Abbas, Charbahar, Jask)	Iran (Bandar Abbas, Charbahar, Jask); Yemen (Hodeidah, Aden)	Djibouti, Somalia (Bosasso , Berbera); Eritrea (Massawa , Aseb); and Sudan (Port Sudan)
Transhipment points	India (Mumbai, Chennai, Calcutta, Kochi), Kenya (Mombassa), Mozambique (Nacala Porto, Pemba, Maputo), Oman (Salalah , Muscat); South Africa (Durban), Tanzania (Dar es Salaam), UAE (Jebel Ali)	India (Mumbai, Chennai, Calcutta, Kochi), Kenya (Mombassa), Mozambique (Nacala Porto, Pemba, Maputo), Oman (Salalah , Muscat); South Africa (Durban), Tanzania (Dar es Salaam), UAE (Jebel Ali)	India (Mumbai , Chennai), Kenya (Mombassa); South Africa (Durban); Sri Lanka (Colombo), UAE (Jebel Ali)	India (Mumbai, Chennai, Kochi), Kenya (Mombassa), Mozambique (Maputo); Somalia (Mogadishu, Kismayo , Bosasso) South Africa (Durban), Tanzania (Dar es Salaam), UAE (Jebel Ali); Eritrea (Massawa , Aseb); and Sudan (Port Sudan)	India (Mumbai, Chennai, Calcutta), Kenya (Mombassa), Oman (Salalah , Muscat); Tanzania (Dar es Salaam), UAE; Yemen (Hodeidah, Mocha, Red Sea coast , Hanish Island group)
Primary sea transportation routes	**Malacca** → Babel Mandeb, Suez **Malacca** → Durban, Cape Aghulas **Persian Gulf** → Cape Agulhas **Persian Gulf** → Sri Lanka/Malacca **Persian Gulf** → Suez	**Malacca** → Bab el Mandeb, Suez; **Malacca** → Durban, Cape Aghulas; **Persian Gulf** → Cape Agulhas; **Persian Gulf** → Sri Lanka/Malacca; **Persian Gulf** → Suez; **Singapore** → SE China/Taiwan/Japan; **Western Australia** → Sunda Strait	**Malacca** → Bab el Mandeb, Suez; **Malacca** → Durban, Cape Aghulas; **Persian Gulf** → Cape Agulhas; **Persian Gulf** → Sri Lanka/Malacca; **Persian Gulf** → Suez; **Singapore** → SE China/Taiwan/Japan; **Western Australia** → Sunda Strait	**Malacca** → Bab el Mandeb, Suez; **Malacca** → Durban, Cape Aghulas; **Persian Gulf** → Cape Agulhas; **Persian Gulf** → Sri Lanka/Malacca; **Persian Gulf** → Suez; **Singapore** → SE China/Taiwan/Japan; **Western Australia** → Sunda Strait	**Malacca** → Bab el Mandeb, Suez **Malacca** → Durban, Cape Aghulas; **Persian Gulf** → Cape Agulhas; **Persian Gulf** → Sri Lanka/Malacca; **Persian Gulf** → Suez; **Singapore** → SE China/Taiwan/Japan; **Western Australia** → Sunda Strait
Destination regions/ countries/ ports	Major European ports		Major European ports	Somalia (Kismayo, Mogadishu, Haradhere, Bossaso); Yemen (Hodeidah, Aden); Eritrea (Massawa , Aseb); Sudan (Port Sudan), Gaza, Lebanon and Syria (via Suez)	Bahrain, Iran, Kuwait, Qatar, Saudi Arabia, UAE, Yemen
Means of transportation	Container vessels (TEUs), Dhows, Fishing vessels, General cargo vessels, Go-fast boats	Container vessels (TEUs), Dhows, Fishing vessels, General cargo vessels , Go-fast boats	Container vessels (TEUs), Dhows, Fishing vessels, General cargo vessels, Go-fast boats	Container vessels (TEUs), Dhows, Fishing vessels, General cargo vessels, Go-fast boats	Container vessels (TEUs), Dhows, Fishing vessels, General cargo vessels, Go-fast boats

and Sudan, and to a lesser extent from Djibouti. For those persons that survive the transit, many are trafficked onwards to Saudi Arabia and the Gulf states and sold into sexual and/or domestic servitude.

When assessing illicit trafficking within and via a maritime space, six key features are required:

- Source countries
- Points of export (ports/harbours/coastlines)
- Transhipment nodes/countries (if/where applicable)
- Means of transportation (vessel type)
- Sea transportation routes
- Destination countries/ports

Terrorist Threat in the Maritime Domain

In the Indian Ocean, there has been little in the way of maritime terrorist activity since the early part of the last decade, when Al-Qaeda was still a significant concern from the point of view of attack operations and advanced operational planning under the leadership of Abd al-Rahim al-Nashiri (captured in November 2002). The considerable weakening of Al-Qaeda has effectively neutralized their operational maritime capability, but not its strategic aspirations. It now seems clear that Al-Qaeda-Core will rely upon affiliates to conduct operations of high complexity. Given their current potency in Yemen and the high-profile nature of their intent to attack international targets, the most relevant affiliate is Al-Qaeda in the Arabian Peninsula (AQ-AP). Currently, there is no evidence to suggest that AQ-AP has the capability to mount an attack against vessels at sea, at anchor, or in port. However, in February 2010, AQ-AP's deputy commander, Said al-Shihri, publically declared the group's interest in closing the Bab al-Mandeb (BAM) and bringing the straits under the protection of Islam. There were no hints of how this highly ambitious goal might be achieved, but it could not be done without directly attacking transiting vessels.

There have also been indications that AQ-AP would like to advance their alliance with an Al-Qaeda affiliate on the other side of the Gulf of Aden, Al-Shabaab, to assist them in this respect. AQ-AP could not threaten BAM in any lasting or permanent way; however, their ability in the short to medium term to attack individual vessels should not be discounted, particularly those ships calling at Yemeni ports or terminals or transiting close to the Yemeni coastline. Furthermore, the continued presence of large numbers of foreign warships in the IRTC, as well as tankers carrying crude to the West, also serves to sustain and focus their ideological vigor in the long term. Currently, there is no evidence that Al-Shabaab has a maritime attack capability or is actively planning maritime operations.

The other contemporary maritime terrorist threat comes from the Abdullah Azzam Brigades (AAB), which has demonstrated the capability to attack shipping in the Persian Gulf. Formed after 2004, AAB is an Al-Qaeda-affiliated cellular Islamist terrorist group operating in various countries in the Levant and parts of the Arabian Peninsula. On July

28, 2010, an AAB maritime cell attacked the laden Japanese-owned very-large crude carrier (VLCC) *M.Star* at night as she was transiting the Strait of Hormuz. The explosives-laden attack craft was detonated close to the starboard side of the vessel beneath the superstructure. Fortuitously, the blast damage was not sufficient to cause crippling damage and the tanker proceeded to a port in the UAE.

The fortunate outcome notwithstanding, the incident itself is of considerable significance as an act of maritime terrorism. The attack was executed by an Islamist terrorist group not previously judged to have a maritime operations capability; the assault was conducted against a moving target at night (previously Islamist terrorists had only managed to attack merchant vessels at anchor or berthed at a terminal); and, it was executed in the world's most critical trading chokepoint in one of the most militarized maritime spaces in the world. It is far from certain whether AAB could mount another attack of this kind. However, it must be assumed by security forces, militaries, and the international shipping community that it can, and that such an attack will be conducted without warning and may, in the next instance, be far more destructive, not only for the vessel itself but also for the sea area in which the attack occurs.

Key Evolving Security and Industry Trends

Merchant Vessel Motherships

Using a mothership to support long-range and/or extended sea deployment Somali PAG operations in the Indian Ocean has been a feature of the Somali piracy threat for several years. The traditional mothership has typically been a dhow or small fishing vessel used to tow and support two to three attack skiffs for PAGs operating in distant hunting grounds and deep-ocean shipping lanes. Captured merchant vessels have been used for logistical support and refuelling in limited ways since 2008, but pirates began using hijacked vessels in more complex attacking operations in 2010. For instance, the now-released general cargo vessel *M/V Izumi* was used directly in an attack against the tanker *M/V Torm Kansas* in November 2010. Aside from her role as a launch platform for the attacking skiffs, *Izumi* closed to within small arms range of the target vessel and pirates on board provided fire-support for the attackers. Other examples of vessels being used as long-range motherships (effectively mobile forward operating bases) have included *M/Vs Eagle, Hannibal II, Motivator, Orna, Polar, Shiuh Fu No.1*, and *York*. These kinds of vessels—general cargo vessels and product/chemical tankers—have given PAGs the following key operational and tactical advantages and capabilities:

- **All-weather/all-season capability:** These vessels enable PAGs to deploy into hunting grounds and stay on station year round, regardless of monsoon seasons.
- **Attack fire-support platform:** Though not commonly used in this way, vessels of this size are ideal for mounting heavier weaponry that could be used for sustained fire-support, or in a direct vessel-to-vessel attack role. (Heavier weapons could conceivably include the Russian-designed DShK 12.7mm (.50 cal) heavy machine gun (HMG), which has been widely used ashore on Somali 'technicals.')

- **Hostage shield:** The vessel's crew always remains on-board to operate the ship. As such, they constitute an ideal 'human shield' as hostages should naval forces intercept the mothership and attempt to recapture her.
- **Logistical support:** The ship's bunkers, stores, food, communications, and accommodation can provide long-term support for greatly enlarged PAG teams (of up to as many as 50 pirates). Cutting and other tools the vessel may carry are also ideal for enabling attackers to breach even heavily fortified citadels on target ships.
- **Oceanic range:** These vessels give the PAGs long-range capability either to seek out distant targets or remain in/near hunting grounds for sustained periods.
- **Sustainable high speeds:** Generally, merchant vessels can travel at up to at least 10 knots, even in heavy weather, enabling them to move at least 240 nautical miles in a given 24-hour period. This is significant, as a PAG can arrive without warning to attack in an area not previously determined as a high threat sector for transiting shipping.

This very serious capability enhancement notwithstanding, the existence and use of mothership vessels also gives security forces an opportunity to track the PAGs using them, and thus issue advance warnings to mariners approaching sectors of ocean where such ships have been sighted or are estimated to be heading.

Use of Armed Guards on Merchant Vessels

Ship owners' and charterers' use of privately contracted armed security personnel (PCASP) to protect their vessels transiting HRA of the Indian Ocean is fast becoming the norm—rather than the exception—for companies choosing to take a more proactive stance in protecting their vessels by employing specialist security firms. However, this approach has raised crucial questions regarding the quality, capability, and professional integrity of the rapidly growing number of companies offering their services. This issue is important for three principal reasons:

- Effectiveness in deterring and defeating an armed pirate attack.
- Safety of the crew, given the presence of weapons and armed men on board vessel.
- Robust legal protocols (including appropriate liability agreements) and comprehensive insurance cover.

As the use of PCASP has proliferated, the international shipping community has recognized the importance of ensuring that all the vital criteria listed above are met. Most significantly, the International Maritime Organisation (IMO) has set forward important guidelines for ship owners, operators, masters, and flag states in the selection of PCASP. The guidelines and recommendations contained within IMO MSC.1/Circ.1405 and 1406 (May 2011) clearly and concisely establish what interested parties need to be aware of and demand regarding PCASP, prior to agreeing upon contracts for their use. Following an operation risk assessment undertaken by the owner/operator, key due-diligence criteria concerning the private military security company (PMSC) include: financial position; insurance cover; management experience; maritime experience (e.g., number of armed transits undertaken);

understanding the threat and capacity to provide continuous threat intelligence provision; licenses for firearms use and legal transport; suitable weapons selection; thorough vetting of security personnel (military records and criminal checks, etc.); and personnel maritime and security training and qualifications.[1]

As long as Somali piracy is a major security problem, shipping companies' use of PCASP will remain widespread. Indeed, if the threat remains at current levels, the ability of many companies to obtain war risk hull and machinery insurance cover and P&I cover will be linked to the level of security preparedness undertaken. For some insurers, this can include the requirement for PCASP as part of a rigorous security risk assessment and the proper implementation of BMP.

From the perspective of other key actors, such as international naval forces and governments, the increasing deployment of three-and four-man armed security teams on-board merchant vessels is a positive development. However, there is also cause for concern. On one hand, this more robust security offers deterrence and protection for a number of transiting vessels that could not possibly be protected throughout the HRA by the very limited numbers of warships deployed at any given time. Conversely, as the number of armed security teams proliferates and their preparedness to use lethal force becomes an acknowledged part of the operational risk assumed by PAGs seeking target ships, there could be an increase in the levels of fire-power and aggressiveness on the part of Somali pirates. Such an escalation is likely to make the task of deterring and disrupting piracy in the Indian Ocean more problematic for naval commanders and policymakers. As the era of the PCASP evolves throughout 2012 and beyond, governments and decision-makers in the shipping industry will be monitoring whether the use of armed protection generates ever-greater deterrence, or fuels increased aggressiveness of hijackers willing to assume greater risks in order to capture ships.

Petroleum Exploration and Production (E&P) in the East African Littoral

Prolific oil and gas E&P has a long history off Africa's west coast, primarily Namibia, Angola, Cameroon, and Nigeria. However, oil experts are increasingly speculating that Africa's eastern coast could represent one of the few remaining major petroleum frontier regions in the world. Over the last several decades, seismic surveys have revealed an abundance of natural gas deposits and promising signs of oil from Somalia to Mozambique, along a geological structure known as the Davie Fracture Zone. As a result, numerous international oil companies (IOCs) and national oil companies (NOCs) are increasing their upstream operations (seismic surveying and exploratory and wildcat drilling) off Kenya, Tanzania, Mozambique, and Madagascar.

In early 2010, Texas-based Anadarko Petroleum Corp. announced the confirmation of a giant gas play off the Mozambique coast in the Rovuma Basin,[2] and comprehensive seismic surveys have been conducted to determine the full extent of the reserves. Kenya, Tanzania, and Mozambique are issuing more offshore exploration licenses, which has in turn attracted a number major petroleum companies, including Anadarko, BG Group, CNOOC, Eni, ExxonMobil, Petrobras, PETRONAS, Shell, Statoil, and Total.[3] GB Group, which made two important gas discoveries off Tanzania in 2010, has said that discovery "success is starting

to gain momentum" and that depending on the size of fields, there could even be liquid natural gas (LNG) export potential to markets in Asia. Separately, Dominion Petroleum spent $40 million in upstream activity in Tanzanian and Uganda in 2010, while upstream activity in Tanzania's territorial waters and EEZ is being led by major companies such as BG Group, ExxonMobil, Shell, Eni, and Petrobras.[4]

Most current E&P activity revolves around gas, with the most promising areas for prolific yields in the deep-water blocs. However, there is also confidence of significant potential for oil deposits off the Somali coast, with some analysts speculating there may be reserves of up to 10-billion barrels in the northern sector of the basin.[5] Currently, however, the chronic insecurity situation in Somalia and continued vessel hijackings throughout the Somali Basin are preventing seismic surveying and exploratory drilling.

The increase in offshore activity has necessitated the contracting of seismic survey vessels and drill ships by oil companies large and small. Given the vulnerability of these kinds of vessels and the operational profiles—very slow steaming for seismic runs, restrictions in ability to manoeuvre with deployed seismic arrays or static with set drill strings, and the numerous support vessels required—the security complications are considerable. As of early 2012, there is less concern with regards to Islamist terrorist threats, although Somalia-based Al-Shabaab remains a potential threat to foreign interests and personnel in Kenya (and to a lesser extent, in Tanzania). Nevertheless, going forward, piracy and vessel hijacking still present the most serious security challenge for these kinds of upstream operations in the Somali Basin and Mozambique Channel. Given the capacity for these kinds of companies to accept and absorb high risk in order to achieve success, and their considerable resources for utilizing comprehensive security, however, the steady increase in offshore operations in eastern Africa presents an intriguing opportunity to help deter and impede Somali piracy.

The current number of warships deployed on counter-piracy operations is never going to be sufficient to diminish the threat, and clearly the warships that are available cannot be everywhere they are needed. Still, it is conceivable that if increasing numbers of private maritime security assets (e.g. well-armed escort craft and embarked PCASP) are deployed in these waters on a more or less permanent basis protecting seismic survey groups, drill ships, and offshore support vessels, then the net effect on littoral security could be significant. Indeed, if this kind of security were also complemented by augmented Kenyan, Tanzanian, and Mozambique naval and/or coastguard services, PAGs' ability to move and attack at will could be further limited. This is essentially an incremental, self-fuelling phenomenon. As more E&P operations deploy in the region, there will be a concomitant upswing in the security needed and deployed. In turn, this increased security—both actual and perceived—will encourage other companies to enter the region, necessitating additional security assets, and so on. Already, this process is somewhat underway; however, it could be accelerated with some international assistance for additional coastal patrol vessels and training for the three countries highlighted above.

Reality Check: Implications of the Interaction between AQ-AP and Al-Shabaab

The full extent of practical (or operational) ties between Yemen-based AQ-AP and Somalia-based Al-Shabaab is not possible to ascertain definitively, particularly from open-source material. This is very important to note, as there is far too much speculation by some media outlets in parts of the Middle East, Africa, and Asia regarding the seemingly impending threat of an AQ-AP/Al-Shabaab alliance—a union that could potentially threaten shipping in the region, specifically in the Gulf of Aden and Bab al Mandeb (BAM). Nevertheless, more credible reporting during 2010 and 2011 does indeed demonstrate that links between the two groups do exist, and that the development of this cooperation has been encouraged by senior Al-Qaeda leadership. In July 2011, reports indicated that U.S. intelligence officials and senior military officers have voiced concerns over the support that Al-Shabaab has been receiving from AQ-AP, specifically in the form of weapons, fighters, and explosives training. Some commentators in Washington have also suggested that the efforts of Islamist extremists on both sides of the Gulf of Aden are converging to the extent that we are seeing the emergence of a 'conflation of jihadi conflict zones' in this strategically vital space.[6]

If an operational alliance between the two groups' expeditionary-capable cells were to emerge, this would certainly be a concern for policymakers and military commanders in US Central Command (CENTCOM), NATO, EUNAVFOR, and others. However, undue concern is precipitous. Currently, Al-Shabaab is under considerable pressure to retain control over its territorial stronghold in the southern parts of Somalia due to the effects of the chronic drought and military advances by government and troops from the African Union Mission in Somalia (AMISOM).[7] (Al-Shabaab has forbade most international aid agencies from distributing famine relief in areas under its control, which is prompting thousands to travel to areas of Mogadishu controlled by the transitional federal government (TFG) to get aid.) Furthermore, the leadership has also publicly conceded that there have been serious divisions and infighting amongst regional leaders, which has dented their organizational and combat effectiveness, and emboldened their enemies.[8]

Although Al-Shabaab remains a key force in the country and the group's leader, Ahmend Abdi Godane, has hinted at wanting to broaden the group's operational reach, there is currently little or no capacity to initiate an international maritime-capable force. AQ-AP is better placed geographically, logistically, and technically to develop a maritime cell capable of attacking vessels off the Yemeni coast. Recognizing this threat, the CIA in September 2011 labelled AQ-AP as the 'most dangerous' of the extremist Al-Qaeda affiliates.[9]

AQ-AP has made notable gains in southern Yemen and is certainly taking full advantage of domestic political upheaval and insecurity, but it will remain under pressure to maintain its operational tempo and capacity on land. At this juncture, despite a declared intent to implement maritime operations in the Gulf of Aden, AQ-AP is unlikely to have the operational bandwidth and flexibility to conduct strike operations against shipping whilst it is tied up on shore.

Looking forward, the intent for greater operational congruence between AQ-AP and Al-Shabaab is clear, and in time this could include a maritime attack dimension in the Bab

al Mandeb, Gulf of Aden, or Horn of Africa. However, the increased likelihood of this will depend on a lessening of pressure on both groups on land, more focused maritime-capable/experienced cell leadership and operation design, and greater determination by Al-Shabaab to properly develop a discernable maritime cadre. These conditions could emerge at some point in 2012-13.

Potential Policy Responses

This paper's objective has been to provide a concise status report of the form and extent of piracy and vessel hijacking; analyze the trafficking of illicit drugs, SALW, and persons; and highlight the extant threat from maritime-based terrorism. It has also sought to examine in greater detail some important evolving trends. Given that these serious security challenges are occurring amidst other substantial geopolitical and humanitarian problems in the region, two interrelated concerns are manifest going forward:

› These challenges will, in all likelihood, intensify in the years ahead.

› There are not enough resources (principally military) being provided to address these problems.

Piracy and Vessel Hijacking

The oceanic area now threatened by Somali PAGs is vast (more than 2.5 million square miles), and security of this space could never be assured, even with hundreds of warships. Nevertheless, the 35-45 warships collectively provided by many states that are routinely deployed in the IRTC and in parts of the Somali Basin are woefully inadequate. There are some short-term solutions to this problem. Most of the Gulf Cooperation Council (GCC) states have decent-sized naval forces and numerous patrol vessels with adequate range to patrol the Gulf of Oman, which has seen a greatly increased PAG presence during the last two years with the advent of merchant vessel motherships. The Gulf States rely heavily on shipping for their economic prosperity, especially to secure the flow of crude oil exports. This reality should be matched with far more robust and sustained naval patrolling by Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE. Western powers that have replenishment capabilities could provide logistical support to an augmented GCC patrol effort. Meanwhile, on the northeastern and eastern side of the HRA, India and Pakistan could likely provide more sea and air surveillance resources to ensure better security nearer to their EEZs. (Indeed, India's National Shipowner's Association, figuring that piracy costs the global shipping trade $9 billion annually, has formally urged the Indian government to back the creation of a maritime anti-piracy force under UN command.)[10] Additional Maritime Patrol Aircraft (MPA) and Unmanned Aerial Vehicle (UAV) assets based in the Seychelles, Kenya, Tanzania, Oman, and Madagascar would further enhance current levels of maritime domain awareness (MDA). Additionally, those states with sufficient warships, such as the US, UK, China, France, Germany, Japan, and Turkey, could provide additional frigates and destroyers to extend the patrolling footprint deeper into the HRA, guided by improved MDA and intelligence.

Ever since the piracy threat began to grow in 2008, MDA has improved considerably due to the efforts of the United Kingdom Maritime Trade Organisation (UKMTO), the Maritime Security Center – Horn of Africa (MSC-HOA), and various combined task forces. Nevertheless, more could be done to harness the surveillance and threat-reporting capability of all of the merchant vessels in the HRA, which could potentially expand the intelligence-gathering capacity for military forces by an order of magnitude. This would prove particularly important in helping to track motherships. In the longer term, an internationally-supported financial program to boost the naval and coastguard capacity of countries such as Kenya, Tanzania, Mozambique, Madagascar, Mauritius, and the Seychelles would better enable these states to provide far better maritime security in their own backyard. From a technical perspective, some studies still need to be done to determine the optimum offshore patrol craft these states would need for counter-piracy in these waters.

Illicit Trafficking

Interdiction and seizure of narcotics trafficked by sea depends upon three key factors:

- Timely, accurate intelligence
- Effective security screening and reliable officials at points of export, transhipment, and/or landing
- Capacity for interception at sea (e.g., coast guard, marine police, and/or naval vessels)

For the most part, the reliability of effective cargo screening and the integrity of customs and security officials cannot be relied upon at any of the points of export, transhipment, or landing in the region. Thus, international forces must rely upon meaningful intelligence, deterrence, and at-sea interdiction. Already, intelligence has led to some significant arms trafficking intercepts at sea. In March 2011, for instance, the Israeli Navy intercepted the Liberian-flagged *M/V Victoria,* which was found to be transporting 50 tons of weapons, including six C-704 anti-ship missiles. In November 2009, the Israeli Navy also seized 320 tons of weapons on board the *M/V Francop*, including 600 122mm Katyusha rockets. Previously, the Israel Defense Force (IDF) had seized the *M/V Santorini* in 2001 and the *M/V Karine-A* in 2002, both of which were trafficking very large consignments of illicit arms. All of these weapon shipments originated in Iran. There have also been some drugs shipments seized in Aden, Hodeidah, Mombassa, Dar es Salaam, Jebel Ali, and Karachi in recent years, but most of the largest consignments of sea-trafficked illicit opiates still make it through to major European container ports such as Rotterdam, Antwerp, Hamburg, Bremerhaven, Valencia, Felixstowe, and Gioia Tauro.

In regards to human trafficking, arguably the largest concern in the region is trafficking by organized criminal groups across the Gulf of Aden and Red Sea. This is problematic for several reasons, including the very large volume of trafficked persons from Africa bound for the Arabian Peninsula; the high death toll on these very dangerous crossings in overcrowded, unseaworthy vessels; and, the cover opportunity for the transfer and exchange of terrorist fighters from Al-Shabaab and AQ-AP across the Gulf of Aden. The points of departure for trafficking of persons across this divide are well-known, as are the drop-off points and routings. The difficulty is that with virtually all available international and regional naval

and coast guard assets dedicated to counter-piracy operations, there is little or no spare capacity for trafficking interdiction. This is unlikely to change in the short to medium term. This security concern is best tackled at the ports of departure rather than at sea. However, given where the primary ports are located and the fact that many of the smaller trafficking craft leave from more remote, unpatrolled coastlines, the challenge is substantial. In this respect, coalition forces and the UN must continue to strengthen cooperation with the security forces and port authorities in Somaliland (particularly the Somaliland Navy, which has a good number of well-armed ships manned with trained crews). The reduction in human trafficking from this side of the Gulf of Aden is best affected before they put to sea.

Maritime Terrorism

Addressing the threat of maritime terrorism in this region is achieved by having excellent intelligence coupled with the precision forces (special forces and advanced aerial assets) needed to thwart a terrorist attack before a group's operation moves into the execution phase. The groups of greatest concern in this region are AAB, AQ-AP, and, to a reduced extent, Al-Shabaab. The US has boosted the numbers of its UAVs (including the advanced *Reaper*) to provide enhanced aerial surveillance and strike capability in the region, with reported increases in the number of UAVs based at Camp Lemonier in Djibouti, Ogaden in Ethiopia, and the Seychelles. The use of UAVs in a strike role against terrorists has been highly effective in Pakistan and Yemen. However, there remain concerns over mistaken targeting and collateral damage due to out-of-date or erroneous intelligence.[11] Intelligence coverage of AQ-AP and Al-Shabaab appears to be of a high order, but much more needs to be done to improve the coverage of AAB, which prior to its surprise attack on the *M.Star* in the Strait of Hormuz, had not been credited with a maritime strike intent, much less a capability to execute such an ambitious and complex operation.

Maritime Security Developments in the IOR Out to 2030

Due to enduring, and in some cases growing, demand for narcotics in Europe and parts of the African continent, drug trafficking from Central Asia (via Pakistan and Iran) will persist, with Africa remaining both a key transit hub and a destination for opiates. Human trafficking and displaced people migrating to Asia from Africa will continue in the same volumes across the southern Red Sea and the Gulf of Aden until countries in the Horn of Africa (principally Somalia) become more stable, possibly toward the end of this decade. Indeed, only when Somaliland and Puntland have more robust policing and legal forces will the disruption of organized criminal gangs engaged in human trafficking be truly effective. This could become possible with meaningful and sustained assistance from the wealthy regional states, in particular those from the GCC.

Somalia will likely become more secure in the coming decade, as neighboring states and the country's transitional federal government (TFG) collectively push to weaken Al-Shabaab in the south the country. If the TFG can be given sustained assistance to fortify security in the country, particularly on the coast, this will diminish the ability of pirate groups based in Haradhere, Hobyo, and Eyl to sortie into the Somali Basin at will. In time, leading regional states will need to help Somalia with developing a reliable coast guard of its own to help

police its own ports and coastline. However, this level of security is unlikely to be fully implemented by 2020.

Illegal, unregulated, and unreported (IUU) fishing will continue in the western Indian Ocean's most important fishing areas, most notably in the important tuna grounds in the waters around Mauritius, Comoros, Madagascar, the Seychelles, and Reunion. Currently, albacore, yellow-fin, and big-eye tuna are being fished to the maximum limit deemed possible by conservationists. However, IUU has long been a growing threat, both to key fish species and to the economies of the island states where the fish are hunted. Though the Indian Ocean Commission has been able to help some states with satellite and radar surveillance to curtail IUU, the navies and coast guards of these states are too small to cope with the vast areas of ocean in which this activity occurs. Patrol boats based in the Seychelles and Mauritius have made arrests where and whenever possible. However, if tuna stocks in the IOR are to have any chance of being maintained, island states in the western and southwestern IOR will require assistance in the form of additional patrol vessels, intelligence, training, and funding.

As offshore exploration and production for oil and gas evolves along Africa's east coast from Mozambique northwards to Somalia, more private and government maritime security will be put in place. On one hand, this will improve maritime security in the littorals where this activity is concentrated—northern Mozambique, Tanzania, and Kenya. On the other hand, however, as the offshore industry expands, infrastructure, ports facilities, and support shipping will likely be tempting targets for armed robbery, piracy, kidnappings, and sabotage for a range of actors, including pirates, organized criminal gangs, terrorists, and insurgent groups (some of which have yet to emerge or be identified). This is not to suggest that insecurity will be seen on the scale witnessed in the waters off Nigeria in recent years; however, the industry and those countries concerned will need to be prepared for this risk.

Historically, the settlement of territorial disputes has been one of the most protracted areas of geopolitical conflict. In most instances, the dispute is benign, rendering it virtually dormant. Nevertheless, several disputes in the IOR have the potential to become flashpoints in the coming decades, and will need to be addressed with care. As of early 2012, key disputes include the lack of agreement to settle the maritime boundary between Iraq and Iran in the Shatt al Arab waterway; unresolved maritime boundaries between Indonesia and Timor Leste; and the dispute between the UAE and Iran over sovereignty of the Tunb Islands and Abu Musa Island in the southern Persian Gulf.

Viewed from afar, there appear to be a daunting number of maritime security threats and challenges in the IOR, both extant and potential, and insufficient resources to address them. Indeed, the mere fact that the IOR constitutes the world's largest swath of maritime space falling under the Lloyd's Market Association Joint War Committee 'Hull War, Piracy, Terrorism, and Related Perils Listed Areas' signifies that the region will arguably remain the maritime area with the greatest array of security challenges for the foreseeable future.[12] However, while the resources that a very large and diverse group of states has devoted to addressing these challenges have never been adequate to the task, the largely successful coalition-building and joint task-force development projects have been impressive. With the appropriate leadership, this kind of multilateral effort can be built upon in the future

to bring far greater weight to bear on the key aforementioned challenges. Key states and coalitions must continue to lead these projects, especially the US and the EU. At the same time, other key states must come forward to forge regional multilateral solutions to address piracy, hijacking, trafficking, IUU, terrorism, and the integrity of EEZs. The most notable states in this group include Australia, India, Saudi Arabia, UAE, Oman, Pakistan, Iran, and South Africa. While not all these states and powers will be (or can be) grouped to address every challenge, opportunities for security cooperation and confidence-building measures (CBMs) in the IOR exist in abundance.

Many of these CBMs and coalitions will be instigated in diplomatic forums, but, as has been discussed by other commentators, analysts, and policymakers, there also exists the possibility to study and address the security challenges faced by the IOR out to 2030 in maritime centers of excellence (MCEs) based in the region. Key locations for MCEs in the coming years might include Singapore, Dubai, Mumbai, Abu Dhabi, and Kuala Lumpur. Already, several universities and think tanks in some of these locations are undertaking important research in these areas. Policy initiatives advanced by well-funded MCEs might even be the catalyst required to build some cooperative regimes for the IOR along the lines of the Association of Southeast Asian Nations (ASEAN) and Asia-Pacific Economic Cooperation (APEC).

Notes

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10 Associated Press, "Indian shipowners say piracy costs tops $9 billion annually, demand UN maritime force," in *The Washington Post*, October 3, 2011.

11 Frank Gardner, "US uses drones to target al-Qaeda in the Horn of Africa," in *BBC,* September 21, 2011, http://www.bbc.co.uk/news/world-africa-15012962.

12. Lloyd's Market Association (Joint War Committee), "Hull War, Strikes, Terrorism and Related Perils," August 1, 2011, http://www.lmalloyds.com/Web/market_places/marine/JWC/JW_Bulletins/JWLA019.aspx.

    Note: Listed Areas—Indian Ocean/Arabian Sea/Gulf of Aden/Gulf of Oman/Southern Red Sea—These waters are enclosed by the following boundaries: a) On the north-west, by the Red Sea, south of Latitude 15° N; b) on the west of the Gulf of Oman by Longitude 58° E; c) on the east, Longitude 78° E; d) and on the south, Latitude 12° S.

Chapter Three

Naval Power in the Indian Ocean: Evolving Roles, Missions, and Capabilities

Rupert Herbert-Burns

Strategic Environment

During the Cold War, strategic ocean theaters centered largely on the Atlantic and Pacific Oceans—the former in particular—with naval forces from NATO deployed against those of the USSR and the Warsaw Pact. Naval missions included: ensuring sea lines of communication (SLOC); deploying ballistic missile submarines (SSBNs) to key patrol areas; using attack submarines and major surface warships to identify and track opposing units; and deploying exercising amphibious groups. During this time, the Indian Ocean was not considered a major theater for potential superpower confrontation. The primary US objective was to ensure sufficient force deployment to deter any potential Soviet moves against critical oil supplies. Nevertheless, the Indian Ocean remained vital for secure exports of crude oil from the Persian Gulf producers (as it does today), and parts of the ocean's northern reaches were the setting for a major inter-state war between Iran and Iraq during the 1980s.

Though general maritime trade within and via the Indian Ocean was important during the Cold War era, volumes were far smaller compared to the trans-Atlantic and trans-Pacific trades. Today, however, the picture has altered significantly. 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 has totally recalibrated the Indian Ocean's strategic importance to the world. When this economic and trade picture is viewed within the context of the numerous, serious ongoing security challenges in the Indian Ocean Region (IOR), it is no surprise that the major naval powers and regional navies have placed the Indian Ocean as a priority theater in current and future operations, and strategic planning.

Following a concise description of the geographical parameters of the IOR, this chapter examines the primary security threats and capability requirements in the region, considers the contributions, sizes, and missions of some of the numerous extra-regional and regional navies operational in the IOR, and explores the evolving role of Asia's rising major powers as they implement strategic maritime posture in the IOR.

Current Threats and Critical Requirements

At the time of writing, there are a substantial number of extant maritime security and safety concerns, threats, and intrastate conflicts that necessitate the active involvement of naval and/or coastguard forces. Further, several concerns exist for potential future insecurity that variously involve senior naval commanders and their political masters from numerous states. When viewed in totality, the Indian Ocean has a greater number of serious current and potential future security issues than any other ocean in the world.

Iranian Threats to the Persian Gulf Region and Military Operations in 2011–2012

The Iranian armed forces and the Iranian Revolutionary Guard Corps (IRGC) conduct military exercises and drills throughout any given year. Usually there is nothing particularly remarkable about this; the maneuvers are often at expected times of year and are generally publically announced by the government-controlled media. However, the five-day exercise between November 16-20, 2011—'Defenders of the Sky of Velayat III,' the largest exercise ever held at the time[1]—occurred at a time of increasingly elevated tensions between Iran and Western powers, following the release of a damning International Atomic Energy Agency report that stated Iran had carried out tests 'relevant to the development of a nuclear device'.[2]

This major exercise, which also saw the testing of a new air defense missile system, was followed by other major maneuvers by Iranian air, army, naval, and IRGCN forces in the Persian Gulf and the Straits of Hormuz in December 2011. The 10-day Velayat-90 exercises began on December 24, and occurred following further increases in tensions over announcements of US-led plans to seek far more exacting sanctions that would curb the Iranian's ability to sell its crude oil on the global market. Velayat-90 involved the full spectrum of Iranian naval capabilities, including corvettes, fast attack gunboats, shore-launched anti-shipping missiles, ship-based helicopters, minelayers, and special forces.

On December 28, 2011, Iran's Vice-President, Mohammad Reza Rahimi, threatened to effectively close the Straits of Hormuz if Western powers imposed further sanctions against Iran—specifically those targeting its oil exports.[3] (Ironically, Iran needs the Straits of Hormuz open more than other Gulf exporters, as it has no alternate route for its crude exports and needs to import high volumes of refined products such as gasoline, diesel, and Jet-A due to its declining domestic refining capacity). In one of the Iranian leadership's more aggressive statements, Tehran threatened on January 3, 2012, to take unspecified action if the US Navy sent the strike carrier *USS John C. Stennis*—or any other carrier—back into the Persian Gulf. The *USS Stennis* had previously transited through the Straits of Hormuz on December 27, 2011, to take up position in the Arabian Sea to provide air support for the war in Afghanistan.[4]

This remarkable series of events reveals important factors concerning Iran's domestic political and economic state. Fundamentally, international sanctions are working, which is exacerbating the country's fragile capacity to maintain sufficient rates of crude production and generate export earnings. This is forcing the leadership to conduct provocative military exercises in an attempt to regain some control by trying to keep the international

community off-balance and divide the P5 in the UN Security Council. Nevertheless, Iran's recent behavior must also be viewed with serious consideration for its potential to spark further instability and insecurity in the region, disrupt key maritime trade, and induce oil price and insurance premium spikes in the market.

It is true that Iran could not blockade the Straits of Hormuz for long, yet it could sufficiently threaten commercial shipping and warships with shore-launched anti-shipping missiles (the Qader, Nour, and C-802), sea mines, high-speed gun boats, and Kilo class submarines to deter vessels from transiting the Straits of Hormuz for a short period. Though a substantive US-led international naval and air campaign would eventually force an Iranian capitulation and reopen the Straits of Hormuz, even a short war would have an inimical impact on oil prices and trade, force Iran further into a dangerous isolation, provoke Iranian interference in Iraq, and deepen wider insecurity in the Gulf region.

Two days after Velaya-90 ended in early January 2012, the IRGCN commander, Admiral Ali Fadavi, announced that Iran would hold the largest naval exercises ever staged by the country—called 'The Great Prophet'—in February 2012.[5] That did not auger well for diplomatic attempts to diffuse tensions in a key part of Asia that has altogether too many extant flashpoints and on-going conflicts.

Naval Force Presence, Scale, and Operations in the Indian Ocean Region

This section examines the range of extra-regional and regional naval forces in the IOR, and provides details of numbers of vessels and operations. Where applicable, details will be given concerning the various multilateral task groups in operation, their composition, and primary mission. The overview of the various naval forces in the IOR will be divided into three categories: extra-regional; regional (large); and regional (small).

Extra-Regional Naval Forces

The deployment of naval forces and expeditionary maritime forces (including strike and amphibious groups) by countries from outside of the IOR has a long history. For the most part, the country with the biggest and most permanent presence has been the US. (In 1995, the US Fifth Fleet was reactivated as a dedicated naval formation responsible for the Persian Gulf, the Arabian Sea, and the Red Sea. The US Fifth Fleet is based in Bahrain, which is also used by the British Royal Navy.) To a lesser extent, the larger European navies—principally the British Royal Navy and the French Navy—have maintained a relatively robust presence in the IOR as well. The largest deployments of European navies occurred during the Iran-Iraq War (with peak deployment in 1987), the First and Second Gulf Wars, and during the US-led War on Terrorism. In May 2009, France formally announced the opening of a naval basing facility at Port Zayed in Abu Dhabi in the United Arab Emirates.

The very substantial US naval presence in the region has been necessitated for several key reasons, 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 deterring Iranian aggression; and undertaking maritime

security operations (MSO), which include counter-terrorist, counter-trafficking, and counter-piracy missions. Force levels and composition fluctuate in accordance with mission requirements and demands in other theaters. However, in general, all of the various primary components that comprise the US Fifth Fleet—such as the Battle Force, the Amphibious Force, and Maritime Patrol Forces and Logistics—provide a sustained weight of US naval capability that dominates the region. Indeed, it could be argued that over the years the US Fifth Fleet has been the vital underpinning of all allied MSO since the mid-1990s.

This means that as MSO became a principal US mission in the wake of 9/11 and Operation Iraqi Freedom, other maritime security concerns in the IOR could be more potently addressed using the coalition-building-and-deployment formula. In this way, those MSO missions to address anti-trafficking, anti-terrorism, and anti-piracy were implemented and became highly effective, particularly Combined Task Forces 150, 158 (now CTF-IF), 151, and 152. These forces have become truly international in composition and spirit, and are emblematic of the international approach of using naval forces to tackle the various maritime security challenges in vital parts of the Indian Ocean.

Aside from those countries mentioned above, the following states have had (or still have) warships and other maritime assets in the IOR: Canada, China, EU/Europe (Denmark, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Spain, and Sweden), Japan, New Zealand, Russia, South Korea, and Turkey.

Additionally, the European Union initiated its own dedicated counter-piracy force—the EU's Naval Force Somalia (EU NAVFOR), Operation Atalanta—in December 2008. Its mandate is to contribute to:

- The protection of World Food Programme (WFP) vessels delivering food aid to Somalia.
- The protection of vulnerable vessels off the Somali coast, and the deterrence, prevention, and repression of acts of piracy and armed robbery off the Somali coast.
- The monitoring of fishing activities off the coast of Somalia.[6]

Since its inaugural operation in 2008, EU navies contributing warships to Operation Atalanta have 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 was growing concern in the closing months of 2011 that large-scale multilateral naval operations may not be sustainable into 2012 and beyond.

Regional Naval Forces (Large)

Ten states within the IOR have what can be viewed as large standing naval forces. These navies tend to have submarines, various numbers of major surface combatants (frigates and destroyers), and high numbers of coastal patrol vessels (see Figure 3.1). These states include Australia, Egypt, India, Indonesia, Iran, Israel, Malaysia, Pakistan, Singapore, and Thailand. All of these countries have discernable strategic interests in the IOR—some common and others more specific to their geographical location. Some key countries are worthy of specific examination.

Australia. The Royal Australian Navy (RAN) has been a routine and active supporter of the Combined Task Force-Iraqi Maritime (CTF-IM) since its inception, and also a supporter of CTF-150. The RAN's force structure enables it to deploy frigates with replenishment support throughout the IOR. The RAN is currently undergoing a period of modernization, centered on the *Hobart class* air warfare destroyer, new amphibious ships, and major upgrades to its *Collins class* submarines. The technologies and weapons going into these projects will be some of the finest in the world. The RAN has also made considerable upgrades to its patrol vessel fleet with the addition of the *Armidale class*—a vessel that is arguably an ideal ship for inclusion into some of the smaller regional naval forces.

Egypt. Egypt has one of the larger navies in the IOR with four submarines, nine major surface combatants, and more than 50 patrol craft. However, despite its size, the force rarely deploys far from its EEZs in the Mediterranean and Red Sea, partially due to its limited replenishment fleet. Interestingly, Egypt views all of the Red Sea as part of its sphere of interest, including the Red Sea's southern reaches, and Egypt remains very uncomfortable with foreign navies operating there. In theory at least, a greater Egyptian naval presence in the southern Red Sea could be beneficial to deterring piracy in these waters, which the country is certainly concerned about. Since the piracy threat deepened in 2008, there has been a noticeable drop in the numbers of very large crude carriers (VLCCs) using the Suez Canal, as such vessels have favored going around the Cape of Good Hope instead.

India. The Indian navy is by far the largest of the regional forces in the IOR. Aspects of this force, which is fundamental to long-term maritime security in the IOR, will be examined in greater detail in a subsequent section.

Iran. The Islamic Republic of Iran Navy has generally been configured mostly for coastal defense and littoral operations in the Persian Gulf and Gulf of Oman. In comparison to other larger navies in the IOR, it does not have a substantial traditional surface warfare capability, possessing only a handful of very dated deployable frigates. Nevertheless, five crucial facets to the Iranian navy remain key to its effectiveness as a disruptive, if not dominating, force in the region. Firstly, the navy has a long experience of using its small craft forces very effectively in an asymmetric capacity, as demonstrated initially during the 1984-1988 Tanker War (Iran-Iraq War). Secondly, Iran has good naval bases both inside and outside the Persian Gulf (Bandar Abbas and Char Bahar, respectively). Furthermore, it has military facilities on key, strategically-located islands in the Gulf (such as Jask, Abu Musa, Khark, Larak, and Sirri) which are ideal for defilade anti-shipping missile firing points that can potentially threaten the main shipping lanes in the Persian Gulf and Straits of Hormuz in times of crisis. Thirdly, the navy has three *Kilo class* submarines, which are widely regarded as amongst the most effective conventional submarines in service. Fourthly, the deployment of six warships to the Gulf of Aden in May 2009 and the deployment of a frigate and a replenishment vessel to the Mediterranean Sea in February 2011 via the Suez Canal signalled a clear intent by Iran's leadership to demonstrate an out-of-area naval capability.[7] Iranian surface ships also entered the Red Sea in July 2011, ostensibly on anti-piracy operations.[8] Lastly, despite its modest size in comparison to the other branches of the Iranian military, the navy is undergoing a modernization program, highlighted by the building of a new class of guided missile frigate and domestically-built fast missile boats.

Singapore. The Republic of Singapore Navy (RSN) is considered one of the best and most modern in the IOR, and its importance to the security of the vital waters of the Singapore Straits and the Malacca Straits cannot be overstated. The force is centered on six re-conditioned *Challenger class* submarines and six modern multi-role *Formidable class* guided missile frigates, commissioned between 2007 and 2009. Routine patrolling and MSO in the Straits and the piracy-prone waters around Singapore are conducted by the service's 17 corvettes and patrols boats. Maritime security is pivotal to Singapore's national and economic security, and for this reason the navy is given substantial resources. In light of the potential maritime terrorist threat to the Singapore Straits, the RSN also has very capable maritime CT capabilities. This modern maritime force operates regularly with navies from the Five Power Defense Agreement (FPDA)—Australia, Malaysia, New Zealand, Singapore, and the UK—and has also operated as part of Operation Enduring Freedom and CTF-151.

Regional Naval Forces (Small)

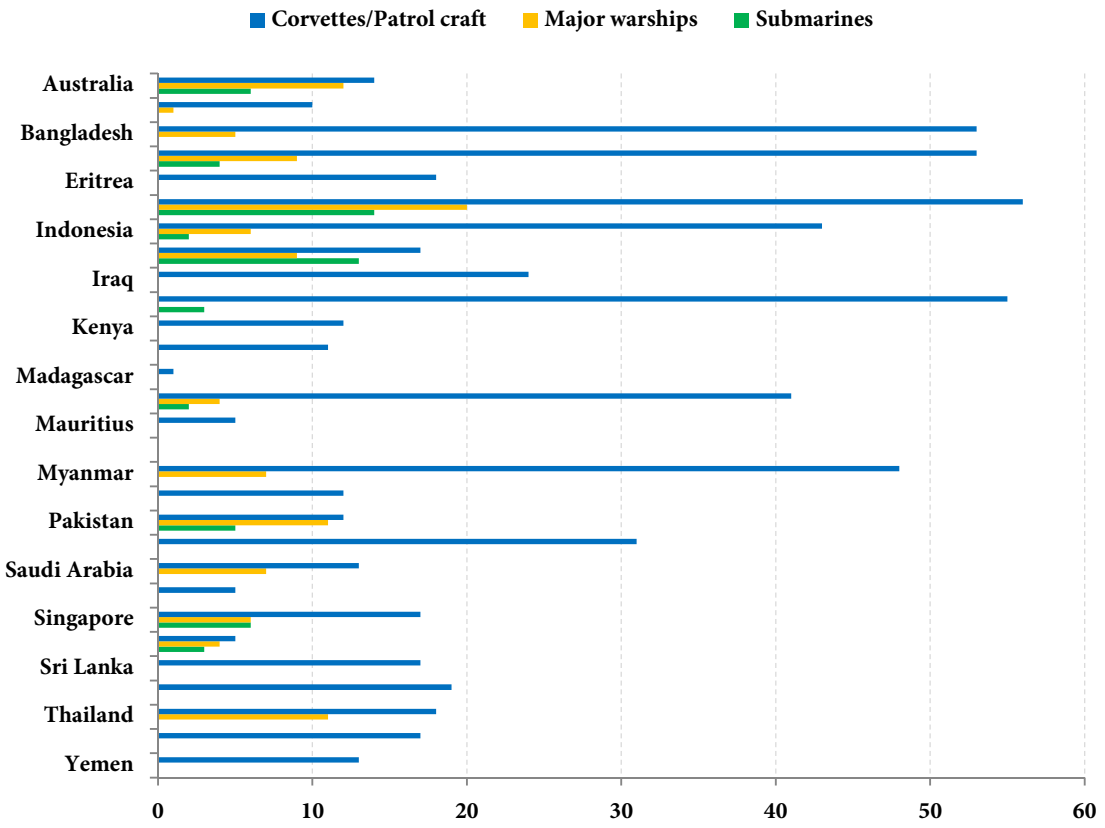
Maritime security in the IOR in the short-to-medium term is going to be founded upon the robust and sustained naval presence of the larger extra-regional navies and the large regional powers. However, in looking to the longer-term future maritime security of this vital maritime space, the increased naval and/or coastguard capabilities of the smaller regional forces will be crucial.

Currently, some of those countries that do have reasonable-sized forces are arguably not deploying at their full potential to assist with MSO near their territories. This group includes the Gulf Cooperation Council (GCC) states, which are highly reliant upon the maritime security of the IOR for the security of their exports and imports. In light of the substantial current and future MSO challenges in the Arabian Sea, some GCC states should consider altering their naval procurement planning to include more corvette-sized and larger blue-water patrol vessels. These more capable craft are far more effective in counter-piracy and counter-trafficking operations throughout the Gulf of Oman and northern sectors of the Arabian Sea due to their increased endurance and operational flexibility. In addition to the gradual expansion of their longer-range blue water capabilities with the addition of larger warships, Qatar, Saudi Arabia, and the UAE could further boost the MSO contribution of the GCC by evolving a joint at-sea replenishment capability to enable more continuous MSO for their own navies and provide support to extra-regional forces.

As Figure 3.1 demonstrates, other smaller forces could be considered for additional international assistance to boost capacity to more effectively patrol their coastlines and offshore spaces. In looking at the now-considerable reach of Somali PAGs (particularly those using captured merchant vessels as motherships), a number of key countries could be assisted in this regard to provide more endemic maritime patrolling and greater counter-piracy capabilities in Indian Ocean high risk areas (HRA). Built around leadership already being shown by Kenya and Tanzania, six countries could provide far greater contributions to MSO if they received sufficient financial and training support: the Comoros, Madagascar, the Maldives, Mauritius, Mozambique, and Seychelles.

These countries have very little or no naval and/or coastguard forces, as Figure 3.1 shows. Several of these states have received support from extra regional powers such as the US,

Figure 3.1: Naval Capability in the Indian Ocean Region



Source: Rupert Herbert-Burns

the UK, France, and, increasingly, India. However, with more support going forward, the combined activity of these IOR countries could help significantly in the fight to counter piracy and armed robbery, illicit fishing, and trafficking by sea in the HRA. Resources and exact requirements will of course vary, but essentially small navies and coastguards engaged in policing littoral areas, EEZs, and territorial waters require medium-sized patrol vessels. These craft can be armed and equipped in the following way:

› A light gun (20-30 mm) and heavy machine guns (.50 cal/12.7 mm), GPMGs, and/or Miniguns (7.62 mm)

› High-specification surface search radar and a stabilized, electro-optical surveillance system

› A high-speed RIB (RHIB) for vessel boarding, search and seizure operations (VBSS)

The vessel should have a high engagement speed (25+ knots) and sufficient range of over 2,000 nautical miles. There are several modern designs that fit this description, including the Australian *Armidale class*, the BAE Systems Offshore Patrol Vessel, and the Damen Stan Patrol 4207 design.

China, India, and the Indian Ocean Region

This section addresses the rise and development of Indian and Chinese naval power and deployment in the Indian Ocean, arguably one of the most important aspects of 21st-century maritime security. Indeed, the individual ambitions and counter-moves by the two dominant Asian powers are arguably more reflective of 19th-century Mahanian naval geopolitics than 21st-century maritime security concerns. In government and senior military circles in both countries, the philosophy of the founding father of naval geopolitics and power projection is readily embraced.

For China, the primary concern is securing the extensive sea lines of communication (SLOCs) that traverse the Indian Ocean and western Pacific, linking Persian Gulf crude exporters to China's main oil terminals and coastal refineries. In fundamental terms, Beijing is not willing to take the risk of leaving the security of critical eastward petroleum streams and westbound containerized exports to others in the IOR and South China Sea. For India—also increasingly reliant on imported oil and natural gas to fuel its economic expansion—the Indian Ocean is considered New Delhi's backyard, and thus is for the Indian navy to dominate and police.[9]

India's Naval Expansion and Objectives

As stated earlier, India has by far the largest navy of all the countries in the IOR. Indeed, India now has one of the largest navies in the world with organic air power, an expanding fleet of modern major surface combatants, and conventional and nuclear-powered submarines, including an indigenously designed and built ballistic missile submarine, the *INS Arihant.*

As India's navy has evolved, it has demonstrated its ambition to project influence and power across the IOR and beyond. In 2004, it participated significantly in relief operations in the wake of the tsunami disaster, deploying more than 27 ships. In 2006, naval vessels evacuated more than 2000 Indian, Sri Lankan, and Nepali expatriate nationals from Lebanon during its war with Israel. Further, Indian naval ships have assisted in the aftermaths of most major cyclones in the IOR. The navy has also been involved in counter-piracy operations since 2008, with substantial deployments to the IRTC in the Gulf of Aden and the Somali Basin. As an extension of its counter-piracy mission, in 2011, the navy initiated *Operation Island Watch* to deter and disrupt Somali PAGs hunting off the Lakshadweep archipelago.

Notwithstanding the Indian navy's internationally recognized humanitarian operations and MSO activity in the IOR, it is Delhi's wider strategic objectives that are driving its naval expansion, both in terms of fleet development and modernization, and also in terms of extending maritime diplomacy and basing/logistic agreements with strategically-located countries and island states in and around the IOR. Donald Berlin, professor at the Asia-Pacific Center for Security Studies in Honolulu, and an expert in maritime strategic issues, captured the essence of India's posture with regards to the IOR:

> "New Delhi regards the Indian Ocean as its back yard and deems…that India functions as, eventually, the predominant influence in this region…In the expansive view of many Indians, India's security perimeter should extend from the Strait of Malacca to the Strait of Hormuz and from the coast of Africa to the western shores of Australia."[10]

Figure 3.2: Indian Naval Capability

Platform	No.	Class/type
Aircraft carriers	1	Viraat class (Sea Harrier)
Submarines	14	Shishumar & Sindhughosh class
Destroyers	8	Delhi and Rajput class
Frigates	13	Shivalik, Talwar, Brahmaputra, Godavari, and Giri class
Corvettes	8	Khukri and Giri class
Offshore/ASW patrol vessels	10	Kora and Sukanya class
Minesweepers	9	Pondicherry/Karwar class
Missile boats	12	Veer class
Amphibious ships	11	Magar, Kumbhir class, and LCUs
Auxiliary tankers	3	Jyoti, Aditya, and Deepak
Future ships, submarines, and aviation		Vikrant class and Vikramaditya class aircraft carriers; Kolkata class destroyers; Talwar class frigates; Scorpiene class conventional submarines and Akula II nuclear attack submarines; and MiG-29 K/KUB fighters for aircraft carriers

Source: Rupert Herbert-Burns

Almost 89 percent of India's oil requirements are imported by sea.[11] As Indian dependence on imported crude oil and raw materials grows, and as the demand for consumer goods increases, India's strategic maritime objectives are being founded on ensuring the security of SLOCs from the Persian Gulf, Europe, and East Asia. The security of these vital shipping lanes is also vital for the country's exports—most notably the increasing quantities of refined distillates, fuels, and petro-chemicals being exported throughout the IOR and beyond from facilities such as Jamnagar.

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 regional powers, has driven the country to reach out deep into the ocean, far beyond its own littoral to enable more expansive maritime domain awareness (MDA), develop basing opportunities, and fortify naval operational and diplomatic ties. Currently, India has close naval ties with Mozambique, Mauritius, and the Seychelles, having donated patrol vessels to both of the latter countries. As part of its MDA expansion program, the Indian navy has also established a radio and radar monitoring station on Madagascar, and has long maintained monitoring capabilities in the Nicobar Islands that sit astride shipping routes leading to and from Malacca. The extension of the Indian navy's ability to monitor the IOR has been driven in no small part by China's steadily expanding commercial and maritime ties with Bangladesh, Iran, Kenya, Myanmar, Pakistan, Seychelles, and Sri Lanka.

Any country hoping to have a macro effect in terms of patrolling, MDA, MSO, and power projection in the IOR needs substantial assets to do so. Currently, the only navy capable of meeting these requirements is the US Navy. Nevertheless, India's naval expansion program, both quantitatively and qualitatively, is being undertaken with this purpose in mind. Key warships and systems in this regard include:

- The acquisition of the former Russian aircraft carrier, *Admiral Gorshkov*, scheduled for delivery in 2012
- Construction of the 40,000-ton *Vikrant class* aircraft carrier
- Development of the 65,000-ton Indigenous Aircraft Carrier (to enable formation of up to 3 CVBGs)
- E-2D advanced Hawkeye AEW&C aircraft
- The commissioning of *Kolkata class* guided missile destroyers
- Additional Talwar frigates
- Akula-II SSNs
- MiG-29K/KUBs
- Additional fleet tankers for at-sea replenishment

The Chinese People's Liberation Army Navy (PLAN) and the Indian Ocean Region

Beijing is in the midst of a well-advanced and ambitious project to expand its naval power projection capabilities well beyond its littoral, and indeed well beyond the South China Sea—large parts of which China is already claiming sovereign rights over. Aside from the alarm among India and other Asian states regarding China's expanding maritime footprint, the evolution of China's maritime power (or what Beijing has dubbed "Far Sea Defense") is also of increasing concern to the US.[12]

The introduction of the PLAN's "far sea defense" (or *yuanyang fangyu*) strategy (FSDS) is the primary driver behind an ongoing effort to transform the composition of Chinese naval forces. A retired PLAN rear admiral, Yin Zhuo—now a senior researcher at the navy's Equipment Research Center—has stated that the navy is tasked with two principal missions: preserving China's maritime security (including its territorial seas and EEZ); and protecting China's expanding and distant maritime economic interests, especially those in the IOR and West Africa.

Clearly reflecting the FSDS, Rear-Admiral Zhang Huachen, the deputy commander of the East Sea Fleet, recently stated that "with the expansion of the country's economic interests, the navy wants to protect the country's transportation routes and the safety of our major sea lanes."[13] In terms of the practical requirements for implementing FSDS, he added that "in order to achieve this, the Chinese Navy needs to develop along the lines of bigger vessels [and] with more comprehensive capabilities."[14] This requirement is being realized thanks

Figure 3.3: Chinese Naval Capability

Platform	No.	Class/type
Aircraft carriers	1 (sea trials)	Converted/refitted former 67,500-ton ex-*Varyag* (*Admiral Kuznetsov class*)
Nuclear submarines (SSN)	5 (+2 bldg)	*Han* and *Shang class*
Conventional submarines (SSK)	47	*Romeo, Ming, Song, and Yuan class*
Destroyers	26	*Luyang, Luyang II, Luzhou, Luda, Luhu, Luhai, and Sovremenny class*
Frigates	51	*Jiangkai I & II class, Jiangwei I & II class, Jianghu I, II, III, IV & V class*
Amphibious ships	84	
Auxilliary tankers	153	
Future ships, submarines, and aviation		Type 095 & 097 SSN, Type 052C Luyang II guided missiles destroyer (VLS); Type 045A guided missile frigate; 50,000–60,000-ton *Shi Lang class* aircraft carriers (based on Varyag design, and projected to be completed in 2015); and Sukhoi 33 & Shenyang J-15 fighters

Source: Rupert Herbert-Burns

to considerable increases in government defense spending. Officially, China's budget for military spending in 2010 was $78 billion; however, the Pentagon estimated the true amount to be between $105 and $150 billion. Given the sheer scale of China's equipment-procurement and shipbuilding programs alone, the US figures are likely far more realistic. Figure 3.3 summarizes the current state of the PLAN.

The most obvious and significant manifestation of FSDS is the development of the converted former 67,500-ton ex-*Varyag* aircraft carrier (an *Admiral Kuznetsov class*) at the Dalian shipyard in northeast Liaoning Province. In August 2011, the Chinese state-run news agency Xinhua announced that the carrier had begun sea trials. It is not known when the vessel will be ready to join the fleet in a fully operational role; however, the PLAN is unlikely to waste time now that the ship is virtually completed. Full operational capacity will only be attained once a complete air group has been acquired and all of the necessary pilots trained. It is expected that the ship will initially embark Sukhoi 33 fighters (a naval variant of the Russian-designed 'Flanker'). Once the carrier is fully operational and combat-ready, it will mark the inception of China's capacity to deploy expeditionary organic airpower worldwide. Some analysts are predicting that this vessel could be followed by as many as four other carriers, two of which might be nuclear-powered. This would potentially enable the PLAN to deploy multiple CVBGs to more than one theatre simultaneously, providing China with precisely the kind of power projection that can and will be sent to the Indian Ocean to protect Chinese interests.

PLAN Operations and Activity in the Indian Ocean Region

As a practical indication of Beijing's willingness to steadily extend the operational scope and geographical coverage of China's naval capabilities in the IOR, the PLAN has been engaged in several operations, exercises, and deployments in recent years:

› In 2003, the PLAN conducted its first joint naval exercises with Pakistan and India (conducted separately) in the Arabian Sea.

› Bilateral naval exercises have also been undertaken with French, British, Australian, Canadian, Philippine, and US navies in the IOR.

› In December 2008, the PLAN deployed a task group consisting of the guided missile destroyers *Haikou* and *Wuhan*, and the replenishment ship *Weishanhu*, to the Gulf of Aden to participate in anti-piracy operations. This was the first time Chinese warships have deployed outside the Asia-Pacific region for a military operation since the 15th century.

› The PLAN has maintained a continuous, rotating three-ship flotilla of two warships and one supply ship in the Gulf of Aden since the beginning of 2009, and has actively sought leadership of the 'Shared Awareness and De-Confliction' body (SHADE). However, the latter would require an increase in the number of Chinese warships routinely contributing to the international counter-piracy effort.

› In August 2011, a suspected Chinese spy trawler was sighted in international waters off the Nicobar Islands. The vessel was suspected of monitoring Indian naval and military installations and operations in this vital part of the Bay of Bengal.[15]

The Indian Ocean Region and Current US Security Concerns

Especially in light of the respective geopolitical rises of China and India, the IOR remains of considerable strategic importance to the US. Indeed, given the fact that the US forces operating under the umbrella of CENTCOM are engaged in several IOR theaters of varying intensities and priorities, it could be argued that the continuous and robust US military presence in the region is more vital than it has ever been. As a reflection of the reality of the situation the US now finds itself in regarding Indian Ocean, author Robert Kaplan (in *Monsoon: The Indian Ocean and the Future of American Power*) describes the US position in the region as one "where the rivalry between the United States and China interlocks with the regional rivalry between China and India, and also with America's fight against Islamic terrorism in the Middle East, which includes America's attempt to contain Iran."[16] As US policymakers and senior military officials continuously ponder decisions concerning the scale and composition of force structures required in the IOR to support operations in and around Afghanistan, Iraq, and Somalia, several complicating strategic and operational-level factors are evolving:

› The naval expansion and deployment programs of India and China

› The persistent challenge presented by Iranian intransigence, its facilitation of drugs and arms trafficking, and its increasing naval activity

- Concerns over long-term base security in Bahrain as a result of political turbulence
- The potential for the deepening intersection between Al Shabaab in Somalia and AQ-AP in Yemen
- The possibility for a full-scale civil war or insurgency in Yemen
- The decline of naval forces being deployed by both extra-regional and regional navies as a result of government spending cuts
- The continued weakness of regional maritime forces, and the current lack of a multilateral instrument, regime, or treaty to evolve a collective maritime security capacity to address extant threats, in particular piracy and vessel hijacking

Notwithstanding the United States' own mounting budgetary pressures in coming years, this collection of security concerns in this critical region of the world evidences the continued need for a very strong, if not strengthened, US naval presence in the IOR well into the future.

Maritime Strategic Picture and Naval Presence and Operations Out to 2030

Looking out over the next two decades through to 2030, it is clear that the IOR will become an increasingly important and complex maritime space from a geostrategic perspective in several key respects, characterized both by continued naval involvement from long-established actors and the steadily increasing naval task-group and expeditionary-force presence from rising Asian powers.

Aside from the continued strategic relevance of well-known and long-acknowledged chokepoints, vital terminals and ports, and primary sea lines of communication (SLOCs), certain maritime areas and littorals will emerge and develop into important strategic foci in the coming years. I have termed these areas "evolving strategic maritime regions" (ESMRs), which include:

- **The east African coast.** Comprising the Mozambique Channel, Tanzania, Kenya, Somalia, and the Seychelles, this ESMR will develop commensurately with the expansion of offshore oil and gas exploration and development along much of the coast line (including the Seychelles and, eventually, Somalia). The development of the major petroleum terminal and hub port at Lamu in Kenya, and a planned LNG liquefaction and export facility in Mozambique, will further raise the geostrategic profile of this region.
- **The mid-section of the Red Sea.** Situated between 24°N and 20°N, this area will grow in strategic importance as the refining capacity at Yanbu on Saudi Arabia's Red Sea coast is greatly increased, and as Saudi Aramco increases the transmission capacity of the East-West Crude Oil Pipeline (Petroline) from Abqaiq to Yanbu to offset risks associated with security vulnerabilities in the Strait of Hormuz.
- **The northern Gulf of Oman and the Omani littoral between Fujairah and Mina al Fahal.** This area will increase in strategic relevance once the UAE's Habshan-Fujairah oil

export pipeline comes on stream in mid-2012. This may result in other Gulf Cooperation Council (GCC) exporters wanting to export through an eventually expanded-capacity line to reduce their dependence on the Strait of Hormuz in the coming years.

› **The Bay of Bengal.** This region's rising importance is linked to the evolution of India's offshore petroleum activity; the expansion of Myanmar's Shwe gas production; Chinese investment in pipelines and deep-water port facilities in Myanmar; and the possibility of the eventual construction of the Kra Isthmus Canal in southern Thailand.

› **The Timor Sea.** The Timor Sea's status as an ESMR stems from the steady development of its substantial gas production capacity (much of which will be exported to China as LNG); its role as a vital Australasia SLOC inter-connector; the growth of US military capacity based in Darwin, Australia; and Indonesian efforts to settle outstanding territorial disputes.

As China's energy-importing requirements and widespread commercial investments in the IOR expand, so too will its deployment of naval and expeditionary forces to monitor and protect those interests. This will be made possible by the substantial increases in its blue-water naval power-projection capabilities over the next 10-15 years, which will likely center on organic airpower and long-range logistical support capabilities. In response, the US must continually adapt its strategic posture and military deployment priorities as the IOR's strategic ontology evolves.

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Chapter Four

New Capacities and Recurring Risks: Developments in the International Shipping Industry

Rupert Herbert-Burns

The purpose of this chapter is to provide a concise picture of the effects of the 2008-09 economic crisis upon the international shipping industry, examine some key industry trends and technological developments, and consider some of the implications of a potential second global economic downturn. When examining the non-marine international media, much of the focus on the shipping industry is dominated by security concerns, specifically with regards to piracy and armed robbery at sea. However, it is important to consider that industry leaders and governments are also concerned with ongoing operational and structural fragility in the industry as a result of the 2008-09 crisis.

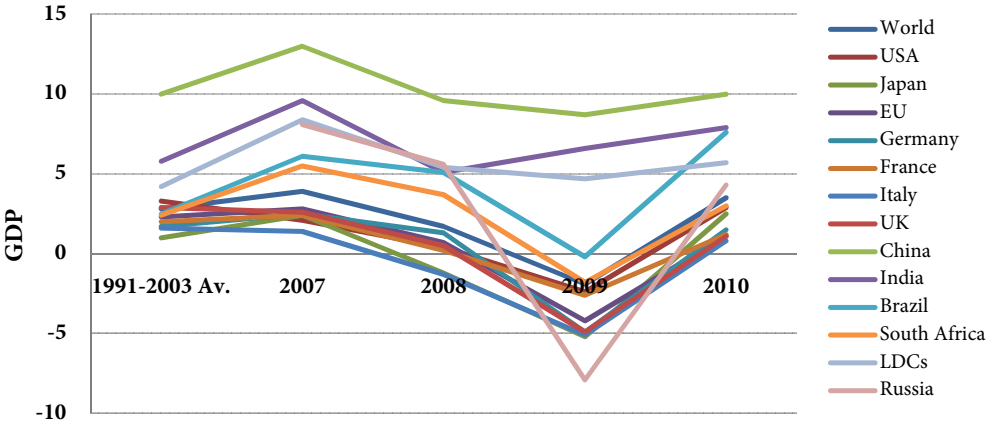
On the positive side, if economic demand can recover in the advanced consumer countries, then shipping fleets and shipping activity can expand more sustainably. Further, technological changes in the industry are being harnessed to construct vessels that can carry goods more economically and produce far less emissions while in transit. In the coming years, production growth in the major manufacturing and industrializing countries in Asia will require expanded supplies of petroleum and other raw materials. In this area, technological revolutions in vessel- and offshore-infrastructure design are providing solutions such as floating liquid natural gas (FLNG) units that can produce and liquefy millions of tons per year of once-stranded natural gas supplies in the Indian Ocean Region (IOR) and elsewhere.

Global Shipping Developments

Overview and Linkages to Global Economic Activity

In contemplating the state of the world's shipping industry toward the end of 2011, an observer is confronted with some seemingly unexpected realities and juxtapositions. In the earlier part of 2011, it seemed that while many of the advanced industrial economies of the Organization for Economic Cooperation and Development (OECD) were experiencing admittedly weak GDP growth, they enjoyed *sustainable* growth nonetheless. Even this modest situation was remarkable, given the state of global markets following the credit crisis and the deepest economic downturn in recent history. Figure 4.1 illustrates the movement of global economic activity since 2007, providing vital context for the current state of worldwide maritime trade.

Figure 4.1: World Economic Growth, 2007–2010



Source: United Nations Conference on Trade and Development (UNCTAD); UNCTADstat

The economic growth rates of India, Brazil, China, and the least developed countries (LDCs) stand out immediately. Indeed, although India's and China's growth fell in 2008, the decline was not nearly as marked as that of the EU, US, and Russia. To a fair degree, the sustained positive economic performance of China, India, Brazil, and the LDCs prevented a far worse seaborne trade situation from 2008 through the beginning of 2010.

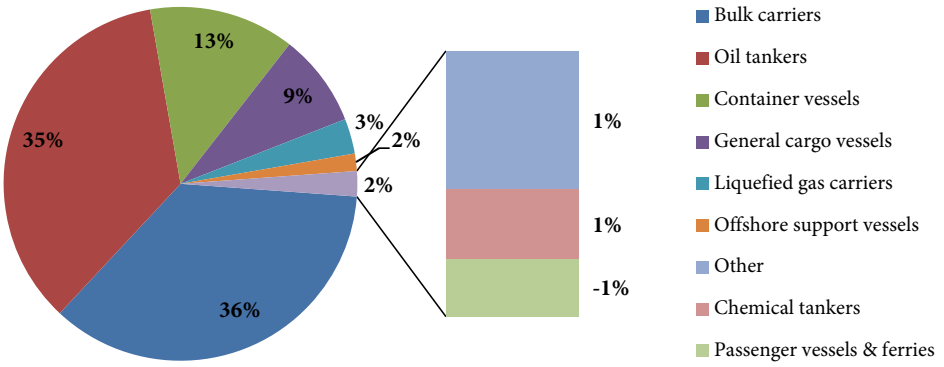
World seaborne trade volumes fell by approximately 4.5 percent in 2009, which some commentators have said marked the end of the 'grand super cycle' of economic growth. In 2009, global goods loaded onto ships of all kinds fell in aggregate to 7.8-billion tons, down from 8.2-billion tons in 2008.[1] However, developing states—dominated by those countries in the Indo-Pacific realm—account for the largest proportion of seaborne trade. Since the early 1970s, developing countries have traditionally exported more cargo than they have imported. Nevertheless, the volume of their imports of manufactured and finished goods has been increasing as a proportion, and it is this trade between LDC exporters and developing economies that has supported seaborne trade during the worst phase of the downturn and helped fuel its recovery. But the scale of the contraction in the EU and US in 2009 had a substantial effect on the shipping industry and maritime trade, which has meant that recovery in 2010 has been correspondingly gradual and fragile. In the coming years, another contraction of the global economy could threaten seaborne trade anew.

Structure of the World Fleet

In January 2010, there were some 102,194 merchant vessels listed as operational in the global fleet, amounting to an aggregate tonnage of 1.276 million DWT (deadweight tonnage). Of this, 35.8 percent were bulk carriers, 35.3 percent were oil tankers, 13.3 percent container vessels, and 8.5 percent were represented by general cargo ships (see Figure 4.2).[2]

Figure 4.2 provides a clear depiction of the form and function of the world's maritime trading business, which is dominated by the two main bulk trades, bulk and liquid, and containerized conveyance. Seemingly at odds with the economic downturn, the world's fleet

Figure 4.2: Global Merchant Fleet by DWT



Source: United Nations Conference on Trade and Development (UNCTAD); UNCTADstat

actually grew by some 84 million DWT (or 7 percent) by the beginning of 2010. This was a result of a record number of deliveries of new ships that had been ordered and contracted for prior to the economic crisis. (New vessel deliveries for the three main trades in the global fleet grew by 42 percent in 2009 over figures recorded for 2008.)

This massive oversupply in world tonnage initially resulted in huge numbers of ships being laid-up in the world's largest anchorages, such as Singapore, Shanghai, Hong Kong, and Fujairah. In time, however, reductions were made as owners sent older vessels (deemed to be no longer economically viable) to be dismantled in the world's main breaking yards in India, Pakistan, Bangladesh, and Turkey. As a result of the downturn and the decline in seaborne trade, the amount of new vessel orders fell sharply in 2008. While orders for bulk carriers and tankers have yet to rebound in any significant way, throughout 2010 and 2011 the number of new container vessels on order nevertheless climbed markedly. This was a result of replacement orders for discarded vessels and long-term optimism regarding China's continued export growth.

Fleet Ownership and Registration

Charting the ownership and registration of vessels in the world's fleet has for many years yielded familiar results, and those findings have become largely institutionalized in the industry. However, some important (if not altogether unexpected) changes are underway. By January 2010, Greek companies and individuals owned almost 16 percent of the world's tonnage, followed by owners from Japan (15.73 percent) and Chinese owners (8.96 percent). Indeed, China has overtaken Germany as the third-largest ship-owning country in the world.[3] This milestone is the result of China's strategic campaign to own and flag more of the shipping that has become an increasingly critical component of the country's current and future economic prosperity and security.

In terms of numbers of hulls, Japan continues to be the leading country, with 3,751 ships of 1,000 GT (gross tonnage) or above, followed by China with 3,633 ships.[4] When aggregated,

the top 35 ship-owning countries (in terms of DWT) control more than 95 percent of the world's tonnage. Of this, 30 percent is controlled by companies from developing countries, and the remaining 70 percent is owned by companies based in developed countries. Of the top 35 countries, 15 are located in the Indo-Pacific maritime realm—China, Hong Kong, Taiwan, India, Indonesia, Iran, Japan, Kuwait, Malaysia, Saudi Arabia, Singapore, South Korea, Thailand, the UAE, and Vietnam.[5] Between them, these states own 44.7 percent of total world merchant tonnage.

At the beginning of 2010, the 35 largest flags of registration accounted for 93.23 percent of the world fleet. The largest flag by DWT remains Panama with 22.6 percent, followed by Liberia (11.1 percent), the Marshall Islands (6.1 percent), China (Hong Kong) (5.8 percent), and Greece (5.3 percent). These top five registries accounted for more than 50 percent of the world's DWT. More than 68 percent of the world's tonnage is foreign-flagged.[6] One of the key motivations for shipowners to use a foreign flag is that it enables them to employ foreign seafarers, the majority of which are from LDCs where wage levels are correspondingly low. Other benefits of 'flagging out' tend to include less stringent inspection, and safety and operating regimes that can greatly reduce operating costs. Furthermore, many open registries continue to offer substantial advantages in terms of reduced or negligible tax burdens. Some registries can also ensure owner anonymity, which continues to be a concern in some cases for law enforcement and intelligence agencies seeking to uncover shipping operations that may have (or had) terrorist or organized criminal linkages.

Shipbuilding Trends

Despite the 2008-09 global economic crisis, the world's largest and most productive shipyards continued to deliver newly built ships. Vessels continued to be built and delivered because of orders placed by major shipowners and operators prior to the economic crisis. This trend reflected an assumption prior to the downturn that global trade growth would be driven by continued OECD country consumption and Asian exports, principally from China. Both of these factors, of course, drive the need for bulk raw materials and petroleum for manufacturing, transport, and power generation.

More than 90 percent of shipbuilding was undertaken in only three Asian countries—South Korea, which accounted for 37.3 percent of new gross tonnage, China (28.6 percent), and Japan (24.6 percent). Yards in all of the world's remaining shipbuilding countries combined to account for only 9.6 percent of construction in 2009. The three main shipbuilding countries specialize in different vessels. South Korea focuses on container ships, oil tankers and, to a lesser extent, specialized LNG carriers, while China dominates the dry bulk carrier market, partially due to the fact that its yards are not yet as technically advanced as those of South Korea and Japan. The Japanese yards, meanwhile, concentrate primarily on oil tankers and a small number of container vessels.

Modern Shipbuilding, Design, and Marine Technology

Revolutionary New Ship Designs

Persistently high oil prices, combined with ongoing concerns over the shipping industry's CO_2 emissions levels, have driven the world's foremost container shipping company—Maersk—to embark upon arguably the most ambitious ship development and acquisition project in a generation: the 'Triple-E'. In February 2011, Maersk Line signed a contract with Daewoo Shipbuilding for 10 of what will be the largest cargo ships ever built (aside from a handful of Ultra Large Crude Carriers that are no longer in service), with an option for 20 additional vessels. The ships will have a nominal capacity of 18,000 TEUs (Twenty-foot Equivalent Units), and will be delivered from Korea's Daewoo Shipbuilding & Marine Engineering (DSME) shipyard between 2013 to 2015. The $190 million Triple-E design is based on three main principles: economy of scale, energy efficiency, and environmental sustainability. The ships will be 400-meters long, 59-meters wide and 73-meters tall, rendering them 16 percent larger (2,500 TEU) than the world's largest in-service container vessel, the *Emma Maersk*.

The latest marine technology has been incorporated into the design, including waste heat recovery systems (WHR) for the two engines, which are ultra-long two-stroke machines that operate at far lower RPMs than conventional designs. These twin engines will turn the ship's massive propellers to provide the same dynamic propulsion, while turning at slower RPMs. The intended optimum service speed for the ships is 19 knots, which contrasts markedly to the 23-26 knots at which modern large container vessels typically steam. Steaming at this reduced speed would reduce fuel consumption by a significant 37 percent, though slower speeds would add between two and six days to voyages.

Maersk is acquiring the ships to position itself to profit from an anticipated five- to eight-percent growth in trade from Asia to Europe that the company expects, and to maintain its dominant position in the industry. With their unsurpassed size and unit cost, the ships will ensure both lower operating costs and lower CO_2 emissions—50 percent less CO_2 released per container moved than the current industry average on the Asia-Europe trade.[7] Because of their extensive draft of 14.5 meters (48 feet), these ships will draw too much water to use any port in the Americas, and they will be unable to transit the Panama Canal. However, based on the projected growth in Chinese manufactured goods exports in the coming years, the vessels were specifically intended to service the main trade routes between Europe and Asia via the Indian Ocean, and are thus able to transit the Suez Canal and navigate safely through the Singapore Straits.

The Europe-Asia trade route via Suez and Malacca is Maersk's largest market, and the company has sent a clear message to the industry that it is determined to consolidate its share of the Europe-Asia trade with the addition of the Triple-Es. As a reaffirmation of this commitment, Maersk placed an order in June 2011 for 10 additional Triple-Es, worth roughly $1.9 billion.[8] However, some industry observers have suggested that the project, despite it clear technological benefits and flair, represents a gamble by Maersk. By ordering new high-capacity vessels at time of clear surplus tonnage, those observers contend, the company is relying on the seeming certainty of continued Chinese export expansion well into the next decade.[9]

Floating Gas Liquefaction Vessels (FLNG)

In May 2011, Royal Dutch/Shell announced that it was proceeding with its plan to order the world's first-ever floating gas liquefaction vessel (FLNG), which will be built by South Korea's Samsung Heavy Industries. Once completed, the vessel will be positioned at the company's Prelude gas field in the Indian Ocean off western Australia, with a start-up date set at 2016. Despite the vessel's enormous cost (estimated at between $5-10 billion), the figure is lower than the cost of a shoreside liquefaction plant built with all of the necessary connecting offshore pipelines.[10] Indeed, the FLNG concept also arguably provides environmental benefits, as shoreside facilities could conceivably have damaging effects on coastal habitats and ecosystems.

These huge, highly complex platforms (the Shell unit is 450 meters in length with a breadth of 70 meters) will revolutionize the exploration, production, and export of natural gas from certain parts of the Indian Ocean, and eventually from other regions of the world as well. The facility is planned to produce 3.5-million tons of LNG per year and 1.5-million tons of condensate and liquefied petroleum gas per year.[11] Approximately 30 percent of the world's gas reserves are deemed 'stranded' gas, given their remote locations and/or complexity of production. For those deposits in offshore, deep-water areas, the FLNG vessel will facilitate the sea transportation of gas previously denied to the market, allowing the potential to transform the industry. Shell's design is intended to operate in distant harsh conditions. If the deal with the Technip/Samsung

Heavy Industries is finalized, 10 of these giant vessels could be built in the next 15 years.[12] Several of the units may operate in parts of the Indian Ocean where shoreside infrastructure construction is problematic, particularly in remote stretches of ocean off the coasts of Africa and southeast Asia. As demand for LNG grows in China and India, Shell is planning further investments in FLNG projects that will enable these crucial expanding markets to be served by once-stranded gas deposits in east Africa and Indonesia, which are potential target regions for Shell's FLNG expansion.

Notwithstanding the technical challenges and enormous capital burden of these revolutionary vessels, floating static facilities of this type will be far more vulnerable to piracy and armed robbery in parts of the Indian Ocean, particularly off the west and east coasts of Africa. Indeed, any consideration to position FLNG units in elevated threat waters will likely necessitate comprehensive security arrangements with local state support.

Implications of a Second Major Economic Downturn for the World Maritime Industry

Shipping company statistics from the first half of 2011 clearly show the challenges faced by companies in all three of the major shipping sectors, with revenues falling sharply largely due to an overcapacity of tonnage. Even major ship operators that have healthy capitalization have reported significant losses as weak freight rates and excess capacity continue to drive revenue down to the extent that, for some, earnings are barely covering costs, and crew salaries are going unpaid.[13]

As a well-known industry marker of the economic health of the shipping business, freight rates provide vital insight for key sectors of this most global of industries. Tanker and dry bulk spot rates fell sharply in 2011 to very worrying levels. In some instances, they did not just fall below break-even margins needed for owners and operators to meet operating and capital costs; in some cases, they barely covered the cost of fuel. Some rates have effectively meant that shipowners and operators are essentially paying the charterers to lift their goods. In the first half of August 2011, for instance, average time charter fixtures on the key bell-weather Middle East to Far East very large crude carrier (VLCC) trade was less than $8,000 per day. This is far below nominal operating costs. Generally, a day rate of $40,000 is needed to make a profit on a new vessel ordered when prices were at their peak in 2007 and early 2008.[14]

The world's main container liner trades also continued to struggle in 2011, and many of the key companies reported results that have put them in the red. The hoped-for increase in business and a corresponding rise in freight rates in the second half of 2011 did not take hold.

On the positive side, operating cost-saving measures—such as slow-steaming—limited the scale of some container company's losses in 2011. Further, although many executives remain worried, losses in 2011 were not nearly as bad as those seen across the industry in 2009. Despite there being far more vessels available for charter than there is freight (usually referred to as 'over-capacity'), carriers have not yet resorted to large-scale 'laying-up' of vessels. Nevertheless, further cost-cutting options are limited. There is talk of even slower steaming, but this would create problems with shippers that base the attractiveness of their services on fast, time-scheduled cargo deliveries.[15]

Finally, intra-regional trade between the large Asian manufacturing states (such as China, Japan, and South Korea) and the developing countries that supply them with raw materials and petroleum will help sustain trade in the Indo-Pacific realm going forward. However, if growth in the economies of major Western consumer nations remains anaemic (or even recedes) in 2012 and the coming years, then international maritime trade, port development, and investments in important, ground-breaking advances in marine technology and shipbuilding will be compromised.

Notes

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Chapter Five

International Law and Order: The Indian Ocean and South China Sea

Caitlyn Antrim

The Indian Ocean and South China Sea encompass a wide range of geographical, geological, and biological features. The region includes several of the most heavily travelled international straits, major fisheries, and areas with high potential for discovery of energy resources. Meanwhile, the nations bordering the region range from some of the most prosperous and dynamic countries of the developing world to some of the developing world's poorest and most dysfunctional states. The diversity of interests of nations bordering this region can lead to conflict. International law, particularly the 1982 UN Convention on the Law of the Sea, plays a pivotal role in peacefully resolving such conflicts. Yet while legal measures and policy initiatives have helped mitigate international tensions through diplomatic processes, political, economic, and environmental issues can still lead to disputes and conflict.

Introduction

In the decades since World War II, advances in maritime technology, increases in maritime trade, and the growing economic value of offshore energy, mineral, and living resources have collectively led to a breakdown of the centuries-old division of the ocean between three-mile territorial seas under coastal state authority and the high seas, where freedom of navigation and exploitation typically reigned. Following a period of expanding coastal state claims over the sea and its resources, the 1982 UN Convention on the Law of the Sea (UNCLOS) established a new order of the oceans that promised the stability needed to protect sovereignty, provide for national security, promote trade and development, and safeguard the marine environment.

UNCLOS defines ocean zones and the rights and obligations of states within those zones (see Figure 5.1). It establishes organizations to carry out collective responsibilities for both defining the boundaries of national jurisdiction and managing mineral resources beyond those limits. It also provides alternative processes for conflict resolution, with some issues subject to mandatory settlement of disputes.

UNCLOS is also a framework agreement upon which more specialized treaties, organizations, and activities are established. These agreements, organizations, and activities include a framework convention governing fish stocks on the high seas; the operation of the International Seabed Authority in managing minerals beyond national jurisdiction; and the implementation of security and environmental pacts negotiated under the International Maritime Organization, as well as security partnerships such as the Proliferation Security Initiative.

Figure 5.1: Ocean Zones: Rights and Responsibilities

Under the UN Convention on the Law of the Sea, the ocean is classified into eight zones:

Territorial Sea: The coastal seas extending as far as 12 miles from shore, in which the coastal state has sovereign authority, subject to the recognition of the right of innocent passage for ships on their way from one location to another.

Contiguous Zone: An area extending 12 miles beyond the territorial sea, in which the coastal state may enforce its fiscal, customs, immigration, sanitary, and security laws.

Exclusive Economic Zone (EEZ): The seas beyond the territorial sea extending to 200 nautical miles, in which the coastal state has the sovereign right to manage, exploit, and protect mineral and living resources, subject to providing access to unused portions of what the coastal state determines to be the maximum allowable catch of the living resources. Other states are guaranteed high seas navigation rights and the right to lay and maintain cables and pipelines.

Continental Shelf: Both the seabed of the EEZ and the areas of the seabed beyond the EEZ that meet geological requirements specified in UNCLOS. The coastal state manages the resources of the continental shelf (and shares revenues derived from exploitation of mineral resources of the shelf beyond the EEZ) with the international community.

High Seas: The waters beyond the EEZ in which vessels and activities are under the authority of the flag state, and subject to only a limited number of international prohibitions, such as measures outlawing piracy and the slave trade.

The Area: The portion of the ocean floor beyond the limits of national jurisdiction. Mineral resources of the Area are managed by the International Seabed Authority, as established by UNCLOS.

International Straits: Straits that are used in international navigation regardless of whether they are sufficiently narrow to otherwise be considered territorial seas subject to innocent passage. International straits are subject to the regime of Transit Passage, in which ships and aircraft may pass through or over international straits in their "normal mode" without the restrictions imposed on innocent passage.

Archipelagic Waters: Those waters within boundary lines drawn to encompass the islands of archipelagic states. Passage through archipelagic waters is subject to conditions similar to Transit Passage in designated sea lanes and innocent passage in other areas of the waters.

In a broad sense, the law of the sea—both under the Convention and as implemented through other treaties, organizations, and agreements—provides the stable legal order necessary to manage the increasingly intense development of the ocean and its resources. This is particularly important in the Indian Ocean and the South China Sea, where overlapping claims of sovereignty and sometimes dysfunctional governments are placing the international legal regime under great stress.

International Agreements and Organizations

The region encompassing the Indian Ocean and South China Sea is an area of intense multinational activity. All but two of the coastal nations bordering the Indian Ocean and South China Sea are parties to UNCLOS. Those two countries, Iran and Cambodia, have signed the Convention and are expected eventually to seek approval for accession through their domestic legal processes. All of the littoral states are members of the International Maritime Organization (as well as members of at least one regional fisheries organization), and most are also members of a regional seas program that addresses environmental concerns (see Annex I).

Maritime Boundaries

With the exception of the central South China Sea, the delimitation of national maritime boundaries in the greater Indian Ocean region (IOR) has been remarkably smooth. While there exist some legal challenges to the specific baselines along the coast, boundaries between adjacent nations have in many cases been established by treaty and reflect principles of equidistance, equity, history, and special circumstances. In some cases, disputes have been taken to one of the venues specified in UNCLOS.

The central South China Sea—which has witnessed periodic eruptions of conflict and is subject of regional diplomatic efforts—represents a special case. Resolution of claims of sovereignty and access in this area has been complicated by uncertainties regarding the potential economic value of the natural resources (fisheries, minerals, oil and natural gas) to be found in the South China Sea, and by the changing interests and ambitions of the surrounding states.

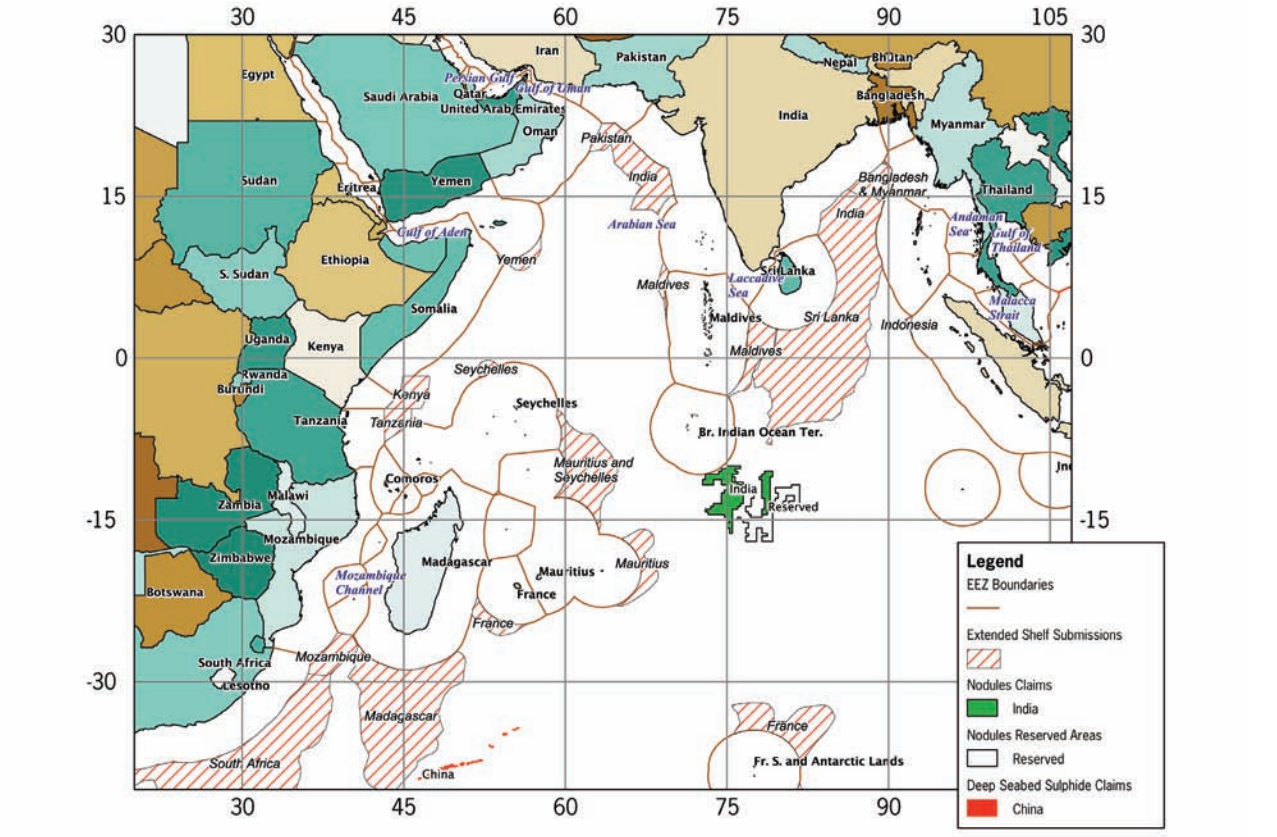
International Fishing Agreements

Fisheries and fish stocks that exist wholly or partially outside national jurisdictions pose a special problem for fishery management. Fishing on the high seas is a freedom for all states, but the lack of effective enforcement of sustainable fishing policies permits highly mobile fishing fleets to overexploit a resource and move on, leaving once-rich resources depleted and damaged.

The UN "Fish Stocks Agreement" was opened for signature in 1995 and came into force in 2001.[1] The agreement provides the framework for the establishment and operation of regional agreements to manage high seas and straddling fish stocks in accordance with UNCLOS. As an example, the Southern Indian Ocean Fisheries Agreement (SIOFA) is a regional agreement negotiated under the Fish Stocks Agreement to address high seas fisheries in the southern Indian Ocean region.

As the UN agency responsible for international fishery issues, the Food and Agriculture Organization (FAO) plays a key role in promoting sustainable fishing in regions around the world, both in national waters and on the high seas. Under the FAO, four other regional fishery commissions have been established in the Indian Ocean and Southeast Asian region: the Asia Pacific Fishery Commission, Bay of Bengal Program-Inter-Governmental Organization, Indian Ocean Tuna Commission, and South West Indian Ocean Fisheries Commission.

Figure 5.2: Jurisdictional Claims in the Indian Ocean Region



Source: Stimson

Seabed Minerals Beyond National Jurisdiction

All parties to UNCLOS are also members of the International Seabed Authority (ISA), the agency that manages the mineral resources of the seabed beyond the limits of national jurisdiction. There are three known classes of hard minerals on the world's deep seabed:

- Polymetallic nodules of manganese and iron oxides enriched in nickel, copper, cobalt, and rare earth elements are found on the abyssal plains;
- Cobalt crusts consisting of iron and manganese oxides enriched in cobalt and rare earth elements, and found on the slopes of seamounts; and
- Polymetallic sulfides of copper and zinc, sometimes enriched with gold, that are found near spreading centers and subduction zones.

Over the past decade, rising demand (particularly in China) for seabed minerals with industrial applications drove metal prices upward, resulting in increased commercial interest in seabed mineral deposits. India and China have each sponsored national applicants for ISA recognition of exclusive rights to explore mineral sites in the Indian Ocean. India's claim is for a deposit of polymetallic nodules, while China's claim is for a deposit of polymetallic sulfides.

Maritime Safety and Security Agreements

All of the coastal states of the Indian Ocean and South China Sea are members of the International Maritime Organization (IMO). The IMO is the source of international rules and guidelines governing shipping operations that flag states, port states, and coastal states apply to international shipping in order to protect against vessel-source marine pollution. The IMO also works with straits and archipelagic states to gain agreement on the designation of sea lanes in international straits.

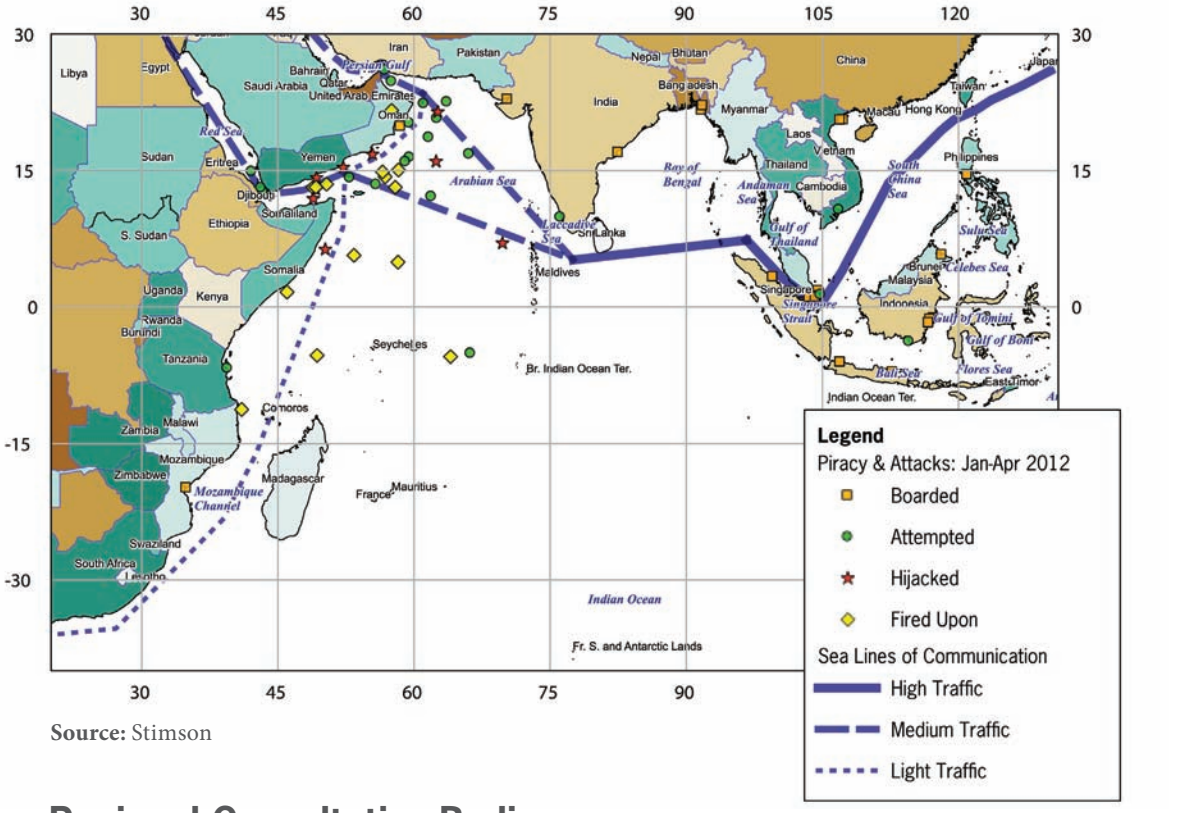
Several key maritime safety and security conventions have been negotiated under the auspices of the IMO. With regard to shipping, two of the most important are the Convention on Safety of Life at Sea (SOLAS) and the Convention on the Suppression of Unlawful Acts (SUA). Both are evolving agreements that have been supplemented and modified through subsequent protocols. Most recently, protocols to the SUA have been negotiated to address acts of international terrorism.

The IMO also supports regional efforts to promote maritime security. In 2009, the IMO convened a meeting in which East African nations adopted a "Code of Conduct Concerning the Repression of Piracy and Armed Robbery against Ships in the Western Indian Ocean and the Gulf of Aden." The signatories requested that IMO and other international organizations provide support in implementing the Code of Conduct, particularly in building national maritime and legal capacity to implement it effectively.

In addition to the IMO, the UN Security Council has the authority to intervene in matters affecting peace and security in the oceans. In recent years, the threat of piracy off the coast of Somalia led the Security Council to issue a series of resolutions encouraging a maritime response and authorizing actions that would otherwise exceed national authority as recognized by UNCLOS. For example, UNSC Resolution 1946 provided (for a period of 12 months) explicit authority for foreign ships to enter the territorial sea of Somalia to counter piracy and armed robbery as if they were on the high seas. It also ensured that this authority did not undercut the rights normally accorded by UNCLOS and did not establish new customary international law. This authority, and the conditions placed on it, has been renewed in successive Security Council resolutions.[2]

Smaller groupings of coastal states have also established specific regional initiatives. In 2004, the states bordering the Strait of Malacca began tripartite cooperation in anti-piracy activities. A Regional Cooperation Agreement on Anti-Piracy—including East, Southeast, and South Asian states—focuses on information sharing, capacity building, and cooperative agreements, including an Information Sharing Center established in Singapore.

Figure 5.3: Piracy in the Indian Ocean Region and South China Sea, January–April 2012



Source: Stimson

Regional Consultative Bodies

There are several regional organizations that are not actual lawmaking bodies, yet have significant policy roles in the Indian Ocean and South China Sea regions.

The Association of South East Asian Nations (ASEAN), for example, provides a forum for addressing conflicts among its members and with neighboring states. ASEAN's 2002 "Declaration on the Conduct of Parties in the South China Sea" called on China and the ASEAN states to seek peaceful resolution of their territorial disputes, and promote activities in other maritime issues.[3]

The United Nations Environment Program (UNEP), meanwhile, supports two "Regional Seas" programs in the Indian Ocean. The first, UNEP-administered East Africa Regional Seas program, gathers members spanning the coast and islands from South Africa to Somalia. Its principal legal framework is the "Nairobi Convention," which coordinates programs meant to strengthen capacity to protect, manage, and develop the coastal and marine environment.

The second regional seas program is the South Asia Cooperative Environment Program. This body—comprising of Pakistan, India, Bangladesh, Maldives, and Sri Lanka—oversees implementation of the South Asian Seas Action Plan, which addresses integrated coastal zone management, oil spill contingency planning, human development, and environmental impacts of land-based activities.

International Dispute Settlement Bodies

As parties to UNCLOS, regional coastal states (except for non-parties Iran and Cambodia) have recourse to the dispute settlement mechanisms created by the Convention—the International Tribunal on the Law of the Sea or the Arbitration and Special Arbitration panels provided by the Convention. (Additionally, they have recourse to the International Court of Justice.) The Convention's dispute-resolution system has been used on several occasions to resolve maritime boundary disputes in the Indian Ocean and South China Sea, but there is a strong preference for diplomatic processes over judicial approaches to resolve boundary disputes.

Current Regional Ocean Issues and Disputes

In some cases, UNCLOS provides detailed prescriptions of rights and obligations at sea. In other cases, general guidance is provided for later definition, leaving issues of jurisdiction to be resolved when they arise. This has led to a number of current or potential disputes in the five areas of concern listed below.

1. Maritime Boundaries, Sovereignty, and Resources

Determination of areas of sovereignty and national jurisdiction is moving in a generally satisfactory direction, with only a few significant problem areas:

- **Territorial claims and conflicts.** The most difficult issue in determining zones of maritime authority is not related to the law of the sea. Instead, the problems lie in the determination of sovereignty over land in the form of islands and rocks in the South China Sea. These small points of earth were unimportant until nations began to consider the economic potential of the resources in and beneath the surrounding waters. As jurisdiction over the seabed and fisheries rose in importance, nations began to claim jurisdiction on whatever basis they could justify. China justifies its claims over the islands and rocks of the Spratly and Paracel chains based on records of claims dating back to the 15th century and by reference to the international law of that era that is said to have not required occupation to establish and retain national claims. Vietnam and the Philippines, meanwhile, make claims based on more recent use, and all contenders have attempted to demonstrate jurisdiction by establishing outposts and occupation.
- **Determination of maritime jurisdiction.** Maritime boundaries are primarily based on sovereignty over the adjoining land territory, with rules based both on UNCLOS for breadth, including principles of equidistance and equity in dividing jurisdiction between adjacent or opposing states. There is a considerable body of international law that governs the application of these principles, but their practical implementation necessarily rests on the prior resolution of any disputes regarding sovereignty over the neighboring land territory.
- **Confrontations in the South China Sea.** China's claim of authority in the South China Sea is based on its "9 Dash Line." This has led to confrontations and incidents related to fishing activities, oil and gas exploration, and habitation on rocks and islets. China's

claim of historic rights is countered by arguments from the Philippines and Vietnam for resolution based on UNCLOS, but efforts to resolve the conflict must first address the nationality of individual islands and determination of which ones qualify for EEZs. Without diplomatic resolution of sovereignty issues, all parties are likely to confront one another to defend their claims.

› **Shifting coastlines and disappearing islands.** Areas of coastal state jurisdiction are based largely on the baselines drawn along coasts and around archipelagos. UNCLOS was written with only limited consideration of possible shifts in the geography of the coastline upon which the baselines are constructed. Coastal states are to submit their baselines to the UN, but guidance on how to revise baselines to reflect changes of physical coasts exist in the case of deltas only. In this case, the coastal state need not revise its baselines in the face of shifting coastlines.

Beyond the case of deltas, there are three cases in which baselines, and the maritime jurisdiction they convey, might be reconsidered based on changes of geography. The first concerns the removal or addition of physical material in a way that changes baselines. A decade ago, Indonesia expressed concern that Singapore's use of sand to extend land beyond its previous boundaries could change the median line in the waters between Singapore and Indonesia to Indonesia's disadvantage. A 2010 treaty resolved the issue by establishing permanent base points to determine the maritime boundary between the neighbors regardless of future changes in the physical coastline.[4] A second case concerns the modification of a coastline due to natural disaster, such as the subsidence of territory in an earthquake or massive coastal erosion due to tsunamis or hurricanes. If a permanent retreat of the coastline results from such disaster, does the baseline need to be redrawn? A third case potentially looms as sea levels rise, prospectively submerging some or all of the territory of an island nation. Would a nation, or at least its claim to maritime jurisdiction, disappear if its territory no longer qualified as an island or rock under UNCLOS? This is a serious issue for the Maldives off the southwestern coast of India, where sea level rise could force migration of the population. If claims to EEZs and continental shelves could be retained in spite of loss of the islands on which claims were made, they might provide financial support for the population wherever it might relocate. Alternatively, some islands might attempt to shore up or reinforce their receding coastlines by adding materials before the land is lost to the sea. But such artificial enhancement or enlargement of island territory could run afoul of exemptions ordinarily excluding the extension of maritime zones around artificially created islands.

› **Archipelagic baselines and sea lanes.** As archipelagic states, Indonesia and the Philippines are able to draw baselines enclosing their islands from which the countries' respective territorial seas and EEZs may be determined. Self-interest and domestic public pressure encourage the broadest of interpretation in establishing these baselines, sometimes exceeding the provisions of UNCLOS. The zones of authority may encroach on jurisdictional claims of nearby states or on the freedom of navigation of maritime nations. In these cases, it may be preferable to resort to the "special arbitration" annex of UNCLOS, in which disputes over maritime boundaries could be submitted to arbitral panels of experts in maritime boundary delimitation.

The Special Case of Boundaries in the South China Sea

Determination of national jurisdiction in the South China Sea is a difficult problem that has been exacerbated by coastal states' interest in exploiting fisheries and controlling the region's potential energy resources. In recent years, competing claims to islands and rocks in the Spratley and Paracel Island groups, questionable claims that barren rocks meet UNCLOS' standard of human habitability (thereby gaining EEZs and the continental shelf, in addition to a 12-mile territorial sea), differing legal and historical claims for land jurisdiction, and a historical record of recourse to force have all combined to leave jurisdiction over islands (and maritime zones derived from the land) uncertain.

China continues to assert its claim of jurisdiction in the heart of the South China Sea, enclosed by China's "9-dash line," while Vietnam and the Philippines claim jurisdiction over specific islands in the Spratley and Paracel groups. China refuses to address jurisdiction through formal dispute settlement processes, and has so far resisted multilateral approaches to resolve the fate of the two island groups.

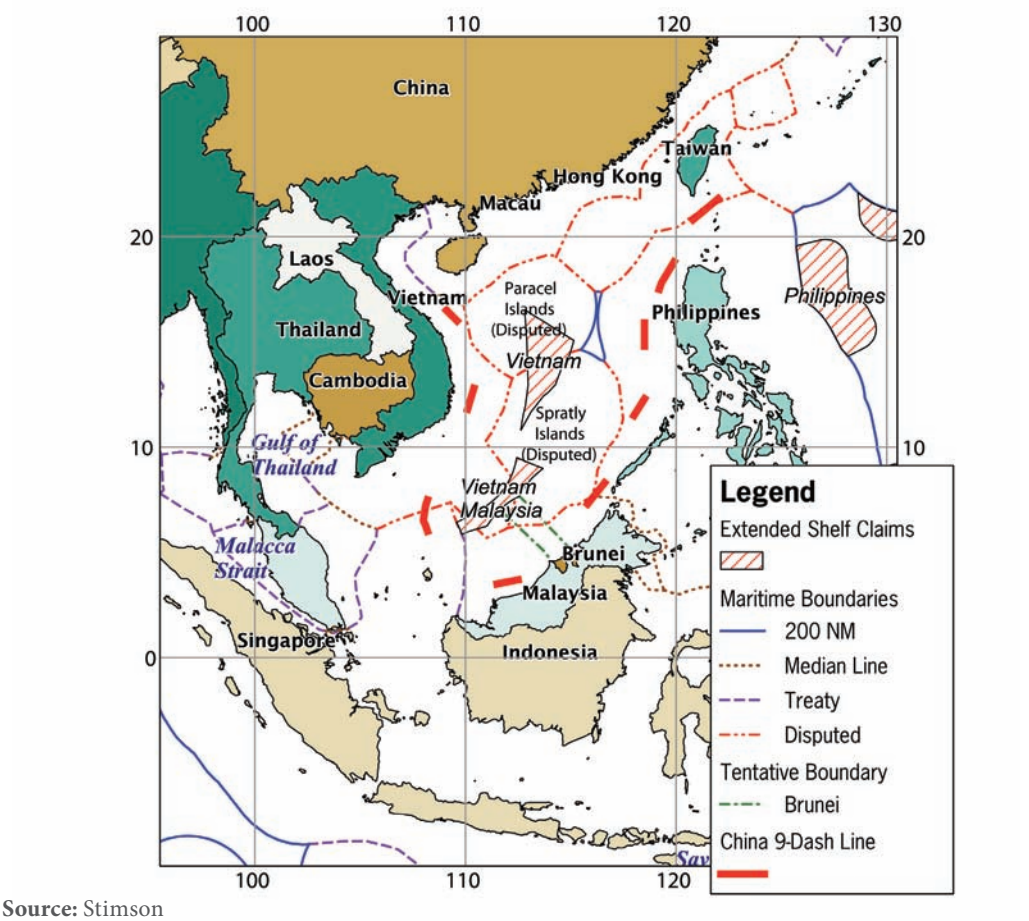
While armed confrontation linked to the Spratley and Paracel island groups had diminished during a period of cooperation between China and the ASEAN states, the potential for confrontation has once again increased, in part due to China's designation of the South China Sea as a "core interest" on the same level of strategic importance as Taiwan and Tibet. There has also been continuing economic pressure throughout the region to exploit the continental shelf's energy resources. However, a new agreement between China and Vietnam to resolve their territorial disputes in accordance with international law suggests the use of force is again off the table—at least for the time being.

Claims in the southwest region of the South China Sea involving Indonesia, Singapore, Malaysia, and Brunei have been settled peacefully, but the claim indicated by China's "9 Dash Line" remains in conflict with these otherwise resolved boundaries.

If island and maritime claims in the South China Sea are not resolved in the near future, there exist four potential long-term outcomes. First, political uncertainty may discourage all commercial development of energy resources, and competing coast guards may deter significant fishing activities. Second, limited development activities may take place under state military protection. Third, the regional states may reach an agreement on an interim joint development regime while retaining their jurisdictional claims. Fourth, disputes may spiral into armed conflict.

Similarly, the establishment of sea lanes through archipelagos could become a source of friction or conflict if they are established without due consideration of the interests of maritime nations in shipping and aviation routes or paths for undersea cables.

Figure 5.4: Jurisdictional Claims in the South China Sea



Source: Stimson

2. Coastal State Threats to Maritime Freedoms

UNCLOS is a comprehensive document in terms of the issues it addresses, but it does not spell out every detail of how it is to be implemented. States that are party to the Convention are expected to implement its provisions in good faith, including respecting the rights of other parties. This is particularly true in the EEZ, where coastal states may establish laws and regulations pertaining to exploration and exploitation of natural resources, marine scientific research, and the marine environment, while taking into account rights of other states to exercise high seas freedoms. Warships and ships on government service are exempt from the provisions related to the marine environment, but are expected to honor their intent as much as possible.

Innocent passage. The right of innocent passage through the territorial sea is long standing, with the 1982 Convention simply providing greater clarity and limiting discretion by the coastal state over passage. Innocent passage never included a requirement for prior notification in customary law (and was not added by the 1982 Convention), but a number of states in the region—among them China, India, and Pakistan—now claim that foreign

flag vessels must give prior notification before exercising this right. Bangladesh requires advance notice for vessels entering its territorial sea with cargos containing "dangerous goods and chemicals, oil, noxious liquid, harmful substances, and radioactive material."[5] These claims are challenged periodically under the US Navy's "Freedom of Navigation" program.

Transit passage. The right of transit passage derives from pre-Convention rights to pass through straits used in international navigation, with additional navigational freedoms defined in the Convention. Some strait states have claimed that the right of transit passage is available only to parties to the Convention, and that non-parties have only the more limited right to innocent passage through international straits.[6]

As traffic through straits has increased, the financial and regulatory burdens on states bordering the straits has risen, as have the risks of catastrophic accidents, piracy, and armed robbery at sea. The UNCLOS regime leaves strait states responsible for providing for the safety of navigation and protection against crime, but it does not provide mechanisms for covering the domestic costs of supplying this international service. These costs can be quite high for a developing state, and to date, efforts to secure funding through voluntary contributions have fallen short. In the future, some international arrangements will be needed that provide for necessary services while respecting the sovereignty of the strait states and protecting the freedom of navigation for maritime states.

Limits on activities in the EEZ. In spite of provisions of the Convention that protect high seas navigation rights in the EEZ—and specifically protect rights of government ships, including warships—some states have sought to limit military activities within their EEZ. Most notable has been China's interference with military aircraft and government-owned ships engaged in survey and observation activities beyond the territorial sea. In 2001, the mid-air collision of a Chinese fighter and a US Navy EP3 reconnaissance aircraft (with the loss of the life of the Chinese pilot) demonstrated the seriousness of this effort to expand coastal-state jurisdiction at sea. Meanwhile, India claims the right to require prior consent for foreign military activities in its EEZ. The United States has protested all of these activities as unjustified restrictions on navigation rights.

Advanced notice of cable and pipeline maintenance in the EEZ. The right to lay and maintain cables and pipelines across the seabed of the EEZ is explicitly protected in UNCLOS. Despite the fact that undersea cables constitute the communication infrastructure for the Indian Ocean and South China Sea, some countries in the region have claimed the right to demand that firms submit advance notification and obtain prior permission before conducting cable-maintenance activities in their EEZs, in spite of the requirement that such activities not be impeded by the coastal state. While advance notice can facilitate managing uses of the ocean floor, it also allows bureaucratic inefficiency to delay essential maintenance operations. Submarine-cable companies must rely on their parent governments to challenge these requirements through diplomatic channels, with UNCLOS being a major source of leverage for action.

3. Monitoring, Regulation, and Enforcement

Parties to UNCLOS have the right to manage resource development, marine scientific research, and environmental protection in their EEZs, as well as the duty to combat piracy on the high seas. Without the capability to monitor activities and enforce regulations at sea, coastal states lack the ability to fulfill their responsibilities to combat illegal practices, and may suffer losses and damages as a result.

Piracy. As the most heavily travelled and high-value sea routes in the world, the points of confluence of sea lanes in the Indian Ocean and South China Sea have become attractive hunting grounds for pirates. Small-scale piracy—based on the capture of ships and cargo over the past few years near the Horn of Africa and the Strait of Malacca—has been supplanted by capture and ransom activities against lightly crewed vessels with high-value cargoes traveling from the Persian Gulf and the Suez Canal, even as piracy in the eastern Indian Ocean has declined. (As of April 23, 2012, there were 151 acts against shipping worldwide, with 51 off the coast of Somalia. Of these, there were 13 hijackings, of which 11 were off the Somalia coast, while 158 of 173 hostages worldwide were taken off Somalia.[7] The distribution of incidents and hijackings in 2012 is shown in Figure 5.3 on page 70.)

While piracy is an international crime to which all maritime nations must respond, many states have failed to provide domestic authority or resources to act against pirates. For example, local actions against Somalia-based pirates were impeded by the lack of a capable national government to act against pirates within national waters. Given that action by foreign states within a coastal state's territorial sea is normally a violation of international law, maritime states have had to seek and obtain a UN Security Council resolution to authorize states to pursue and capture pirates within Somalia's territorial sea. Since 2008, the UN Security Council has adopted 12 resolutions dealing with piracy, armed robbery at sea, and arms trafficking in maritime spaces.[8] The Security Council has also endorsed operations of Combined Task Force 151 and other forces combating piracy off Somalia's shores.

Illegal, unreported, and unregulated fishing on the high seas. The increasing sophistication of fishing systems has allowed modern fishing vessels and fleets to enter a fishery and quickly harvest available resources before moving on to other grounds. Many poor developing states have limited resources to invest in coast guards capable of patrolling their EEZ and enforcing fishery regulations. This situation has left these countries' offshore resources vulnerable to illegal, unreported, and unregulated (IUU) fishing, with major economic losses both to the state and to local fishing industries. IUU fishing has proven even more problematic for fisheries that straddle the EEZ and the high seas, or fisheries that migrate across national boundaries.

Somalia serves as a case in point regarding the loss of a national resource due to a lack of capacity for offshore management and regulation. While it would be an exaggeration to blame the rise of Somalia-based piracy solely on the decimation of the country's offshore fisheries and the subsequent displacement of fishermen to other livelihoods, the failure to protect and utilize Somalia's once-rich offshore fisheries is a major economic loss that undermines the development of a national government capable of regulating activities in its own EEZ.[9]

Figure 5.5: Strengths, Weaknesses, Opportunities, and Threats Analysis

Strengths of international law in promoting peace and sustainability in the Indian Ocean:

- Rules and processes for determining maritime boundaries defuse conflict by focusing on implementation of agreed upon principles rather than national competition
- Increased clarity of national rights and obligations in ocean zones for both coastal and distant water states reduces chances for serious disputes
- Mechanisms for settlement of maritime disputes under UNCLOS have increasingly gained respect and application
- Regional recognition of UNCLOS and membership in the International Maritime Organization provide common basis for establishing international ocean policy and addressing disputes among nations

Weaknesses of international law as a basis for regional peace:

- Implementation of principles and general provisions depends on good faith obligations of sovereign states to implement provisions of the Convention
- Additional agreements are necessary to create binding rules and regulations for protection of the marine environment
- Delineation of maritime boundaries depends upon agreement on sovereignty over land, and on functional governments to negotiate boundary agreements
- Without means to monitor offshore activities and enforce rules at sea, rights of coastal states under UNCLOS cannot be assured
- Long-term stability of international law requires adherence by all major ocean powers

Opportunities to improve peace and stability through application of international law:

- Roles for regional and functional international organizations and agreements to address multinational and transboundary issues
- Formal review process of claims to continental shelves beyond the 200-mile EEZ
- Regional organizations can lead or assist in the development of binding multilateral agreements to protect the marine environment
- Partnerships with the US and other advanced maritime states can enhance monitoring capability and bolster training of coast guards' monitoring and enforcement capacities
- The International Tribunal and UNCLOS arbitral panels have gained a positive reputation for dispute resolution in the region that can provide a trusted alternative to use of force

Threats to international law, peace, and stability:

- Unilateral declarations of authority over the seas and seabed in excess of UNCLOS provisions
- Failed states and states that lack the capability to monitor their waters and enforce their laws
- Unresolved, overlapping claims to islands in the South China Sea
- Retreat of coastal baselines due to rising sea level or natural disaster
- Non-party status of the US—a global sea power with maritime interests in the Indian Ocean and South China Sea—undermines commitments of parties to their obligations under the Convention, and leaves the option for other states to leave the Convention

The weakness of many littoral states notwithstanding, all of the coastal countries bordering the Indian Ocean and South China Sea belong to one or more regional fishery bodies and most belong to a regional seas program. Increasingly, they may turn to inter-governmental and non-governmental organizations for assistance in developing management plans for their EEZs.

In the years ahead, heightened demand for fish for domestic consumption and international trade will increase pressure on high seas– and straddling fish stocks. If coastal states and flag states prove unable to both monitor fishing in the EEZ and enforce regulations in port and at sea, then IUU fishing will likely increase, to the detriment of coastal state fishing interests and consumers.

4. Protection of the Marine Environment

Ship breaking. Dismantling ships to salvage equipment and recycle metals is highly labor intensive. This is one of the primary reasons the ship-dismantling industry has moved to India and other nations with large, low-cost labor forces. Instead of dismantling vessels in a dock, ships are often simply run up on shore, where they are broken apart. Over their working life, ships accumulate significant petroleum-related residues. Dismantling ships releases these hazardous materials into coastal waters to the detriment of the environment, local populations, and marine ecosystems.

Under UNCLOS, states are responsible for enacting and enforcing laws to prevent pollution of the marine environment, but by itself, this responsibility is not enforceable at the international level. The Convention encourages the development of regional and global agreements that lay out specific rules addressing pollution from land or continental shelf activities.

Climate change and sea level rise. Rising sea levels driven by global climate change have potentially serious implications for coastal cities and infrastructure. There are also significant implications for maritime jurisdiction, since rising sea levels can move maritime baselines inward, taking with them the territorial seas and EEZs that are drawn from those baselines. More critical is the threat that rising seas pose to small island nations, where in some cases the highest points of land sit only meters above current ocean levels. Rising sea levels could eventually submerge these island states' land territory, and with it all of their claims to EEZs and continental shelves.

Migration driven by rising seas has already occurred with the submergence of Bangladesh's Bhola Island in 1995. The loss of Bhola Island, which was located inside Bangladesh's coastal baselines, had no effect on the country's maritime jurisdiction, however.[10] Looking forward, the Maldives—where 80 percent of the country's territory has an elevation of one meter or less above sea level—may be similarly submerged. This would force the Maldivian population off the archipelago and eliminate the Maldives' EEZ, with parts of its continental shelf likely being transferred to India and the British Indian Ocean Territories.

Implications of the Ocean Legal Regime for US Presence in the Indian Ocean and South China Sea

Unless the US is willing to maintain a presence in the littorals of every country that challenges navigational freedoms in the EEZ and international straits, such freedoms must be protected through legal and maritime challenges. As a non-party to UNCLOS, the US may not be able to have its disputes addressed in international fora. Further, as long as US maritime interests must be pursued through international partnerships (such as the multinational anti-piracy task force), military challenges to excessive maritime claims will have to be balanced against maintaining foreign support for other critical activities and minimizing foreign disapproval of US military demonstrations off foreign shores. It is one thing to risk irritating the public of an adversary; it is another to undermine relations with essential allies.

As home to the most strategic and heavily travelled sea routes, the Indian Ocean and South China Sea are critical to US economic and security interests in the world at large. It is important to preserve US navigation rights in the region. As such, it is also important that rights not be the source of confrontations with allies, and that jurisdictional claims not spill over into maritime conflict.

While UNCLOS and other binding international maritime agreements establish the international order for the seas, their adoption does not put an end to ocean diplomacy. This is especially true in the Indian Ocean and South China Sea. However, the leverage of the US in guiding the development of ocean law and regulation is significantly weakened by its failure to become a signatory party to UNCLOS. The US Navy policy of challenging what are viewed as excessive claims can only be a stopgap measure, particularly when challenges must be made against nations that have other non-maritime interests that compete for US attention in the realms of bilateral and international diplomacy.

Proposal for a marine protected area in the British Indian Ocean Territories. A proposal by the United Kingdom to establish a marine protected area in the Indian Ocean in the region of the British Indian Ocean Territories has provoked opposition to date, given that it would prevent indigenous people from returning to the territories from which they were ejected 50 years ago when the UK began preparations for establishing the US naval base in Diego Garcia. Supporters of the UK proposal for a marine protected area in these waters include the British government, as well as a handful of major international environmental NGOs. Meanwhile, opponents—human rights organizations, other environmental organizations, and some neighboring island states where people displaced by the British have migrated—claim that designating a marine protected area is a ploy to make it impossible for displaced populations to return to productive livelihoods in their former home. Efforts to resolve the issue via financial compensation have thus far been rejected by the UK.

5. Dispute Settlement

Claims to maritime zones are guided by UNCLOS rules, but the application on some principles—such as equity and historic use—can require further negotiation, conciliation, or binding settlement to resolve overlapping claims. While resolution of disputes over sovereign control, resources, or territory can lead to armed conflict, coastal nations in the Indian Ocean and South China Sea have resolved (or are in the process of seeking peaceful resolution of) a number of boundary disputes. For example, India and Sri Lanka have a negotiated maritime boundary, while Bangladesh and Myanmar recently resolved a case before the International Tribunal on the Law of the Sea regarding maritime boundaries in the Bay of Bengal. This latter case is particularly encouraging, in that the affected parties have used the UNCLOS dispute-settlement provision to seek clarification on maritime boundary issues rather than prolonging the dispute or turning to the use of force for its resolution.

Outlook for International Law and Peace in the Indian Ocean and South China Sea

As international law for the oceans developed in the aftermath of World War II, a contest emerged, pitting maritime nations interested in freedom of navigation on the seas against coastal states, which were interested in extending both the seaward extent of their authority and the degree of jurisdiction they could assert over the sea, its resources, and activities in its waters.

More than 35 years were spent negotiating a delicate balance between these interests. This balance was eventually codified in UNCLOS in 1982, and it would take another 12 years for the Convention to be brought into force. Yet establishing the Convention represented only one of the steps needed to accommodate the interests of both maritime and coastal states. The next key step will be continuing the process of interpreting and implementing the Convention while protecting the rights of its signatory parties.

Interpretations of coastal state jurisdiction and navigational freedoms differ from country to country. Issues such as fish-stock exploitation and seabed genetic resources beyond the limits of national jurisdiction remain potential sources of conflict. The Indian Ocean and South China Sea comprise a region with three significant maritime powers—India, China, and the US—but no hegemon to enforce its version of proper order for the seas. In place of a dominant power, the states of the region accept the legal order established by UNCLOS, and the international agreements and organizations within its framework.

UNCLOS enjoys near universal acceptance. It provides coastal states with essential tools to protect their coasts and manage offshore resources, while also safeguarding the rights of navigation, overflight, and seabed communications that are essential to maritime powers and trading states. UNCLOS also provides a structure for peaceful resolution of disputes regarding maritime issues. And by meeting the essential needs of coastal and maritime states, UNCLOS reduced the likelihood of conflict over coastal states' efforts to enclose the seas.

By itself, UNCLOS does not meet all the needs of regional parties. Many of its provisions leave details to be resolved through diplomatic efforts as new issues arise. Its provisions on

maritime boundaries rest on determination of control of coasts and islands, some of which remain highly disputed as of early 2012. Further, while the Convention identifies rights and authorities at sea, few of the states of the region have the technical capability to monitor activities, implement laws and regulations, and enforce those laws in their territorial waters.

As a framework, the Convention provides opportunities to improve the maritime order of the region. International organizations, particularly the International Maritime Organization, the Food and Agriculture Organization, and the UN Environment Program all play roles in helping states manage the ocean and its resources. Potential exists to develop partnerships with more advanced maritime states to gain technical capacity, training, and enforcement assistance. Meanwhile, having demonstrated their competence, UNCLOS arbitral panels provide appealing avenues for resolving conflicts.

There remain threats to maritime order provided by the Convention. While grand expansions of coastal state authority have been put to rest, temptations persist to expand authority in smaller steps, such as restricting navigation and access to offshore waters. Security threats have originated in failed states like Somalia, where pirates and armed robbers operate in waters that lie beyond the authority of other states, requiring UN Security Council intervention to exceed the limits of the Convention. The retreat of coastlines and submersion of islands raise tricky questions about who controls offshore waters when the baselines from which such zones are measured shift or disappear. Long-term sea level rise also threatens coastal infrastructure throughout the Indian Ocean and South China Sea regions. Finally, changes in islands' and coastal regions' habitability could trigger problematic large-scale migrations, either within a country or across borders, necessitating massive relocation of port infrastructure and other maritime facilities.

There are two existential threats to the order provided by UNCLOS. The first is the dispute over control of small islands and rocks in the South China Sea's Spratly and Paracel island groups. The Convention cannot guide the establishment of national baselines and boundaries until the question of sovereignty is resolved. Recent recognition of the economic importance of seabed- and living resources has pressured nearby states to make, demonstrate, and enforce claims to maritime territory. However, while China is focused on controlling resources and activities off its coasts, the country's investment in fueling stations and naval facilities in the Indian Ocean, growing dependence on foreign trade, and interest in Arctic exploration suggest a gradual shift in Beijing's outlook from coastal state control to high seas freedoms.

The second threat to the maritime order is the failure of the US to complete the process of joining the Convention. As a non-party, the US—the sole major maritime power outside the Convention—has undercut its own moral authority to press other states to abide by the Convention. Moreover, the US stance holds the door open for other states currently party to UNCLOS to leave the Convention and pursue their interests via means that they cannot utilize as parties. The departure of a country such as China could provide political cover to other countries that disagree with aspects of the Convention, allowing them to justify their exit. With each departure, the stability of the maritime order would be weakened and the world would move closer to the enclosure of the seas by coastal states—to the detriment of maritime powers and trading states. To mitigate this threat, the US needs to complete its ratification process and become party to the Convention.

Notes

1 "United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea," December 10, 1982; "Conservation and management of straddling fish stocks and highly migratory fish stocks," in *UN Document A/CONF.164/37*, September 8, 1995. (Entered into force on December 11, 2001.)

2 "United Stations Security Council Resolution 1846 (2008), S/RES/1846, Paragraph 10," December 2, 2008, http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N08/630/29/PDF/N0863029.pdf?OpenElement.

3 Association of Southeast Asian Nations (ASEAN), "Declaration on the conduct of parties in the South China Sea," November 4, 2002, http://www.asean.org/13163.htm.

4 Treaty between Indonesia and Singapore relating to the delimitation of the territorial seas of the two countries in the western part of the Strait of Singapore, signed March 10, 2009, in force as of August 31, 2010, http://www.mfa.gov.sg/2006/pdf/2009_Boundary_Treaty_Eng.pdf.

5 India claims UNCLOS does "not authorize other States to carry out in the exclusive economic zone and on the continental shelf military exercises or manoeuvres, in particular those involving the use of weapons or explosives without the consent of the coastal State." Item (b), Declaration upon ratification, June 29, 1985. Bangladesh contends that a "notification requirement is needed in respect of nuclear-powered ships or ships carrying nuclear or other inherently dangerous or noxious substances. Furthermore, no such ships shall be allowed within Bangladesh waters without the necessary authorization." Item 4. Declaration upon ratification, July 27, 2001, http://www.un.org/depts/los/convention_agreements/convention_declarations.htm.

6 Transit passage permits warships to operate in their "normal mode" so submarines may remain submerged and aircraft may operate in waters above the strait. The right of transit passage may not be suspended by the coastal state. Innocent passage limits operations of warships, requires submarines to operate on the surface, and does not apply to aircraft. The right of innocent passage may be suspended temporarily by the coastal state after giving advance notice of its intent.

7 International Chamber of Commerce Commercial Crime Services, "Piracy news and figures," http://www.icc-ccs.org/piracy-reporting-centre/piracynewsafigures.

8 11 UN resolutions address piracy and armed robbery off the coast of Somalia, http://www.un.org/depts/los/piracy/piracy_documents.htm.

9 Jasmine Hughes, "The piracy-illegal fishing nexus in the western Indian Ocean," in *Strategic Analysis Paper: Future Directions International (Australia)*, 2011, http://somfin.org/files/0/9/6/4/8/293199-284690/Piracy_IUU_relation.pdf.

10 Emily Wax, "In flood-prone Bangladesh, a future that floats," in *Washington Post*, September 27, 2007, http://www.washingtonpost.com/wp-dyn/content/article/2007/09/26/AR2007092602582.html.

Figure 5.6: International Organization Memberships and Jurisdictional Claims in the Indian Ocean Region

	LOS Status	Fish Stocks	IMO	Ext. Shelf Claim Submission Date	Fishery Commissions*	Excessive Navigation Restrictions**	Regional Seas Programme	Disputed Islands Claims & Maritime Boundaries
South Africa	Party	Party	Member	5/5/2009 & 5/6/2009	IOTC (assoc.), SWIOFC		East Africa	
Tanzania	Party	No	Member		IOTC, SWIOFC		East Africa	
Kenya	Party	Party		5/6/2009	IOTC, SIOFA (sign), SWIOFC		East Africa	Unresolved boundary with Somalia
Somalia	Party	No	Member		SWIOFC	TS	East Africa	Unresolved maritime boundary with Kenya
Madagascar	Party	No	Member	4/29/2011	IOTC, SIOFA (sign), SWIOFC		East Africa	Madagascar claims Bassas da India, Europa Island, Glorioso Islands, and Juan de Nova Island (all administered by France); the cays of Banc du Geyser, which were claimed by Madagascar in 1976, also fall within the EEZ claims of the Comoros and France
Comoros	Party	No	Member		SWIOFC, IOTC		East Africa	Comoros claims French-administered Mayotte, and challenges France and Madagascar's claims to Banc du Geyser in the Mozambique Channel
France, Reunion and Southern Lands	Party	Party	Member	5/6/2009 & 5/8/2009	APFIC, IOTC, SIOFA, (sign) SWIOFC		East Africa	
Mauritius	Party	Party	Member	12/1/2008 & 5/6/2009	IOTC, SIOFA SWIOFC	TS, EEZ	East Africa	Mauritius and Seychelles claim the Chagos Islands; Mauritius claims French-administered Tromelin Island
Mozambique	Party	Party	Member	7/7/2010	IOTC (assoc.), SIOFA (sign), SWIOFC		East Africa	
Seychelles	Party	Party	Member	12/1/2008 & 5/7/2009	IOTC, SIOFA, SWIOFC	TS	East Africa	Mauritius and Seychelles claim the Chagos Islands (UK-administered British Indian Ocean Territory)

	LOS Status	Fish Stocks	IMO	Ext. Shelf Claim Submission Date	Fishery Commissions*	Excessive Navigation Restrictions**	Regional Seas Programme	Disputed Islands Claims & Maritime Boundaries
Maldives	Party	Party	Member	7/26/2010	BOBP-IGO, IOTC, SWIOFC	TS, EEZ, ArBL	South Asian	
Yemen	Party	No	Member	3/20/2009	SWIOFC	TS		
Oman	Party	Party	Member		IOTC	TP		
Iran	Signed	Party	Member		IOTC	TS, EEZ, CS		There is no agreed maritime boundary between Iraq and Iran along the Shatt al Arab Waterway, which prompts jurisdiction disputes beyond the mouth of the Shatt al Arab into the Persian Gulf; Iran and UAE continue to dispute the Tunb Islands and Abu Musa Island, which are occupied by Iran
Pakistan	Party	Signed	Member	4/20/2009	APFIC, IOTC	TS, EEZ	South Asian	See India
India	Party	Party	Member	5/11/2009	APFIC, BOBP-IGO, IOTC	TS, EEZ	South Asian	India and Pakistan seek technical resolution of the disputed boundary in Sir Creek estuary at the mouth of the Rann of Kutch in the Arabian Sea; Bangladesh has referred its maritime boundary claims with Burma and India to the International Tribunal on the Law of the Sea Potential EEZ/CS boundary with Bangladesh
Bangladesh	Party	Signed	Member	2/25/2011	APFIC, BOBP-IGO	TS, EEZ	South Asian	Maritime boundary with Myanmar at ITLOS
Sri Lanka	Party	Party	Member	5/8/2009	APFIC, BOBP-IGO, IOTC	TS	South Asian	
Myanmar	Party	No	Member	12/12/2008	APFIC	TS, EEZ		Maritime boundary with Bangladesh at ITLOS
Thailand	Party	No	Member		APFIC, IOTC		East Asia	
Cambodia	Signed	No	Member		APFIC		East Asia	
Malaysia	Party	No	Member	5/6/2009	APFIC, IOTC	TS, EEZ	East Asia	Central SCS with China
Singapore	Party	No	Member				East Asia	
Indonesia	Party	Party		6/16/2008	APFIC, IOTC	TS, ArBL	East Asia	Central SCS with China

	LOS Status	Fish Stocks	IMO	Ext. Shelf Claim Submission Date	Fishery Commissions*	Excessive Navigation Restrictions**	Regional Seas Programme	Disputed Islands Claims & Maritime Boundaries
Brunei	Party	No	Member					Central SCS with China
Vietnam	Party	No		5/6/2009 & 5/7/2009	APFIC	TS	East Asia	Paracel Islands, Central SCS with China
China	Party	Signed	Member		APFIC, IOTC	TS, EEZ	East Asia	Spratley & Paracel Islands, Central SCS
Philippines	Party	Signed	Member	4/8/2009	APFIC, IOTC	ArBL	East Asia	Spratley Islands with China
UK Island Territories	Party	Party	Member		APFIC, IOTC			Dispute with displaced indigenous people over proposed marine protected area

Source: US Defense Department, Excessive Maritime Claims, 2005.

***APFIC** . . . . . Asia Pacific Fishery Commission
BOBP-IGO . . Bay of Bengal Program-Inter Governmental Organization
IOTC . . . . . Indian Ocean Tuna Commission
SIOFA . . . . . Southern Indian Ocean Fisheries Agreement
SWIOFC . . . . South West Indian Ocean Fisheries Commission
****TS** . . . . . Territorial Sea
TP . . . . . Transit Passage
EEZ . . . . . Exclusive Economic Zone
CS . . . . . Continental Shelf
ArBL . . . . . Archipelagic Base Lines

Chapter Six

Energy in the Indian Ocean Region: Vital Features and New Frontiers

Rupert Herbert-Burns

Regardless of the specificity of prevailing consumption trends, key importers and exporters of petroleum and natural gas are not only bound together within the global petroleum market; but are also very sensitive to the dynamics and productivity of the major sectors of the industry—*upstream*, *midstream,* and *downstream*. Within the Indian Ocean Region (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 sea lines of communication (SLOCs) and pipelines; and the primary refining, storage, and re-distribution nodes that are vital to the region's economic productivity, particularly that of the developing states.

Following an initial section that summarizes the state of oil and gas reserves in the IOR in order to reaffirm their global strategic value, the purpose of this chapter is to offer a series of examples of key evolving industry activity within the region, highlighting the huge impact of petroleum as a defining politico-economic driver for the wider Indo-Pacific maritime realm. These cases will be drawn from three major industry sectors as indicated above.

In the *upstream* sector, examinations will be made of: the planned expansion of oil production in Iraq and the evolution of Basra as a major regional petroleum exporting node; the addition of significant upward revisions of Iraqi and Iranian 'proven' reserves; exploration and production in the Timor Sea; and Chinese and Indian competition over Myanmar's offshore gas fields.

The *midstream* sector will assess the status and significance of primary export terminals in the Persian Gulf, amidst extant security issues regarding these facilities and petroleum shipping in the region. It will also examine the strategic impact of the planned crude oil pipeline across the United Arab Emirates from Habshan to Fujairah, which offers an export alternative to tanker shipments through the Strait of Hormuz.

In the *downstream* sector, an examination of the current and future regional importance of Singapore as a *petroleum gateway* will be given, amidst the possible implications of the potential development of the Kra Isthmus Canal, which would effectively constitute a 'Malacca bypass' for petroleum trade from the Indian Ocean to the Pacific.

The chapter concludes with an outlook for the petroleum industry activity in the IOR out to 2030.

Figure 6.1: Proven Oil and Natural Gas Reserves in the Indian Ocean Region

Country	Oil [BBL]	Percent of global total	Gas (TCM)	Percent of global total
Saudi Arabia	688.9	19.8	7.46	3.92
Iran	137.6	10.3	29.6	15.57
Iraq	115.0	8.6	3.17	1.67
Kuwait	104.0	7.6	1.79	0.95
UAE	97.8	7.3	6.07	3.19
Qatar	25.4	2.0	25.47	13.39
Sudan	6.8	0.5	0.85	0.04
India	5.8	0.5	1.07	0.57
Oman	5.5	0.4	0.85	0.45
Malaysia	5.5	0.4	2.35	1.24
Egypt	4.3	0.3	1.66	0.87
Australia	4.2	0.3	3.12	1.64
Indonesia	4.05	0.3	3.00	1.58
Yemen	3.00	0.2	0.48	0.25
Timor-Leste	0.55		0.20	0.11
Pakistan	0.44		0.84	0.44
Thailand	0.43		0.342	0.18
Bahrain	0.12		0.09	0.05
Myanmar	0.05		0.28	0.15
Bangladesh	0.02		0.12	0.1
South Africa	0.015		0.002	0
Israel	0.001		0.03	0.02
Jordan	0.001		0.006	0
Tanzania	0		0.0065	0
Somalia	0		0.0056	0

Key states with significant reserves of oil and/or gas are marked in red, while those with important reserves are marked in orange.

Source: BP Statistical Review of World Energy, June 2011

Petroleum Reserves in the IOR

Petroleum exists in abundance in the IOR. Crude oil and natural gas remain unquestionably the most important raw material exports from the region. In short, the global economy would not function without them. Much has been written on the nature and productivity of the largest reserves, and thus supplemental commentary and analysis here is not required; however, Figure 6.1 provides a capture of the state of proven reserves of oil and natural gas in the IOR.

When viewed in an aggregated sense, the total oil and gas reserves held by IOR states as a percentage of the entire world's proven reserves are impressive: IOR states have more than 58 percent of the world's proven reserves and more than 46 percent of gas reserves. When one considers these facts and the inescapable importance of the SLOCs in the Indian Ocean connecting Asia, Europe, and Africa for the conveyance of petroleum, the significance of the IOR to the rest of the world is startling.

Upstream Sector

Expansion of Iraq's Crude Oil Production

In October 2011, the Iraqi oil ministry stated that the country crude oil output would reach 3-million barrels per day by the end of the year. This increase would enable Iraq to boost its exports to some 2.5-million barrels per day by the beginning of 2012, in line with its project to expand the handling capacity of its offshore loading terminals ABOOT and KHAOT. Essentially, this development would mark the first of many milestones in the country's long-term plan to massively increase crude production to 12-million barrels per day by 2017. This overly optimistic target is very unlikely to be attained, however, and more sober predictions suggest total volumes of nearer 8-million barrels might be achievable in the early part of the next decade. Nevertheless, the scale of the project has attracted many of the world's most important international and national oil companies.

The entire future of Iraq's petroleum politics hangs on the successful adoption of the Iraq Hydrocarbon Law, a proposed piece of legislation submitted to the Iraqi Council of Representatives in May 2007. The law confers authority on the government to distribute remaining oil revenues throughout the country on a per-capita basis, and would enable the provinces freedom to award production contracts to foreign companies without central government involvement.[1] Since its introduction, however, the legislation has been mired in disagreement over the ability of the three main segments of Iraq's population—Sunnis, Shiites, and Kurds—to negotiate contracts autonomously and decide upon an equitable distribution of revenue.

Interim Technical Sharing Agreements (TSAs): Paving the Way to Greater Production Volumes

At the end of 2010, the Iraqi government had awarded 12 oil-service contract TSAs and three gas licenses as part of its extended plan to boost production. Of these, the most significant deal involves a joint BP-CNPC project to boost capacity from the giant Rumaila field to 2.85-million barrels a day from its current level of 1.07-million barrels a day.[2] BP has said

Rumaila may become the world's second- largest producing field by 2015, which will likely transform Basra into one of the most important petroleum production and export nodes in the Persian Gulf. Indeed, once production has been boosted across all of the other major fields in southern Iraq (such as the West Qurna-1), Basra, and the associated production and expanded oil- and gas-exporting infrastructure will likely constitute a major new 'petroleum gateway' in the Middle East.

The other major project being headed by foreign companies is the ExxonMobil/Shell-led partnership to develop the West Qurna-1 oil field, also in the south of the country. ExxonMobil and Shell initially didn't secure the deal earlier in June 2009 because they rejected the maximum production remuneration fee of $1.90 a barrel set by the oil ministry. However, in October 2009, ExxonMobil and Shell, along with Lukoil and CNPC, capitulated and accepted the offer, calculating that to be involved even under these disadvantaged terms was better than having no access at all to this major Iraqi reserve. The consortium has announced that it will raise production to 2.325 million barrels a day in seven years from the current 270,000 barrels per day.

Expansion of Iraqi and Iranian Reserves

In October 2010, Iraq's oil minister, Hussain al-Shahristani, announced that the country's proven "extractable" oil reserves had risen to more than 143-billion barrels,[3] representing a significant rise on Iraq's previously stated reserves of 115-billion barrels, a figure that had been consistent for nine years. Perhaps not surprisingly, in the same month the Iranian oil minister, Masoud Mirkazemi, announced that because of the discovery of a new oil layer containing approximately 34-billion barrels of oil in the Ferdowsi gas field in the Persian Gulf, the country's proven oil reserves had now increased to 150.31-billion barrels.[4]

Iraq's action was intended largely to send a signal to the rest of OPEC that Iraq would need a greatly expanded daily quota, in line with the country's project to greatly expand the country's production through the revitalization of its major oil fields in partnership with outside international oil companies (IOCs) and national oil companies (NOCs) through to 2016. Iraq has been exempt from OPEC's quota protocols since Saddam Hussein's invasion of Kuwait in 1990. However, this situation would inevitably become untenable in the event its output grew discernibly above its current level to the level where output volumes could depress prices. OPEC's secretary general, Mr. Badri, stated that an Iraqi production of 4- to 5-million barrels per day would "trigger that discussion of how to accommodate them in any future quota agreement".[5] This is precisely the kind of statement that the Iraqi government wanted to hear, as it reflected a renewed recognition of Iraq's geopolitical petroleum status as a top world reserve-holder and producer.

Given the international pressure that Iran is under due to sanctions and its stand-off with Western powers over its nuclear program, a reciprocal announcement was almost inevitable.[6] This utilization of the political value of a state's oil reserves is a shining example of how a government can convert the latent geopolitical value of 'new' expanded reserves (that might not be in production) into usable geopolitical influence. The effects of this can be seen at an inter-state level—in Iran's long-term brittle, competitive relationship with

Iraq—and at a multilateral level, where Iran must assert itself sufficiently within OPEC to ensure its continued influence among other major producers.

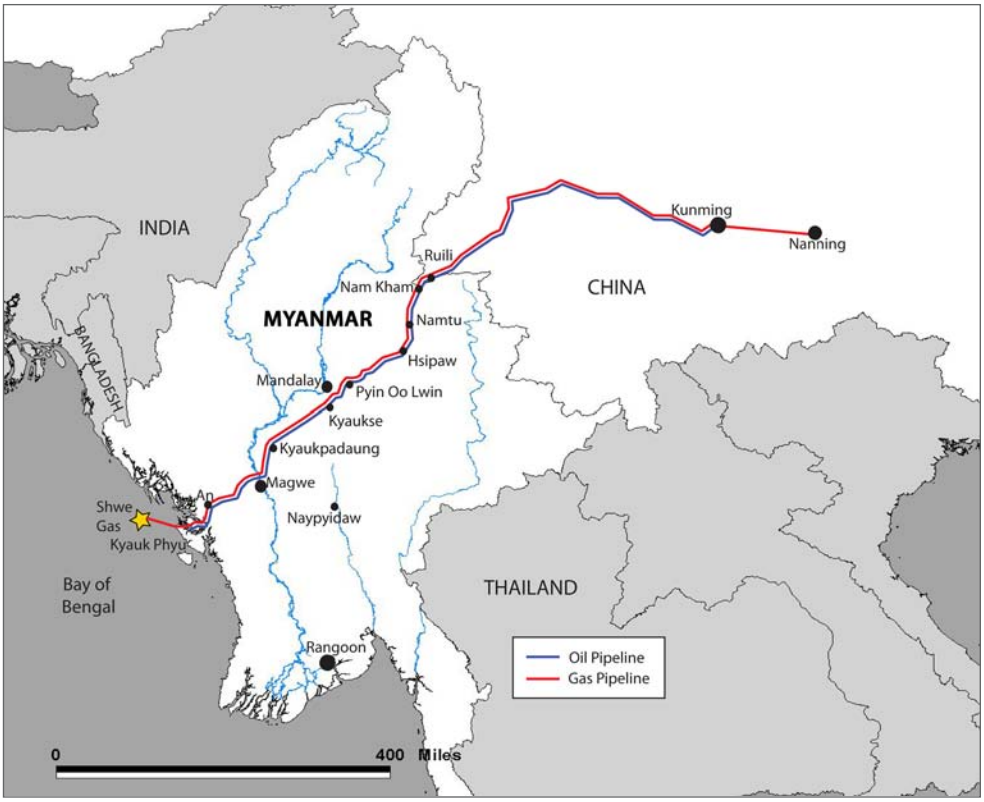
Exploration and Production in the Timor Sea

The seabed beneath the Timor Sea, which lies adjacent to the Arafura Sea between East Timor and northern Australia, contains substantial petroleum reserves. Between them, Blacktip, Petrel/Tern, Evans Shoal, Bayu-Undan, and the Greater Sunrise fields have an estimated recoverable 17.62-trillion cubic feet (Tcf) of natural gas. The undeveloped Greater Sunrise field alone has estimated recoverable reserves of between 5.12 and 7.7 Tcf of gas, and more than 226-million barrels of condensate.[7] Though there are currently only a few oil fields in production, crude reserves are also estimated to be substantial. The scale of these important deposits has attracted large-scale interest and investment from international oil companies, notably in the production of natural gas and liquid natural gas (LNG).

Currently, oil production is underway at the following fields: Challis/Cassini, Corallina, Elang/Kakatua, Jabiru, and Laminaria. However, oil has been discovered in more than 16 other prospects. The only gas field currently in production is the large Bayu-Undan structure, which has estimated recoverable reserves of some 3.4 Tcf. Gas from this field is transported by pipeline to Darwin, where it is converted into LNG and shipped mostly to Japanese power companies under long-term contract. Darwin LNG currently produces 3.5-million tons per annum, but there are plans to greatly expand Darwin's production trains and exports as more gas fields in the Timor Sea come into production during the current decade.[8] Aside from Bayu-Undan, there are some 30 other gas and condensate plays in this strategically vital part of the eastern Indian Ocean.

Discovered in 1974, the massive Greater Sunrise field, which has yet to be developed, will become the single-most important petroleum project in the Timor Sea once it is in full-scale production. Product from the field could generate more than $40 billion in revenue over its projected 30-year lifespan.[9] However, this project (which will be produced jointly by Woodside, ConocoPhillips, Shell, and Osaka Gas) has been stalled due to complications derived from a dispute between East Timor's government and the consortium leader (Woodside) regarding how the gas and condensate from the Sunrise and Troubadour fields will be processed. The fields lie in the 'Joint Development Petroleum Area' (JPDA), located in a region that straddles Australian and East Timor EEZs, and the consent of both governments concerning the project's operations is essential before production can start. Essentially, the Timorese government wants the gas and condensate flow to be conveyed ashore to East Timor via subsea pipeline, from where it will be processed and re-exported as LNG and other products. Clearly, this would require a massive influx of foreign direct investment (FDI) to the country to build the liquefaction, storage, and loading facility, and it would generate considerable local employment, and be a massive boost to the country's economy. The Woodside-led consortium wants the gas to be processed offshore using a pioneering floating LNG (FLNG) vessel currently under development by Shell. Woodside has rejected the Timorese-favored option, in part because they argue that laying a pipeline would be economically and practically prohibitive due to the 3,300-meter trench that lies in the projected pipeline routing.[10]

Figure 6.2: Proposed Myanmar-China Oil and Gas Pipelines



Source: Shwe Gas Movement, http://www.shwe.org

Though this project remains stalled as of early 2012, the wider importance of this petroleum-rich area of the Indian Ocean—which also constitutes a vital sector for Australasian shipping lanes—has ensured that the region has become of considerable strategic importance to the Australian and US governments. In November 2011, President Obama announced a US-Australia agreement that would see as many as 2,500 US Marines, and other naval and combat units stationed on a rotating basis at Australian bases in Darwin. Aside from the strategic importance of the Timor Sea for the reasons described above, this development was widely viewed as a US move to address growing Chinese military presence and strength in the South China Sea. Nevertheless, as the volume of gas exports to Asia grows, this previously quiet part of the Indian Ocean will become of increasing strategic focus for regional powers as well as for international and national oil companies.

Chinese and Indian NOC Competition for Offshore Gas Fields in Myanmar

For India and China, the prospect of gaining access (exclusive or otherwise) to Myanmar's significant reserves of natural gas is an energy security and geopolitical phenomenon of intriguing complexity. It fuses the reality of fierce competition over potential access to an estimated 21-trillion cubic feet of natural gas with the establishment of a strategic energy supply close to areas where it is needed.[11] All this occurs amidst wider geopolitical and

geo-strategic issues, specifically: Chinese commercial and trade access to the Indian Ocean; the implications of China reducing its reliance on tanker shipping transiting the Malacca Straits; and India's drive to strengthen its strategic influence over an oceanic space that it regards as a vital sphere of influence.[12]

Though other deposits have yet to be uncovered off the coast of Myanmar, and the final volume of its total proven reserves of natural gas have yet to be determined, the site for arguably the most intense contest between India and China for upstream access to foreign reserves to date are the fields of the Shwe project, which are estimated to contain some 9.1-trillion cubic feet of gas deposits.[13]

Following conclusively successful appraisal drilling in the Shwe structure in 2004 and 2005, India's ONGC Videsh and GAIL acquired 20-percent and 10-percent interests in the A-1 and A-3 blocks in the Shwe field, respectively. The other consortium partners were Korea's Daewoo, the project leader with a 60-percent stake, and KOGAS, with a 10-percent share. India had hoped that it could turn this exploration and production (E&P) success story into an important strategic gas supply stream for the country by transporting its share of the gas via a 960-mile pipeline from Myanmar to India. However, in mid-2006, as plans for the $3-billion pipeline were being considered by the Indian NOCs in concert with the Junta, PetroChina managed to sign a memorandum of agreement with Myanmar's government for exclusive rights to 6.5-trillion cubic feet over 30 years.[14] Indian diplomats only found out about the deal after it had been negotiated. In an ironic twist, this essentially means that if the Chinese managed to secure exclusive purchase rights, the Indians (along with their Korean partners) would end up having to produce gas to sell to their rival. On the one hand, that could be viewed as a reasonable business deal. On the other hand, however, this was a major setback, as India had viewed its acquisition as a source to fortify its own energy security. This subsequently prompted an Indian presidential visit to Burma in March 2006, which included the signing of additional gas sales to India.

In September 2007, the then–Indian Minister of Petroleum and Natural Gas, Murli Deora, reinjected fresh impulsion into India's quest to secure additional upstream access to Myanmar's offshore gas by witnessing ONGC Videsh's signing of a $150-million, seven-year deal for three deep-water blocks off the Arakan coast. This success came soon after the realization that the planned scheme to develop the Iran-Pakistan-India gas pipeline (IPI) had stalled once again, thereby prompting the government to urgently seek additional sources elsewhere. Unfortunately, given the obstacles to building the proposed Myanmar-Bangladesh-India gas pipeline, any equity gas India's NOCs may have in Myanmar still remained effectively 'stranded' in terms of their utility for India itself. Put another way, though India is seemingly making up for earlier losses to China, if the Chinese manage to secure exclusive rights to buy the gas from the Shwe field (which is then transmitted to China via their own proposed 560-mile gas line to the Chinese-Myanmar border), then this remains a net strategic loss for India.

Underlying India's economic and energy interests in Myanmar is a desire to counter China's growing influence in the country, and, if possible, regain some measure of influence over the volumes and destinations of these important gas reserves. Arguably, the Shwe project can be seen as a microcosm of the contest for resources and political influence in the region

between Asia's two rising powers. However, at this juncture, China is winning in the contest for access to Myanmar's gas. It is aptly demonstrating the significant geopolitical advantage it possesses in having an unobstructed common-land border with Myanmar, as well as exercising its clearly stronger diplomatic influence over Myanmar's government juxtaposed to that of India's.

Midstream

Major Persian Gulf Export Terminals and Crude Trade to Asia

This section examines the crude oil trading dynamics and imperatives from the Persian Gulf and Arabian Peninsula with the primary markets in Asia. The production and exporting of crude oil from this maritime space constitutes arguably the most intensively scrutinized and important feature of systemic petroleum conveyance at a global level. In this sense, the trade of these resources is a major factor in determining important features of the petroleum geopolitical ontology of the Indo-Pacific maritime realm. From the point of view of the economic security of the producer countries in this space and the energy security of the major consuming powers in Asia (in particular China, Japan, and India), there is no more important single factor than the unimpeded export of crude oil from Iran, Iraq, Kuwait, Saudi Arabia, and the United Arab Emirates (UAE).

Saudi Aramco's terminals handle more than 3,000 tanker loadings per year. Aramco terminals are located at Ras Tanura and Ju'aymah on the Arabian Gulf coast, and at Jiddah, Rabigh, Jaizan, Yanbu, and Duba on the Red Sea coast. However, it is the significant dominance of Ras Tanura and Ju'aymah in terms of loading and export capacity that sets them apart. The two terminals alone account for more than 32 percent of total crude exports by sea from the region, and almost 90 percent of Saudi Arabia's annual exports of crude oil. This pivotal concentration of export capacity renders these Saudi terminals arguably the two single-most important crude oil export facilities in the world. Between 1999 and 2009, average global consumption of oil stood at approximately 81 million barrels of oil per day, representing an average annual consumption of some 29.57 billion barrels.[15] Of this, Ras Tanura and Ju'aymah alone account for 1.3-billion barrels, or 4.4 percent.[16]

If Saudi Arabia is the cornerstone of oil supplies to the global market due to the scale of its daily output, then Ras Tanura and Ju'aymah, the two largest crude terminals in the world, are the linchpins of the kingdom's export infrastructure. As much as 80 percent of the approximately 10-million barrels of oil (average: 1999-2009) produced by Saudi Aramco every day is piped from fields such as Ghawar to the processing facility at Abqaiq, which feeds processed crude to the massive tank farms and refinery at Ras Tanura.[17] The Ju'aymah terminal is also fed from Abqaiq. There are six Single Point Moorings (SPMs) at Al Ju'aymah, which combined have a nominal loading capacity of up to 6-million barrels per day.[18] VLCCs and ULCCs bound for the major refineries in China, Japan, South Korea, India, Singapore, Europe, and the United States load approximately 1.3-billion barrels of oil each year at Ras Tanura and Ju'aymah.[19]

These facilities are thus *de facto* the most vital single terminals for the crude oil supply-security for many leading Asian and Western states. Indeed, were the terminals to be put out of commission, the impact upon the global oil market would be severe in the extreme, given that the pipeline capacity within Saudi Arabia is currently insufficient to divert the terminals' output to the kingdom's primary Red Sea terminal at Yanbu. Currently, the 1,200-kilometer 'Petroline' that links oil sourced from the Ghawar, Abqaiq, and Hawtah fields only has a capacity of 5-million barrels per day (MBD).[20] Furthermore, the terminal at Yanbu does not have sufficient loading capacity nor can it accommodate the necessary VLCC turnaround, even if the pipeline capacity was sufficient to redirect the required 179-million barrels per year.

The security considerations regarding Ras Tanura and Ju'aymah are clear on two fundamental and interrelated levels. The significance of the terminals' annual export capacity—as proportions of both Saudi and regional export totals, and also as a percentage of annual global oil consumption—is inescapable. This strategic-level appreciation has clear implications for the crude oil supply security (and thus the national energy security) of a number of dependent states around the world, including major Western powers, the Asian 'Tiger' economies, and Asia's rising powers. As a result, the strategic-level appreciation is intrinsically linked to the operational-level security of the terminals themselves.

In particular, Ras Tanura is a highly attractive terrorist target, due to its conspicuous, isolated, and vulnerable Sea Island terminal structures, its proximity to the shoreside tank farms on the Ras Tanura peninsula, and its larger output.[21] It is estimated that 10 percent of global oil supplies are loaded onto VLCCs at the terminal every day. Furthermore, it has been estimated that a major strike against Abqiaq and Ras Tanura could remove as much as 50 percent of Saudi Arabia's export capacity.[22] This somewhat alarmist estimation by some commentators is difficult to corroborate. Nevertheless, given the enormous output and handling capacity of these facilities, the point is made. Given the history of conflict in the Persian Gulf region and its status as a shatterbelt, in the event of an inter-state war involving Saudi Arabia, the terminals would also be clearly important strategic targets, in the way that Iraq and Iran's major terminals were targeted during the Iran-Iraq War to disrupt oil exports.

Providing comprehensive security for the facilities—both in terms of continuous threat intelligence, and sufficient practical security in the form of protective naval patrols and defences—is therefore of paramount importance not only to the kingdom itself, but also to key dependent consuming states and the stability of the global oil market. It is in part for this reason that Western-led naval coalitions, such as Combined Task Force 152, maintain a continuous presence in the Persian Gulf. Notwithstanding the considerable strategic reserves of oil in the US, Europe, and parts of Asia, the tight supply-demand balance of the contemporary petroleum age means that any prolonged interruption of supply from either or both of these terminals (particularly Ras Tanura) would have considerable repercussions for the oil market and potentially for macroeconomic stability.

Iranian, Kuwaiti, Omani, and UAE Terminals

Kharg Island in Iran, Jebel Dhanna Terminal in the UAE, and Kuwait's Mina al Ahmadi constitute the second tier output terminals in the region, with a combined export output representing 28.11 percent of the region's total.[23] Though Saudi Arabia's maritime export capacity tends to overshadow that of other producers in the region, it can quickly be seen that even if the total maritime export capacity of Iran, the UAE, and Kuwait individually were to be compromised, the effect on dependent countries and the market-volume/price dynamic would be considerable.

Oman's Mina al Fahal terminal is an important facility for geographical reasons. Though Oman's crude output will decline faster in real terms than the other main producers, it is currently the only high-capacity crude terminal in the Arabian Sea located outside of the Straits of Hormuz. (The UAE currently is developing a 1.8 MBD, 360-kilometer oil export pipeline from Habshan to Fujairah, which is expected to be completed in 2012 [see "The Habshan-Fujairah Oil Pipeline" section].)[24]

Lastly, the Al Basra Oil Terminal (ABOT) in Iraq—the country's main maritime export facility, which became the most closely protected terminal in the world following the unsuccessful terrorist strike against both Iraqi terminals by an Al-Qaeda in Iraq (AQ-I) cell in April 2004—will become the focus of expanded regional export capacity in the coming years, as Iraq begins the gradual process of expanding its daily crude production.[25] It is intended that export capacity from the Iraqi terminals will be significantly boosted in order to accommodate increased production capacity from Iraq's major southern oil fields, specifically the north and south Rumaila, west Qurna, and Zubair fields between 2010 and 2016. These terminals will render Basra a major regional petroleum gateway once production has expanded significantly.

The Habshan-Fujairah Oil Pipeline

Due to be completed in August 2012, the Habshan–Fujairah oil pipeline's purpose is ostensibly to provide an additional means of exporting crude oil from the Persian Gulf, by bypassing the Strait of Hormuz. UAE officials have suggested that the line is being built to ensure security of exports from the UAE, in case hostilities with Iran compromise freedom of navigation through the strait.

The 360-kilometer long, 48-inch pipeline starts at the 'Habshan' onshore oil field in Abu Dhabi, and will have an initial capacity of 1.5 MBD of crude, rising eventually to 1.8 MBD. The pipeline is being built by China Petroleum Engineering & Construction Company at a cost of $3.29 billion. Aside from its strategic value, it is thought the pipeline will eventually totally transform Fujairah into an 'Energy Special Zone' with extensive crude oil refining facilities, storage tank farms, and petrochemical plants.

The pipeline will eventually supply a planned 300,000-barrels-per-day oil refinery, as well as the Zone's crude oil export terminal. Some UAE officials also have suggested the desire to convert Fujairah into a 'small Rotterdam' of the region. According to the US Energy Information Administration (EIA), approximately 17 MBD of crude oil is transported through the Strait of Hormuz each day (roughly 20 percent of the daily crude oil produced

worldwide). It is estimated that the Habshan-Fujairah line has the capacity to carry almost 10 percent of what passes through Hormuz in any given year. Clearly, this volume does not fundamentally diminish the oil export significance of the Strait of Hormuz, and indeed a mass of other vital trade and warships must also pass through the chokepoint. Nevertheless, its significance as an 'insurance policy' is clear. Moreover, as the project evolves, it is conceivable that an additional line could be built (and storage capacity increased) as the region assesses the significance of this 'Hormuz bypass' to the Gulf's economic and geopolitical security.

Downstream Sector

Singapore as a 'Strategic Petroleum Gateway'

Singapore is arguably the best example in the world of the confluence of petroleum processing, mass oil storage (including distillates and petrochemicals), tanker loading capacity, distribution coverage, and ideal geographical location. Simply put, it is the most vital petroleum hub in southeast Asia, rendering it an ideal example of what I refer to as a 'strategic petroleum gateway.' That said, Singapore faces increasing competition from new, large facilities in the Indo-Pacific Maritime Realm, such as Jamnagar on India's northwestern coast.

A strategic petroleum gateway derives its status from six key factors:

- Strategic location at an oceanic trading crossroads (e.g. the Malacca Straits);
- The scale of its VLCC and product tanker discharging and loading terminals;
- Massive refining throughput;
- Very large oil storage capacity (crude, distillates, and petrochemicals);
- The existence of a international financial and petroleum trading market; and,
- A region-wide tanker distribution network for distillates and petrochemicals.

In 2004, the Singaporean government made clear its plans to maintain and boost its status with storage expansions, and announced studies into how to transform the country into an LNG hub to complement its oil processing, trading, and distribution capacity. Currently, with more than 70 production and storage companies, Jurong Island is now recognized as one of the world's major oil and petrochemical nodes, and the site of one of the world's top three refining centers, after Rotterdam and Houston. Singapore is also the third largest oil-trading center in the world, after New York and London.[26]

Singapore's Geo-strategic Location

Today, Singapore remains the world's most important single waypoint in the maritime conveyance of crude oil. In 2002, the continuous stream of VLCCs transiting via Singapore from the Indian Ocean to the South China Sea en route to China, Japan, and South Korea

equated to more than 11-million barrels of oil passing through the straits each day (some 32 percent of total global oil trade). By EIA estimates, this volume could reach as high as 24-million barrels of oil per day (37 percent of the global oil trade) by 2030.[27] Currently, VLCCs transport up to 80 percent of China's annual crude imports via the Malacca Straits and Singapore.[28]

Oil Imports, Refining, Storage Capacity, and Distribution

In 2009, Singapore imported 2,598,000 barrels of crude oil and products per day and exported 1,552,000 barrels per day, most of which were refined products, indicating the remainder was crude feedstock for the refineries.[29] Singapore has a total crude oil refining throughput capacity of approximately 1.3 MBD. The country's three refineries are: ExxonMobil's Jurong/Pulau Ayer Chawan facility (605,000 MBD); Royal Dutch Shell's Pulau Bukom complex (458,000 MBD); and, the Singapore Petroleum Company's (SPC) Pulau Merlimau refinery (273,600 MBD).[30]

Viewed cartographically, the pattern of product and chemical tanker trade conveying the fuels and petrochemical products listed above appears as a series of spokes, radiating outward from Singapore along SLOCs through much of the Indo-Pacific Maritime Realm to many of the major petroleum-capable ports and terminals in the aforementioned maritime space. Currently, tankers link the refineries and terminals in Singapore with product and distillate-configured oil discharging terminals in Australia, Bangladesh, Brunei, China, East Africa, Hong Kong, India, Indonesia, Japan, Malaysia, Pakistan, Philippines, South Africa, Sri Lanka, Taiwan, Thailand, and Vietnam.[31] Many of these countries, including Australia, are heavily dependent upon Singapore as a source of all grades of distillates and petrochemicals. However, the geopolitical reach of Singapore's role in the petroleum industry extends even further than the tanker network's already considerable coverage, due to Singapore's status as a hub of for the electronic trading of crude oil and refined products between traders all over Asia. This extraterritorial 'virtual trading' enables Singapore also to influence those petroleum markets that it is not physically connected to by SLOCs and tankers.

Terminals and Storage

Aside from its considerable refining capacity, Singapore's virtually unparalleled status as the most important petroleum hub in Asia is derived from its deep-water loading and discharging terminals for VLCCs and product tankers, and also from its vast oil storage capacity. The three major oil refineries hold 88 million barrels of combined storage capacity (88 percent of the country's total), while Singapore's independent storage operators possess a further 24.4-million barrels of capacity.[32]

Several projects are underway to expand Singapore's storage capacity, and ensure its continued dominance in this regard. The most significant is the construction of the new joint Hin Leong/PetroChina Universal Terminal on Jurong Island. In November 2007, the 2.3-million cubic-meter capacity Universal Terminal, now acknowledged as the largest commercial oil storage terminal in Asia, received its first test cargoes of fuel oil and distillates.

Conclusions and Future Realities for Singapore and the Region

Notwithstanding the country's long-held and continued primacy as a strategic petroleum processing node and conveyance gateway, there are some actual and putative developments evolving in the Indian Ocean and western Pacific realm that will likely alter the pattern of crude and product trade as it concerns Singapore. Aside from the growth in capacity and versatility of the Reliance refinery complex at Jamnagar (India), competition for markets and trade is maturing in Malaysia (with its Melaka refinery), and Thailand has also demonstrated intentions to expand its influence and capability as a refining and distribution hub with the recent completion of its Sri Racha oil center. The latter facility is still disadvantaged geographically compared to Singapore and, for the time being, is disadvantaged in terms of its throughput capacity as well. However, Sri Racha, Jamnagar, and the new and expanded facilities in Saudi Arabia could benefit tremendously if a planned $20-billion Kra Isthmus Canal is built.[33]

Though it is far from certain that the Kra Isthmus Canal will ever be constructed—particularly given its likely staggering cost—it is an intriguing possibility that would transform the petroleum trading and geopolitical map of Asia. In effect, the canal constitutes a 'Malacca bypass', which would shorten the passage from the eastern Indian Ocean to the western Pacific Ocean by some 700 nautical miles.[34] In tanker shipping terms, this would mean that VLCCs and product tankers could steam from the Persian Gulf and from the refinery at Jamnagar directly to the massive markets in China, Japan, and South Korea without transiting via the Malacca Straits and Singapore. This has several economic, logistical, and security implications. A shortened passage would significantly reduce time, charter fees, and bunker costs. Also, such a bypass could effectively neutralize security concerns in the Straits, such as a surge in piracy attacks, a high-consequence terrorist incident, or blockade in the event of a major war.

Clearly, the possible future development of the canal would have considerable economic implications for Singapore, including: lost transhipment dues; decreased bunker sales (Singapore is still the world's largest single vessel refuelling point); lost refining business; reduced oil storage volumes; and, an inimical impact upon locally based product tanker charters. However, as of early 2012, the Thai government has several reasons to delay moving forward with the project, such as its enormous price tag, significant engineering challenges, the need for diplomatic and commercial convergence with Malaysia, and uncertainty regarding the canal's security implications given radical Muslim militant activity or a wider insurgency in Thailand's southern reaches. Singapore, for its part, will be relying on these geopolitical, financial, and security obstacles to delay or totally stymie development, thereby creating a window for it to consolidate its petroleum gateway status and capacity.

Indian Ocean Petroleum Outlook to 2030

The petroleum industry activity in the Indian Ocean for the next two decades will be dominated by two key features: increasing Asian- and developing-country reliance on OPEC production from the Persian Gulf exporters; and, the evolving importance of upstream activity in frontier regions in the IOR, particularly for natural gas and condensate. However, in the midstream and downstream sectors, there will be modifications in volume and patterns of conveyance, and in refining capacity nodes.

Precise levels of crude production output, fluctuation, and growth from Saudi Arabia, the UAE, Iran, Iraq, and Kuwait are complex, if not impossible to predict out to 2030. However, what is certain is that the Asian developing nations and powers will be increasingly reliant on this source as a share of their petroleum energy requirements. This will be reflected in the growth of their NOC involvement in the region, a likely increase in their geostrategic interest in the Gulf, and heightened military commitments in the area—particularly in the form of Chinese and Indian naval task groups, and joint military exercises with (and support for) major Gulf producing states. There will be considerable growth in Iraqi crude output, and a strong likelihood of increasing gas pipeline exports to Europe and the country's first LNG terminal at Basra. An eventual change in the Iranian government to one far more inclined to constructive regional and international cooperation will likely result in a surge in FDI from both Western IOCs and Asian NOCs, enabling Iran to greatly boost its crude production from its massive but dilapidated fields, and pursue the long-awaited development of its LNG production potential from its giant South Pars field. Meanwhile, an increase in infrastructure development at Ras Laffan in Qatar would also likely boost that country's LNG export capacity, largely due to demand from Chinese electrical power companies.

Upstream developments in the frontier regions will be characterized by the growth of projects and investment in the following areas: the Timor Sea; all along the east African littoral (including Seychelles); LNG exports from Mozambique to Asian markets; India's offshore territory in the Bay of Bengal (most notably in the Krishna-Godavari Basin); and growth in Myanmar's offshore gas production. Meanwhile, evolution in the midstream and downstream sectors will be dominated by increased Indian crude and natural consumption and its widening refining output; challenges to Singapore's preeminence as a refining and distribution hub; an increase in Hormuz bypass export capacity across the UAE and Saudi Arabia; and the conveyance of oil from Sudan (and possibly Uganda) to the Indian Ocean via pipelines to the Kenyan coast.

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Chapter Seven

Natural Resources in the Indian Ocean: Fisheries and Minerals

David Michel, Halae Fuller, and Lindsay Dolan

The Indian Ocean 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. The most commercially viable industries are fisheries and minerals. This paper will outline the current status of exploitation, emerging and existing trends, the future implications of these trends, and various legal and governance regimes that have sought to manage resource development in the region.

The Current Situation

Fisheries

Commercial and artisanal fisheries sustain the livelihoods of more than 38 million people worldwide.[1] In the Indian Ocean, fish production increased drastically from 861,000 tons in 1950 to 11.3 million tons in 2010. But while other world oceans are nearing their fisheries limit, the United Nations Food and Agriculture Organization (FAO) judges that, in certain areas, the Indian Ocean's resources have the potential to sustain increased production.[2]

The countries of the east Indian Ocean represent a significant proportion of world fisheries, although most commercial and artisanal activity takes place in coastal zones rather than in deep water.[3] The east Indian Ocean is home to 45 percent of the world's fishers and brings in catches of 7 million tons of fish per year, or 8 percent of total world fish production. Most of this catch is harvested close to shore, placing so much strain on coastal stocks that fishers have been forced to venture further out to sea and even into the exclusive economic zones (EEZs) of neighboring nations. Even so, this trend of fishing far from shore is still in its early stages. Deepwater catches represent less than 6 percent of total catches in Indonesia and 10 percent in Malaysia, for example.[4] Given the overexploitation and overcrowding of coastal fisheries, deepwater fish stocks represent a potential new frontier for commercial and artisanal fisheries in the region.

The west Indian Ocean is also characterized by overfishing and growing exploitation of deepwater fisheries.[5] From 2000 to 2001 alone, total catches increased by 2.2 percent, representing a 10.6 percent increase over the previous decade.[6] Most of this change has been driven by the increasing exploitation of deepwater fisheries by non-littoral states such as Spain, Taiwan, Japan, France, and Uruguay.[7] Due to the overfishing of coastal stocks, many west Indian Ocean countries plan to expand their semi-industrial and industrial national

fleets to new fishing grounds in their EEZs. According to the FAO, most southwest Indian Ocean countries' fisheries have the potential to contribute a larger percentage of littoral states' GDP.[8]

The northwest Indian Ocean region has witnessed concerted government efforts to promote the fisheries industry, yet suffers from an overall lack of fisheries management.[9] Many countries in the region offer subsidies to fishers in order to boost development. The results have been mixed, however. Despite significantly increased fishing since 1990, actual catches have grown by only 12.3 percent. Catch limits are rare. Where they do exist, limits generally apply only to industrial fisheries, not the artisanal fishers who made up 80 percent of reported landings in 2002. The absence of sustainable fisheries management policies and declining stocks have reduced both commercial and artisanal fisheries in the northwest Indian Ocean. In addition, oil fires and weapons debris have polluted the ocean in this conflict-prone region, further degrading its fisheries.[10]

Australia is unique among the countries in the Indian Ocean region in that it has developed strict management controls and limits the exploitation of its fish stocks, resulting in a healthy fisheries industry.[11] From 2000 to 2001, the total fish catch from the Indian Ocean areas of Australia was 36,290 tons, representing 15.8 percent of the total catch for Australian fisheries. About 651 commercial vessels and 28,000 artisanal fishers operated in Australia's Indian Ocean waters during this period. As a result of successful management policies, the number of fish stocks classified as overfished or at risk of overfishing dropped from 24 in 2005 to 18 in 2008.[12]

Minerals

Polymetallic nodules and polymetallic massive sulphides are the two mineral resources of primary interest to developers in the Indian Ocean. Polymetallic nodules are golf-to-tennis ball-sized nodules containing nickel, cobalt, iron, and manganese that form over millions of years on the sediment of the seafloor. Typically found at four to five km in water depth, the nodules must be scooped up and brought to the surface. While polymetallic nodules cover vast plains, polymetallic massive sulphides form in highly localized sites—no bigger than a sports stadium—along hot springs in underwater volcanic ranges. "Massive" refers not to their size but to their mineral content, which contains copper, iron, zinc, silver, and gold. Sulphides are formed when cold, heavy seawater descends deep into the earth's crust and is heated by the magma. When the heated water buoyantly rises to the surface, it precipitates metals from the seawater and concentrates the minerals in deposits beneath and on the sea floor.

India received exclusive rights to explore polymetallic nodules in the Central Indian Ocean basin in 1987. Since then, it has explored four million square miles and established two mine sites. To be commercially attractive, nodule deposits must have a content of nickel and copper of at least 2.25 percent and a nodule density of 10 kg per square meter.[13]

Because of their gold content and greater copper composition, more recent commercial inquiries have focused on polymetallic massive sulphides. In July 2011, China was awarded the right to explore a 10,000 km^2 polymetallic sulphide ore deposit in the Indian Ocean.

Nevertheless, major obstacles have prevented sulphide deposits from being commercially viable in the past. Their local concentration makes finding them particularly difficult.[14] Seafloor deposits also tend to be much smaller than those onshore (seafloor deposits usually are one to five megatons, whereas onshore deposits can reach 50 to 60 megatons).[15] Furthermore, deep-sea deposits, which typically have a 0.2 percent concentration of rare earth minerals, pale in comparison to onshore Chinese concentrations of ore deposits, which can have 5 to 10 percent concentrations.[16]

Other minerals in the Indian Ocean include coastal sediments containing titanium and zirconium off South Africa and Mozambique, and tin placer deposits off the coasts of Myanmar, Thailand, and Indonesia. South Africa is the second largest producer of titanium dioxide and zircon in the world, largely due to its heavy mineral sands.[17] Tin dredged from this area amounts to 10 percent of world production and is worth about $100 million.[18] Elsewhere, heavy mud in the Atlantis II site in the Red Sea contains 94 million tons of ore, including 1.8 million tons of zinc and 425,000 tons of copper. These muds are licensed to Canadian firm Diamond Fields International and Saudi Arabian group Manafa.[19]

Ongoing and Emerging Trends

Population Growth

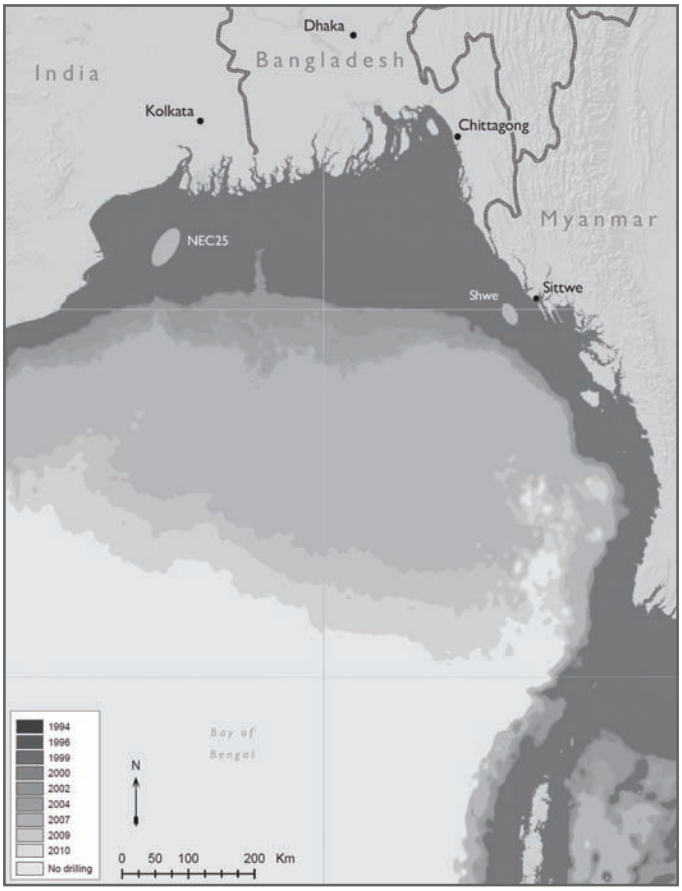
According to the United Nations Environment Programme (UNEP), over the next 30 years more than 6.3 billion people will move to already crowded coastal zones.[20] Such demographic growth has spurred artisanal fisheries in the Indian Ocean. Expanding middle class populations in China and other countries boost the demand for luxury fish such as bluefin tuna and shark fins, driving the overexploitation of those species.[21] A global shortage of fish is projected in the future. The FAO reports that 47 percent of global fish stocks are already fully exploited, while another 18 percent are overexploited.[22]

Environmental Degradation

Rising rates of pollution increasingly threaten Indian Ocean fisheries. Coastal fisheries are particularly vulnerable to agricultural run-off, sewage, and construction. Invasive species have spread as a result of the practice of dumping ballast water from ships.[23] Further, shipping lanes in the Indian Ocean are a main artery of the global energy trade, heightening the risk of oil spills as demand for fossil fuels increases in emerging economies throughout the region.

In 2010, scientists discovered plastic debris in all 12 water samples taken over the 3,000 miles of ocean between Perth, Australia, and Port Louis, Mauritius.[24] Deepwater fishing practices such as bottom trawling have also seriously damaged the ecosystems of continental shelves and slopes by leveling the sea bed, kicking up clouds of sediment, destroying coral, and generating huge amounts of bycatch (species which are swept up in fishing nets but thrown away because they lack commercial value). Meanwhile, fishing gear jettisoned or lost at sea continues to attract and ensnare fish for years after it is discarded—a process known as ghost fishing.[25]

Figure 7.1: Growth of Maritime Territory in the Bay of Bengal Accessible to the Most Advanced Deepwater Drilling Technology, 1994–2010



Source: Jared Bissinger, "The Maritime Boundary Dispute between Bangladesh and Myanmar: Motivations, Potential Solutions, and Implications," *Asia Policy*, No. 10 (July 2010).

Mining activity can also endanger marine organisms. Mining polymetallic nodules substantially disturbs the top few centimeters of sediment, leading to a mortality rate of 95 to 100 percent for macrofauna dwelling in marine tracks. Discharge of waste water from ships mining polymetallic nodules or massive sulphides also poses concerns. When these ships eject seawater after extracting its mineral content, the waste frequently contains trace metals, which interferes with the penetration of light through the top layer of seawater and reduces photosynthesis in surface layers. Temperature differences in the discharged and surrounding seawater also threaten life dwelling in the top layers of the ocean.[26] Sulphide mining machinery and processes alter fluid flows that sustain the ecological community, and it is uncertain whether species would be able to recolonize hydrothermal vents after operations cease.[27]

Technology

Technological advances have considerably increased commercial fisheries catches. Fishing lines can stretch as long as 120 km, and trawlers can cover large distances at high speeds and carry the equivalent of 12 jumbo jets loaded with fish. GPS and radar allow ships to venture into the open ocean and target lucrative fishing grounds with precision. As a result, deepwater fisheries have developed as a new frontier; in 2007, 40 percent of global marine trawling grounds were deeper than the continental shelf.[28]

In recent years, technology has had an even greater impact on the exploitation of mineral resources. Vehicles and machines can now operate in deeper waters than ever before. As Figure 7.1 shows, the amount of accessible seabed territory in the Bay of Bengal over the last 15 years has expanded considerably. Indeed, the Massachusetts-based Woods Hole Oceanographic Institution now has a vehicle that can access depths of 11 km, just one indicator that mining technology will soon follow.[29]

The Nautilus Minerals Solwara-1 project off the coast of Papua New Guinea illustrates the potential of such new technologies. Awarded its 20-year lease in January 2011, the Canadian firm will be the first to commercially mine undersea when the project begins operations in 2013. The technology employed by Nautilus makes use of remote-operated vehicles on the seafloor that crush the ore on the seabed before pipes lift it hydraulically to a surface vessel, which dewaters the ore and pumps the fluid back to the seafloor. The costs of Nautilus's groundbreaking project are expected to amount to $1 billion, a sum of considerable risk given that it invests in areas prone to volcanic activity.[30] But though some analysts suggest that few firms will finance these endeavors, another company, Neptune Minerals, is currently planning mines in the waters off New Zealand.[31] The Solwara-1 project is a positive indicator that technology to mine polymetallic massive sulphides is finally becoming a reality.

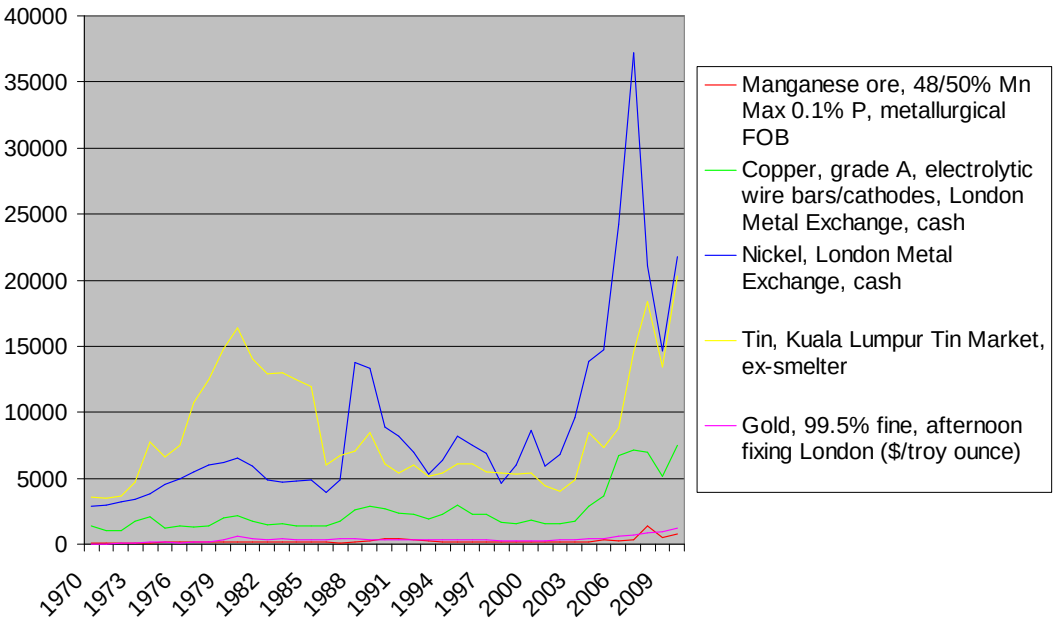
Even so, exploration for seabed minerals faces major hurdles. Only 2 to 3 percent of the global sea floor has been properly mapped, and just 0.0001 percent has been scientifically investigated.[32] Identifying resource sites whose value exceeds comparable onshore counterparts will prove a difficult task requiring ventures with uncertain rewards.

Aquaculture

Techniques for raising fish in captivity have existed for thousands of years. They range from simply attaching a mesh barrier over the outlet of a small river to state-of-the-art commercial fish cages and hatcheries. Artisanal aquaculture sustains many coastal communities, where small-scale fish farmers supplement family diets by raising fish or shrimp. Commercial aquaculture has been gaining ground in recent years, although problems with disease and nutritional value continue to exist when fish are raised in captivity. In spite of these setbacks, technological advances in fields such as biotechnology have spurred the growth of global aquaculture. The portion of fish produced by aquaculture and consumed by humans increased by 42.6 percent from 2006 to 2008 alone.[33]

Recent improvements in technology have opened the possibility of expanding aquaculture to the high seas. In 2009, a team of scientists from the Massachusetts Institute of Technology developed a self-propelled, submersible fish cage that can be moored offshore.[34] Submersible

Figure 7.2: Evolution of Mineral Prices, 1970–2011



Source: UNCTADstat, http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx?sCS_referer=&sCS_ChosenLang=en.

ocean cages are still on the cusp of commercial viability, with doubts persisting about their ability to withstand rough open ocean conditions. Fish farms in North America and Europe have been the first to experiment with ocean cages, but since the Indian Ocean lacks a robust commercial aquaculture industry, it is unlikely that this trend will take root there in the near future.

Risks, Challenges, and Opportunities

Biodiversity Loss

Deep-sea biodiversity, like deep-sea resources, is still an emerging area of scientific study, and relatively little is known about the ecosystem in the deep sea. Estimates of deep-sea biodiversity range from 500,000 to 100 million species.[35] In the oceans as a whole, 10 million species exist, exclusive of microbes. When microbes are taken into account, deep-sea biodiversity is comparable to that of the rainforests.[36]

Marine life arguably offers just as much, if not more, economic value than the mineral resources that surround these species. Species living around hydrothermal vents, where polymetallic massive sulphides form, sustain life in a hostile environment of extreme temperatures and chemical energy. Microbial and prokaryote gene richness in the oceans, particularly in the deep-sea, is orders of magnitude higher than in the rest of the biosphere. Consequently, scientists find that studying the genetic makeup of these species yields unique conclusions about the origins of life on Earth and the potential for life on other planets.

Enzymes from these species are also being used for a variety of DNA-related products and technologies, including fingerprinting technology, and have substantially contributed to pharmaceutical research and products.[37] In the Indian Ocean, a peptide called Dolastatin-10 isolated from sea hare has served as an antitumor agent in clinical trials to treat breast and liver cancers, solid tumors, and leukemia.[38]

Deep-sea organisms also maintain the ocean ecosystem in ways that facilitate human use of ocean resources. Nutrients in the oceans that sustain fisheries are regenerated by deep-sea organisms. Some marine organisms absorb carbon during photosynthesis, which helps to regulate the climate; others also assimilate waste materials that pollute the ocean, acting as a "biological pump."[39]

Economic Implications

While it is difficult to quantify the value of potential marine mineral resources, the deep sea clearly has great potential as a source of minerals, and demand for these minerals is increasing. Prices of nickel and tin reached historic highs in 2007 and 2008 respectively, and copper and manganese have also risen in value relative to the last two decades (see Figure 7.2).

The Indian Ocean possesses some of the few remaining underexploited fish stocks in the world, making it likely that it will come under enormous pressure in the future as the next frontier of the global fisheries market. On the other hand, the heavy reliance of deep-sea fisheries on cheap fossil fuels could put the industry at risk from rising oil prices. Some deep-sea areas could become de facto marine reserves because of the prohibitive cost of exploiting their fisheries.[40]

Marine pollution threatens to reduce the value of Indian Ocean fisheries. Degradation of coastal estuaries, mangroves, lagoons, coral reefs, and kelp forests has destroyed the habitats of many species that support artisanal and commercial fisheries. In 2006, UNEP estimated the long-term costs of the 1998 massive worldwide coral bleaching in between $600 million and $8 billion over 20 years. The destruction of coral reefs and coastal ecosystems also impacts the tourism industry, which is estimated to bring in $30 billion annually.[41]

Stock market values for bioprospecting-related activities far exceed the value of products that have already been developed as a result of genetic use of deep sea organisms. This implies that the market takes into account the optional use of bioprospecting. The entire enzyme market is valued at $50 billion a year.[42]

Food Security

The depletion of Indian Ocean fish stocks could have serious implications for regional and global food security. More than a billion people worldwide rely on fish as their main source of protein.[43] The FAO reports that global fish consumption per capita increased from 16.2 kg in 2004 to 17.1 kg in 2007. Yet one recent study has projected that the world's fisheries will collapse by 2048 if catch rates continue unabated.[44] A 2010 report by the Pew Environmental Group helps put that prospect in context. Pew concluded that if countries with undernourishment levels greater than 5 percent had not overfished their waters, the additional fish catch in 2000 could have fed an additional 20-million people.[45]

Actors, Institutions, and Agreements

Several regional and international agreements exist to promote the sustainable management of the Indian Ocean's resources. Among these, the most important are 1982's United Nations Convention on the Law of the Sea (UNCLOS), 1995's FAO Code of Conduct for Responsible Fisheries, 1996's Indian Ocean Tuna Commission, and 2004's Southwest Indian Ocean Fisheries Commission. Most littoral states have also enacted national legislation to manage their fisheries and marine resources, such as Australia's 1994 Fisheries Resources Management Act and South Africa's 1998 Marine Living Resources Act.

The effectiveness of this legislation is limited by high levels of noncompliance. Fishers have little incentive to limit their catches since monitoring and enforcement of catch limits is low and marine legislation is outdated. In response to this problem, some fisheries have moved towards the decentralization and localization of management authority. Local communities in the southwest Indian Ocean, for example, have increasingly asserted their own regulations and enforcement of fish stocks.

Law regarding the extraction of manganese nodules is further developed than those governing sulphides. The UN Convention on the Law of the Sea established an International Seabed Authority (ISA) to oversee the prospecting, exploration, and mining of marine resources. Regulations also exist regarding nodule mining, but regulations on sulphides have been in a drafting stage since 2007. The creation of legal mechanisms to regulate sulphides has been delayed due to the lack of detailed scientific information on the environmental effects of ocean mining.[46] Commercial enterprises, however, have moved forward with the change in mining technology, rather than with the state of scientific research in the deep sea. In the interim, scientists have called on ISA to revise its stance on resources in international waters.[47] The present focus of ISA regulations is to ensure that resources are exploited in a way that supports "the common heritage of mankind," focusing on equitable distribution rather than on sustainability. Adopting conservation as part of the ISA platform is one method of promoting environmental impact assessments prior to exploitation, allowing time for scientific research to catch up with technological capabilities.

Notes

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Chapter Eight

Environmental Pressures in the Indian Ocean

David Michel

Oceans and coastal regions are coming under rising environmental pressures worldwide.[1] These growing stresses include habitat destruction and biodiversity loss, land-based and marine pollution, overexploitation of resources, and the increasing impacts of greenhouse gas emissions and global climate change. No area of the ocean escapes these strains, and a large part of the world's seas—some 41 percent—suffers from multiple stresses. Significant portions of the Indian Ocean now figure among the most highly impacted marine ecosystems on Earth, and the Indian Ocean region (IOR) littoral countries count among the world's most vulnerable to coastal environmental risks.[2]

This paper will examine the mounting threats that environmental degradation and climate change pose in the Indian Ocean and explore the consequent governance challenges facing policymakers in the region.

Indian Ocean Ecosystems and Environmental Degradation

The Indian Ocean extends over nearly 75-million km^2 and encompasses nine distinct large marine ecosystems: the Agulhas Current, Somali Coastal Current, Red Sea, Arabian Sea, Bay of Bengal, Gulf of Thailand, West Central Australian Shelf, Northwest Australian Shelf, and Southwest Australian Shelf. It is home to 35,000 marine species and biological diversity of both coastal and oceanic taxa equal to or greater than any sea on earth, with particular biodiversity hotspots around southwest Africa, southern India and Sri Lanka, and Southeast Asia, and western Australia. The Indian Ocean's 66,000 km of coastline include 246 large estuaries draining hinterlands of 2,000 km^2 or more and 40,000 km^2 of mangrove forests. The coasts of East Africa, Sri Lanka, and Indonesia harbor the planet's greatest diversity of seagrasses, while the Indian Ocean as a whole contains 30 percent of the Earth's coral reefs. Among all the 793 coral species known worldwide, 719 appear in the Indo-west Pacific region.[3]

Such coastal and marine environments deliver vital ecosystem goods and services, supplying food, fuel, and materials, and regulating hydrological cycles and nutrient flows. Globally, ocean ecosystems have been calculated to provide ecosystem goods and services worth some $21 trillion annually, with more than half of this total derived from coastal systems such as estuaries and coral reefs. On a regional basis, the yearly value of ecosystem services and natural capital for the Persian Gulf, the eastern coast of India, the Bay of Bengal, Southeast Asia, the western Australian coast, and the Indian Ocean's small island states figure among the highest in the world.[4]

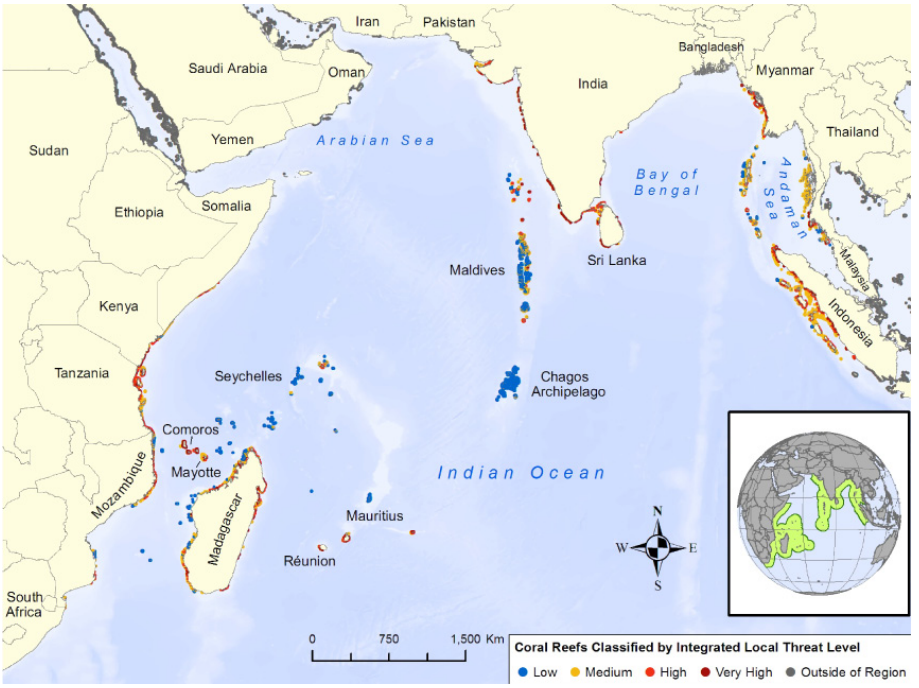
Fisheries constitute perhaps the most commonly known of the ocean's natural resources. According to the UN Food and Agriculture Organization, Indian Ocean marine capture fisheries supplied 11.3 million tonnes (metric tons) of fish in 2010, about 14.6 percent of the world catch of 77.4 million tonnes. Several Indian Ocean countries also possess significant aquaculture industries, farming fish, shellfish, and other aquatic animals in captivity. Six IOR nations—India, Indonesia, Bangladesh, Thailand, Egypt, Myanmar—counted among the top 10 producers worldwide in 2010, farming over 11.3 million tonnes of fish between them.[5] (Globally, about 38 percent of aquaculture takes place in seawater or brackish water, although a notable portion of freshwater aquaculture occurs in coastal ecosystems such as river deltas and estuaries. Similarly, a significant fraction of freshwater capture fishing takes place in coastal zones. About 80 percent of the Bangladeshi and Indian fish catch in the Ganges-Brahmaputra-Meghna river delta comes from the coastal mangrove swamps known as the Sundarbans.)[6]

Fisheries also contribute substantially to many regional economies. In Indonesia, for example, fishing and fish farming employ some 5.97 million people. In addition, the FAO reckons that for each person directly employed in fish capture or aquaculture, another three to four people gain their livelihoods in ancillary activities such as boat construction, gear maintenance, and fish processing, packaging, and distribution. Moreover, the FAO also estimates that each such jobholder on average supports three dependents or family members.[7] Equally important, fisheries furnish a crucial food source for communities around the IOR. On average, the populations of Egypt, Malaysia, Mozambique, Seychelles, Singapore, Tanzania, and Thailand obtain 20 percent or more of their animal protein from fish. The inhabitants of Bangladesh, Comoros, Indonesia, Maldives, and Sri Lanka get more than half of the animal protein in their diet from fish.[8]

For a number of Indian Ocean nations, tourism represents another sector highly dependent on marine and coastal resources. The small island states especially rely on the appeal of their beaches, coral reefs, and coastal waters. Tourism earns 28 percent of GDP and 60 percent of foreign exchange receipts in the Maldives. In the Seychelles it engages 30 percent of the labor force and accounts for 70 percent of hard currency earnings.[9] Much of Egypt's roughly $11 billion in annual tourism also draws heavily on the natural endowments of the Indian Ocean—a lesser-known fact. Surveys indicate that climate, beaches, and water sports (particularly snorkeling and diving in the renowned coral reefs of the Red Sea) represent the top three attractions luring foreign travelers to Egypt, and as much as 90 percent of the country's new investment in tourist infrastructure in recent years concentrated in coastal resorts, especially in the southern Sinai and Gulf of Aqaba.[10]

However, many of the natural goods and services afforded by maritime and coastal ecosystems are harder to quantify and value. Their worth in regulating climate, filtering pollutants, providing habitat, cycling nutrients, stabilizing sediments, protecting shorelines, etc., is not directly monetized or traded in markets. Available analyses suggest these services can be very valuable indeed. One study assessed the shore protection functions of coral reefs at $47,000 per square foot. Another study of seagrasses put their value for shore protection and commercial fisheries habitat at $3,500 per hectare. Depending on their roles providing shore protection, habitat, and feeding grounds, mangrove forests have been valued at $200,000 to $900,000 per hectare per year. Meanwhile, a comprehensive examination of

Figure 8.1: Reefs at Risk in the Indian Ocean



Source: World Institutes Resource, http://www.wri.org/map/reefs-risk-indian-ocean.

Australia's coastal ecosystems figured the annual value of coral reefs at AUS $1,092,383 per km^2; wetlands at AUS $2,658,582 per km^2; seagrass beds at AUS $3,417,227 per km^2; and estuaries at AUS $4,105,563 per km^2 (AUS $1 = US $ 0.76 in 2005).[11]

But myriad human pressures increasingly threaten to degrade essential ecosystem resources and functions. Around the Indian Ocean, coastal development for aquaculture, roads, buildings, and urban infrastructure is damaging or demolishing mangroves, coral reefs, wetlands, and other habitats. Asian coastlines lost 1.9-million hectares of mangroves from 1980-2005, while Africa lost another half million. Pollution, destructive fishing practices (such as the use of dynamite and poisons), coral mining for construction materials, and coral bleaching have already destroyed or critically endanger two-thirds of the Indian Ocean's 12,070 km^2 of coral reefs and almost one-fifth of the 3,175 km^2 of corals in the Red Sea.[12]

Domestic sewage, agricultural runoff, and industrial effluents dumped in the sea can cause eutrophication and hypoxia, or act as toxic substances, killing local flora and fauna. Eutrophication (blooms of phytoplankton resulting from the added nutrients in the effluents) and attendant hypoxia (depletion of oxygen in the water) can engender effective dead zones in coastal areas. Analyses in developed country waters find that dead zones can diminish biological production by millions of tonnes across thousands of square kilometers, drastically reducing fish landings and imposing costs for lost ecosystem services running into the billions of dollars annually.[13] More than a dozen such zones now blot the Indian Ocean. This represents a small fraction of the roughly 500 coastal dead zones recorded around the world, but the paucity of systematic data for many polluted areas of the IOR

leaves reason for concern that numerous additional dead zones may go unreported. By one estimate, some 40-trillion liters of sewage and 4 trillion liters of industrial effluents enter the region's coastal waters every year.[14]

Solid litter and floating refuse increasingly plague all the world's oceans. Marine debris ranges from plastic bottles and bags to cigarette butts and aluminum cans, foam cups, industrial packaging, nets, cords, and fishing gear. Buoyant and durable, plastics compose some two-thirds of marine garbage. Such trash enters the ocean carried by wind, rivers, drainage, and sewage from land-based dumps, as well as discarded, lost, or abandoned by commercial vessels and fishing fleets. Marine litter pollutes all corners of the Indian Ocean. Surveys have recorded up to 690,000 pieces of debris per square kilometer in Indonesia's coastal waters, while the quantity of plastic bottle caps and lids found on South Africa's shoreline rose tenfold from 1985 to 2005.[15] It is thought that about 70 percent of marine litter eventually sinks to the seabed. But much of it remains floating indefinitely, accumulating in vast patches in the open ocean corralled by swirling, wind-driven currents known as gyres. Washed ashore, marine debris despoils coastlines and diminishes amenity values. At sea, it fouls fishing lines and reduces catches, ensnares and injures or kills aquatic life, and can transport harmful chemicals and invasive species that can endanger human health.

Degradation of marine and coastal ecosystems afflicts Indian Ocean countries across the economic and development spectrum. Ironically, significant pressures on ecosystem goods and services frequently stem from efforts to capitalize on natural resources. The marine ecosystems of Southwest Asia and the Persian Gulf in particular bear the brunt of rapidly expanding natural resource development and industry. While petroleum production has driven the region's phenomenal growth, ballast water released from oil tankers, dredging and filling operations, offshore oil and gas installations, tanker loading terminals, and the high volume and density of maritime traffic have proven especially destructive to the coastal environment of the Gulf countries. At the same time, the industrially-advanced but arid Gulf states currently have some of the highest per capita water consumption rates in the world. The revenues—and fuel—derived from their hydrocarbon resources allow them to rely on costly and energy intensive seawater desalinization to meet demand for potable water. As a result, desalinization and power plants generate 48 percent of the industrial effluent volume discharged into the Gulf each year.[16]

On the other side of the Indian Ocean, Bangladesh has sought to exploit its low-lying river delta topography to expand traditional shrimp farming into intensive commercial farming for international markets. From 1983 to 2004, the coastal land area devoted to shrimp cultivation soared fourfold, and the fisheries sub-sector grew to contribute more than 5 percent of Bangladesh's GDP. But the rapidly spreading shrimp farms have also increasingly encroached on other agricultural lands, while the destruction of mangrove forests and the reconfiguration of embankments to enclose saltwater shrimp ponds has altered drainage and siltation patterns and increased the salinity of surrounding soils and water, rendering large areas unfit for agriculture or even, in extreme cases, for habitation. The social and environmental impacts have driven many localities to resist the introduction of industrial shrimp farming, sometimes violently. More than 150 people have been killed and thousands injured during such protests over the past two decades.[17]

Continuing population growth and booming urbanization in the countries rimming the Indian Ocean risk exacerbating these trends. The UN projects that the combined populations of the 36 countries surrounding the Indian Ocean will climb from 2.5 billion people in 2010 to nearly 3.2 billion in 2030.[18] Feeding this rising population will necessitate a corresponding increase in agricultural production. Globally, the collective effects of population growth, rising incomes, and changing diets may boost food demand by 70 to 90 percent by 2050.[19] Whether producers look to respond by intensifying cultivation, expanding areas under cropping, or increasing yields, meeting this demand will almost certainly require considerable growth in the use of fertilizers and other agricultural chemicals. Agricultural effluents, in turn, constitute primary drivers generating toxic dead zones in coastal waters. Transported from fields to the oceans by rain and river runoff, the nitrogen and phosphate compounds contained in fertilizers and agricultural chemicals provide nutrients to the algal blooms responsible for coastal eutrophication and hypoxia. Already, models tracing the deposition of nitrogen compounds to the ocean surface reveal a band of glaring hotspots ringing India from the Bay of Bengal to the Arabian Sea.[20] If these fluxes result in significant dead zones in the midst of Indian Ocean fisheries, efforts to improve South Asia's food security on land could potentially compromise prospective contributions to regional food security from the sea.

Expanding cities across the region will further eat into coastal habitats and ecosystems. At a global level, for example, 62 percent of all freshwater estuaries, 64 percent of the world's mangroves, and 58 percent of its tropical reef systems occur within 25 km of a major urban center with more than 100,000 inhabitants.[21] Growing cities will also generate more waste. Domestic and industrial water use, for example, will surge sevenfold in South Asia by 2050. But 75 to 85 percent of water diverted to domestic and industrial needs in urban areas worldwide is not consumed. Instead, after being used for sanitation, washing, cooling, and other demands, this wastewater re-enters rivers, lakes, and water sources as return flow. All told, more than 80 percent of sewage in the developing world goes untreated, discharged directly into surface and groundwater or the ocean, suggesting expanding urban demand in coastal regions could substantially worsen marine pollution.[22]

Global Climate Change

Coastal and marine areas figure among the most vulnerable of all environments to global climate change.[23] 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 to the atmosphere—growing acidification of surface waters. For Indian Ocean coastal ecosystems and communities, the repercussions 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. Higher water levels and larger wave surges can contribute to accelerated shoreline erosion and retreat. Mounting sea levels can also exacerbate saltwater intrusion into the rivers and aquifers that furnish freshwater to coastal settlements. 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.

Figure 8.2: Top 10 Countries at Risk with Intensification of Storm Surges

Rank	Coastal Land Area	Coastal Population	Coastal GDP	Coastal Agricultural Land	Coastal Urban Areas	Coastal Wetlands
1	Kuwait (81.1)	Bahamas (73.0)	Bahamas (65.7)	Guyana (100.0)	Bahamas (94.1)	El Salvador (100.0)
2	Korea (61.7)	Kuwait (70.0)	Kuwait (65.3)	UAE (100.0)	Guyana (66.4)	Belize (100.0)
3	Namibia (60.2)	Djibouti (60.1)	Belize (61.1)	Nigeria (100.0)	Djibouti (60.4)	Kuwait (95.8)
4	Guinea (58.6)	UAE (60.0)	UAE (58.1)	Qatar (85.7)	UAE (60.2)	Taiwan, China (95.2)
5	El Salvador (55.3)	Belize (56.2)	Mozambique (55.0)	Korea (66.8)	Togo (59.8)	Namibia (81.6)
6	Chile (54.7)	Yemen (55.7)	Togo (54.5)	El Salvador (66.7)	Kuwait (56.4)	Korea (78.8)
7	Bahamas (54.7)	Togo (54.2)	Puerto Rico (52.7)	Ghana (66.7)	Yemen (55.4)	Qatar (75.0)
8	Puerto Rico (51.8)	Puerto Rico (53.8)	Morocco (52.6)	DPR Korea (58.3)	Mozambique (55.1)	Bahamas (71.4)
9	Yemen (50.2)	El Salvador (53.0)	Philippines (52.3)	Togo (50.0)	Tanzania (53.4)	Ecuador (67.3)
10	Oman (50.0)	Mozambique (51.7)	Yemen (52.0)	Equatorial Guinea (50.0)	Cote d'Ivoire (53.2)	Tunisia (63.5)

Note: Numbers in parentheses indicate a percentage impact in "coastal zone." Indian Ocean states highlighted.

Source: Sumita Dasgupta et al., Sea-level Rise and Storm Surges: A Comparative Analysis of Impacts in Developing Countries, Policy Research Working Paper 4901 (Washington, DC: The World Bank, April 2009).

Climate threats to coastal regions reverberate well beyond the shoreline. Both farmland affected by saltwater incursion and fisheries menaced by higher ocean acidity feed populations far from the water's edge. Ports, roads, rail lines, and other facilities that could be damaged by cyclones and storm surges serve producers and consumers located inland. Refugees fleeing coastal flooding may be driven into neighboring countries or even further afield. Countering such risks will present both opportunities for international cooperation and possibilities for international conflict. Many of the Indian Ocean countries most vulnerable to global warming have contributed little to world emissions of greenhouse gases, and many possess limited capacity and few resources to counter or cope with prospective climate damages. These nations will require international assistance—technical, financial, and institutional—to enable them to adapt to and rebound from the looming greenhouse impacts that they cannot avoid.

The countries of the Indian Ocean rim, from East Africa and the Arabian Peninsula to South and Southeast Asia, are particularly susceptible to sea level rise. According to the Intergovernmental Panel on Climate Change (IPCC), global sea level rose at an average rate of 1.8 mm per year from 1961 to 2003, though the rate increased to 3.1 mm/year over the last decade of the period. The IPCC further projected that sea levels would mount 18–59 cm by 2100. On this basis, because of their high population density, susceptibility to coastal flooding and saltwater intrusion from sea level rise, and exposure to storm surges, the IPCC specifically designated several of South Asia's coastal river deltas, including the Ganges-Brahmaputra and the Indus, as particular "hotspots" of climate change vulnerability.[24]

Another 2007 study assessing the climate threat to low-lying coastal settlements found that six of the 10 most vulnerable states worldwide—ranked by total population living in exposed areas—lie on the Indian Ocean.[25] However, more recent analyses suggest that, due principally to meltwater entering the oceans from receding Greenland and Antarctic ice caps, sea levels could rise considerably faster, possibly up to 180 cm by 2100.[26] To put such numbers in context, one meter of sea level rise could potentially reduce Qatar's land area by 2.6 percent, submerge 13.95 percent of Bahrain, and inundate 5,763 km^2 of India's coast.[27] Indonesia could lose 2,000 islands to the rising waters.[28]

Climate change may also expose the Indian Ocean nations to stronger and more frequent storms and higher storm surges. Recent studies suggest that tropical cyclones in the Indian Ocean will grow more intense.[29] A 2009 World Bank paper examined the dangers to developing nations from potential storm-surge disasters. It concluded that 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 are located around the Indian Ocean basin.[30] Projected climate impacts to the Indian Ocean littoral especially threaten the region's growing maritime infrastructure. One analysis has measured the vulnerabilities to global warming of major port cities in the developing world. It determined that eight Indian Ocean ports rank among the twenty cities that will have the greatest population exposed to projected climate threats in 2070, including Kolkata, Mumbai, and Dhaka in the top three spots. Six Indian Ocean cities figure among the twenty ports that will see the largest increase in the value of their assets at risk from climate impacts. Yet global comparisons show the Indian Ocean ports to be among the least prepared to manage and adapt to climate risks.[31]

As cyclones grow more frequent and intense, they will place more coastal communities at risk from inundation and erosion. Mounting sea levels will also contribute to higher storm surges, carrying flooding farther inland. As sea levels rise, saltwater will invade rivers and aquifers, contaminating the freshwater sources on which many settlements depend for drinking and farming. Human exposure to such hazards will almost certainly increase with ongoing coastal development. Under 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.[32]

Additional climate change impacts will manifest in the ocean itself. As humanity's emissions of greenhouse gases have grown, the oceans have absorbed increasing amounts of this added carbon dioxide from the atmosphere. Since the beginning of the Industrial Revolution, the cumulative ocean uptake amounts to some 25 to 30 percent of humanity's total CO_2 emissions. The absorbed carbon dioxide alters the ocean's chemistry, rendering it more acidic (measured by a lower pH value). From preindustrial levels, the surface ocean pH has already fallen by 0.1 units. If greenhouse emissions continue unabated, pH levels will tumble a further 0.2 to 0.3 points over the 21st century, a change 30 to 100 times greater than those seen in the past and at a rate unprecedented in the geological record.[33]

By the same token, as climate change warms global average temperatures, the oceans are also absorbing heat from the atmosphere, raising surface ocean temperatures. Ocean acidification and ocean warming together will have substantial impacts on the life cycles and distribution of marine life. A number of analyses suggest that, to keep pace

with projected food requirements, world fish production would have to rise by about 50 percent from current levels. Yet according to some analyses, climate change impacts could severely impair catches in certain regions, engendering large-scale shifts in potential catch distributions. Indian Ocean fisheries specifically are projected to see marked increases in maximum catch potential relative to 2005 levels in much of the Arabian Sea and east African waters, among other areas, while catch potentials may plummet by 30 to 50 percent or more in the Red Sea, Persian Gulf, and Indonesian waters and some areas of the open ocean. Catch potentials within the Indonesian EEZ, for example, are projected to slip more than 20 percent by 2055, the largest drop for any country. Such a significant shuffle of fishing potential could dramatically alter fisheries politics across the region. Currently, for example, about one-third of the catch from the Bay of Bengal comes from fishing areas beyond national EEZs. This same area is projected to suffer dramatic declines—up to 50 percent—in catch potential at mid-century. This loss of potential in the open ocean could push regional and extra-regional fleets to seek out new fishing grounds to make up the difference, potentially colliding with similar efforts by other fleets.[34]

Small Island States

Climate pressures especially endanger small or low-lying islands like Mauritius, the Maldives, and Seychelles. Major infrastructure in these countries—roads, airports, seaports, towns—is situated almost exclusively along the coasts. Moreover, most small islands possess only limited freshwater resources, making them all the more vulnerable to saltwater invasion of their aquifers or diminished rainfall. The small, low-lying island nations embody in concentrated form many of the thorniest challenges that climate change poses to coastal regions. They make virtually no contribution to the greenhouse gases that drive climate change, yet they will bear the full brunt of global warming's direst consequences. The small island states are essentially completely coastal; no point lies farther than a few kilometers from the sea. The coastal impacts of climate change will inevitably reverberate throughout these societies. To these countries, slow sea level rise and sudden storm surges alike represent existential threats that could potentially eradicate them entirely.

Small island states in the Indian Ocean now stand in the vanguard on many fronts of climate policy and coastal management. Despite their own insignificant emissions, they have begun to move aggressively to curb their greenhouse gas production as well as build their adaptive capacities. Mauritius, for instance, has launched a "Sustainable Island" initiative, supported by the government of France, heavily devoted to developing wind and solar power. In 2009, the Maldives announced its intention to become fully carbon neutral within the decade by switching wholly to renewable fuels.[35] In addition, Seychelles already mainstreams climate policy into crosscutting issues of coastal development through 10-year national environmental management plans. And all the island countries are partnering with the private sector to promote sustainable tourism. (Although, much as they champion adaptation strategies, the small island nations—and the developing countries in general—have announced more action than they have implemented.) Indeed, such is the policy commitment of the island countries that several observers suggest that the SIDS could serve as key proving grounds where adaptive policy measures can be field tested against emerging climate impacts.

Figure 8.3: The Maldives: A Case Study in Sea Level Rise Vulnerability

Source: Wikimedia Commons, http://en.wikipedia.org/wiki/File:Male-total.jpg.

Despite their avowed political will, geography condemns the SIDS to an inescapable policy bind. The small island nations can only *accommodate* or *protect* against so much climate change; they have no space to practice the third adaptation option of *retreat*. Without rigorous mitigation measures from the rest of the world—an eventuality over which they exercise no control—countries such as Mauritius, Seychelles, and the Maldives might be forced to abandon certain islands, or even evacuate their territory altogether.

Such population displacements would have multiple, tangled implications for the countries of origin, the destination countries, and the migrants themselves.[36] For example, the first people to move would likely be those with the capacities—money, job skills, family ties—to do so, leaving behind the more vulnerable and those with lesser resources. What impacts would this have on the sending states? How would such migrants be received in countries that may already be poor and crowded? Where should climate migrants go? To the nearest country? To polluter countries that "caused" the migrants' plight? To countries with jobs? To countries with space, with the requisite environmental carrying capacity? What becomes of the citizenship of a people whose country has disappeared? What of the citizens of other countries now living in the small island nations? (In addition to its native population of some 350,000 people, the Maldives is home to an additional 100,000 expatriate workers who are not counted in the census.[37] About 20 percent of the inhabitants of the Maldives are Sri Lankans, Indians, and Bangladeshis.) What becomes of the sovereignty—or of the EEZs—of states swallowed under the waves? Should such migration be left to the choices of individual emigrants and the disparate decisions of various immigration authorities? Or should climate migration be prepared or planned for in some way? The president of the Maldives has spoken of buying land in other countries as a safe haven to which their compatriots could move if necessary.[38]

The same questions could be asked about potential population movements within climate-afflicted states, from the flood-prone Ganges Delta to the coasts of east Africa, for example. Is there a "right" to migrate under such circumstances? Is there a "right" *not* to be forced to migrate by such circumstances? The possibility that unchecked global warming could generate thousands, hundreds of thousands, perhaps millions of refugees from island states and other countries as well poses tremendous political and ethical dilemmas with which the international community has barely begun to wrestle.[39]

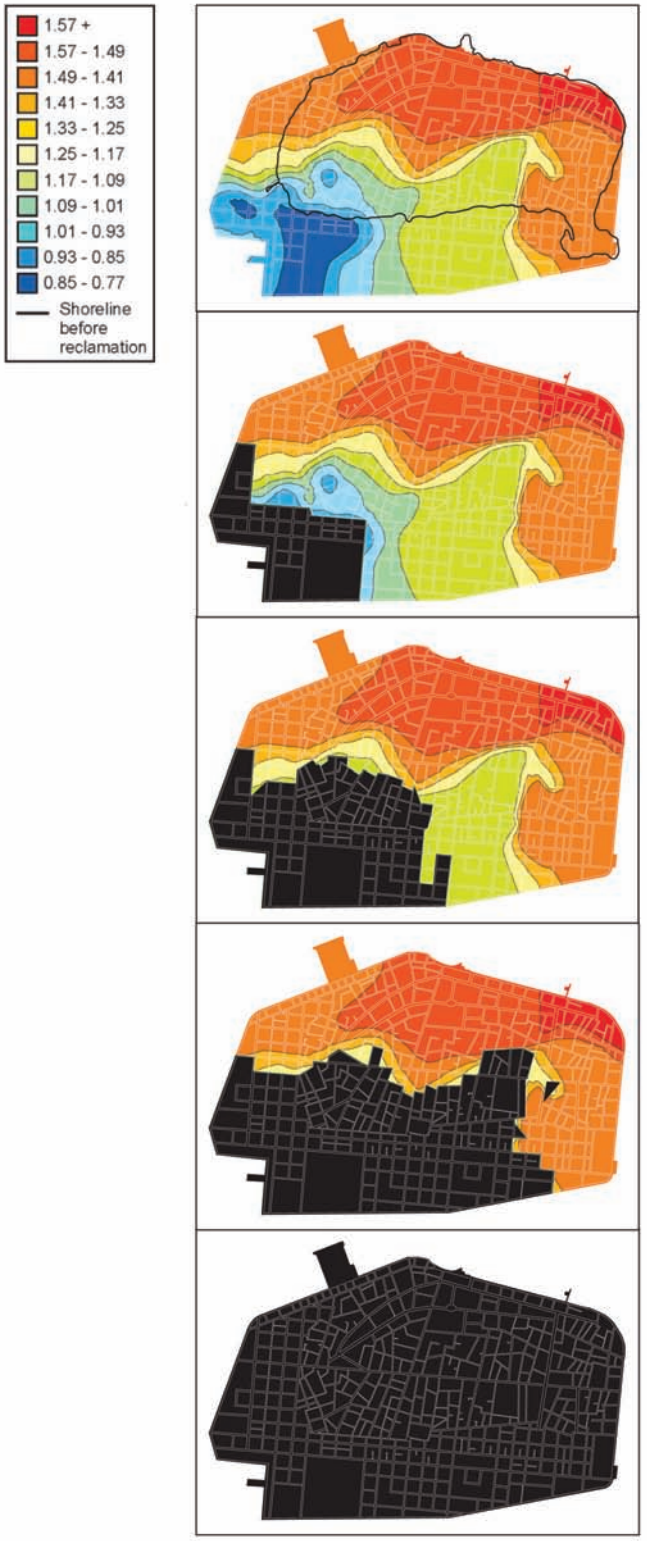
Climate Change, Environmental Degradation, and Environmental Policymaking in Coastal and Marine Regions

Emissions mitigation remains essential to combating climate change. Adaptation efforts will be more costly and extensive the greater the climate stresses to which societies must try to adjust. Beyond certain thresholds, adaptation measures may also become fruitless or even counterproductive. Nevertheless, even if the international community could halt all greenhouse emissions tomorrow, the accumulated inertial momentum of the climate system would still result in continuing global warming and centuries of rising sea levels. Indeed, global greenhouse gas emissions now surpass the highest scenarios anticipated by the Intergovernmental Panel on Climate Change, and observed temperature changes to date are already climbing beyond their previously projected range, suggesting that the chance of significant negative impacts is appreciably higher than foreseen just a few years ago.[40] The countries most vulnerable to rising seas bear little historical responsibility for this trend and can do little to alter it, their emissions constituting a tiny portion of the world total. Consequently, policymakers must urgently undertake measures for adapting to climate changes that can no longer be avoided.

Much climate adaptation, though, will unfold beyond policymakers' control. Natural systems will move to adjust to changing climatic conditions regardless of—or sometimes despite—human actions. But they may or may not do so in ways conducive to human ends. Species may migrate; they may go extinct. Ecosystems, flora, and fauna can only adapt in *reaction* to global warming; they cannot adapt in ways that counter climate changes, and their adaptations may fail. Ironically then, humans may have to intervene most emphatically where they wish to preserve natural ecologies or sustain natural ecosystem services, such as to maintain protective coastal wetlands.

Climate change exposes coastal zones to both gradual, cumulative stresses such as sea level rise and episodic pressures from extreme events such as stronger cyclones. For the most part, policymakers evince considerably greater worry about the latter. Though it represents an incomplete assessment of the climate risk, this growing preoccupation with a potential increase in the frequency and severity of natural disasters may play a useful role. It supplies governments a sharper political catalyst than the remote motivation of prospective long-term threats. At the same time, moves to prepare early-warning systems, disaster management, and response strategies can serve more generally to build adaptive capacity and bolster resilience to the broad range of climate change impacts.[41] Yet contrary to policymakers' present perceptions, a number of coastal regions face greater dangers from the more chronic risks of climbing sea levels against which they have less ready

Figure 8.4: Sea Level Rise Projections for the Maldives



Elevation contour map and street map of Malé overlaid.

Map showing areas that would be inundated in 2025 (high) scenario. That is 0.84m (19.7cm + 64cm*). The same map is also applicable to year 2050 (low) scenario. That is 0.84m (19.9cm + 64cm*).

Map showing areas that would be inundated in 2050 (high) scenario. That is 1.04m (39.7cm + 64cm*).

Map showing areas that would be inundated in 2100 (low) scenario. That is 1.13m (48.9cm + 64cm*).

Map showing areas that would be inundated in 2100 (high) scenario. That is 1.58m (94.1cm + 64cm*).

*Highest astronomical tide for Maldives

Source: First National Communication of the Republic of Maldives to the UNFCCC, 2001.

defense. Many coastal communities, particularly those habituated to monsoon cycles, have developed numerous coping strategies for the already existing peril of recurring storms. In Bangladesh, for instance, farmers have turned to floating gardens, called *baira*, in the face of seasonal flooding. But creeping saline contamination as rising sea levels carry saltwater into the river deltas gradually renders these gardens impracticable.

Policy Institutions and Resources

Much of the current policy debates regarding climate change mitigation revolve around the challenges of developing new sustainable technologies and deploying them to developing countries. In the field of coastal adaptation, in contrast, myriad effective technologies are already in use across the developing world. Water desalination techniques for furnishing freshwater supplies are highly developed in the Gulf region and increasingly in the small island states. Bangladesh has built more than 12,000 kilometers (longer than the entire shoreline of Sri Lanka) of protective coastal embankments and hundreds of raised and reinforced storm shelters. Such technical options, or "hardware" solutions, are available for numerous adaptation problems.

For many countries, securing the "software" of adaptation—financial resources, institutional structures, and social practices that support adaptation policies—has proven more problematic. Adaptation technologies are often costly, and the most vulnerable countries and communities frequently lack sufficient financial resources to acquire them. The parties to the international greenhouse regime established by the United Nations Framework Convention on Climate Change (UNFCCC) and the follow-on Kyoto Protocol have created a dedicated Adaptation Fund, but financing levels to date are sorely inadequate.

Current UNFCCC analyses report that financing adaptation measures in coastal zones will require additional annual investment flows of $11 billion per year by 2030. But these estimates, like most such studies, consider only the incremental cost of adaptation—that is, they suppose that there is already good infrastructure in place to upgrade against climate change. In many places, however, particularly in the developing world, this is not the case. Consequently, many coasts face a pre-existing "adaptation deficit" that most adaptation cost calculations miss. Two additional deficiencies further weaken the UNFCCC conclusions. First, the UNFCCC numbers rely on projections of future sea level rise that now appear too conservative. Second, the estimates fail to consider significant coastal impacts beyond sea level rise, such as the danger of more severe storms. As a result, one recent review suggests that actual coastal adaptation needs could plausibly reach three times the UNFCCC figures, while the costs of making up the coastal adaptation deficit likely exceed the $11 billion per year the UNFCCC reckons future adaptation will demand.[42] At the international negotiations held in Copenhagen in December 2009, the developed county parties jointly pledged to mobilize $100 billion annually in public and private financing by 2020 to help fund mitigation and adaptation in developing countries. (By comparison, the World Bank's *World Development Report 2010* put combined annual adaptation and mitigation requirements by 2030 at $275 billion.)[43] But the Copenhagen accord is legally non-binding. Moreover, several critical questions remain about where this money will come from, how much will be "new and additional" over existing development assistance, and whether

Figure 8.5: Evaluating Cyclone Impacts in Bangladesh and Myanmar, 2007–2008

Preparedness makes a difference—same levels of hazards but different impacts

	Bangladesh Cyclone Sidr, 2007	Myanmar Cyclone Nargis, 2008
Tidal wave (and storm surge)	5 metres (up to 6 meters)	3.5 meters (up to 7 metres)
Wind speed	240 km/hr	255 km/hr
Population evacuated	3 million	None
Deaths	3,406	84,537*
Missing	1,001	53,836
Population "severely" affected	1 million	2.4 million
Total loss and damage	$1,674 million	$4,134 million
Human Development Index (2007)	140	132
Per capita GDP ($PPP, 2007)	$1,400	$1,900
Population below poverty line (2004)	45%	33%

Source: UNESCAP/UNISDR, The Asia-Pacific Disaster Report 2010 (Bangkok: UNESCAP/UNISDR, 20120).

developed countries will make the funding conditional on developing country mitigation policies or other obligations—a possibility the developing countries hotly reject.[44]

Establishing effective adaptation strategies also exacts substantial demands on policy institutions. Adaptation is necessarily site specific. Planning and implementation ought to engage the participation of local communities, incorporate local knowledge, and reflect the local specificities of the particular environments in which policies will be enacted. Yet policymakers often simply do not have the detailed local information (e.g., fine-grained climate models to project local impacts, empirical time-series records of climate indicators, etc.) to so tailor policy decisions. Similarly, policymakers frequently lack the financial and institutional resources and processes to effectively monitor, evaluate, and revise national policies, much less local measures.[45] Many policy declarations and action plans initiated by national governments and regional organizations rest unexecuted. They are not carried down through the ministries, to local levels, or to the point of technical application. Mechanisms for gathering and diffusing policy lessons and best practices across locales, countries, or regionally remain largely to be developed.

Finally, beyond technological strategies, meeting the climate challenge will demand behavioral changes from human society and conceptual shifts from decision-makers. The persistent uncertainties and long-time horizons characterizing climate risks create a novel decision environment requiring the development of new cognitive paradigms for framing policy planning and choice.[46] However, these changes have yet to be realized.

Long-term Policy Challenges

The goal of developing and implementing holistic coastal management strategies—integrating multiple actors, uses, and demands at multiple scales—may conflict with the objective of crafting policies to reflect local specificities. Holistic approaches must necessarily

assimilate multiple competing considerations, eventually muddying or compromising some in favor of others, departing from unique contexts, and abstracting local particularities. Locally tailored strategies, on the other hand, depend on context; they cannot be abstracted without losing their specificity.

Integrated Coastal Zone Management (ICZM) represents the dominant policy approach for grappling with this dilemma. Indeed, some experts argue that ICZM needs to be applied globally to meet the myriad emerging challenges imposed by global environmental change.[47] The ICZM paradigm itself, however, rests on some unsettled foundations. At its core, ICZM proposes consultation among contending stakeholders and coordination among diverse interests and institutions in order to reach policy decisions. But ICZM offers no constant guide as to how such consultation and coordination are best organized. What stakeholders must be consulted and what decision rule should apply when their interests diverge or their needs conflict? Does policy coordination necessitate institutional integration? If so, then how much integration, formal or informal, involving which institutions, is required? ICZM has no definitive answers. Ultimately, opines one expert, "coastal management is an irreparably complex phenomenon…[T]he 'multi-layered political administrative system' notoriously criticised in the ICZM literature…is neither a temporary flaw in the system nor a short term administrative aberration; it is structurally inevitable."[48]

By the same token, to formulate policies integrating multiple sectors across multiple scales, decision-makers must determine what sectors to include and what scales to balance. Yet ICZM has yet to define consistent parameters for delimiting its effective sectoral scope and appropriate geographic extent. Thus for example, coastal managers well know how inland rivers influence the seaboard. The water runoff, mineral sediments, and organic materials draining from upland basins continually nourish estuaries, fertilize wetlands, renew and reconfigure shorelines, and shape and reshape coastal deltas. Human interventions weigh heavily on these processes. According to recent global studies, upstream dams and diversions now trap almost one-third of all the sediment flow that would otherwise have reached the coastal zone. Without these sediments reaching coastal deltas—where they have traditionally replenished land mass and served as a buffer against storm surges—delta regions will become increasingingly vulnerable to the effects of sea level rise. One assessment found that this loss of river-borne sediment accounted for substantially more relative sea level rise than did mounting ocean levels in nearly 70 percent of 40 deltas surveyed around the world, including the Indus, the Tigris-Euphrates, and several other deltas in the IOR.[49] Water policymakers are keenly aware of these trends. And, ironically, water managers widely employ techniques of Integrated Water Resources Management (IWRM) quite similar in approach to ICZM. Yet ICZM and IWRM have developed as largely separate disciplines, rarely linked in planning or in practice.[50]

The individual countries of the IOR struggle with many of the same issues, but they lack a common regional policy framework for addressing their shared problems. Such a framework could fulfill several useful roles. It could facilitate wider data collection, distribution, and evaluation and help establish early warning systems at the regional scale corresponding to environmental risks that transcend national boundaries. It could also foster technology transfer and disseminate best practices.

Currently, much marine coastal zone management falls well short of this ideal. Frequently, perceived economic priorities prevail at the expense of environmental considerations. For policymakers in developing countries across much of the Indian Ocean region, eventual climate impacts appear quite distant relative to more immediate poverty alleviation imperatives. Integrated policy planning requires decision-makers to think across political boundaries as well as across functional fields. Climate change impacts ignore administrative and jurisdictional borders. Data collection, monitoring, and policy design should therefore correspond to the scale of habitats, catchments, and ecological zones. Implementation should be defined by social and environmental rather than political parameters.[51] Unfortunately, current policymaking too often restricts public deliberation and decision to particular stakeholders and policy elites. Local communities frequently find themselves excluded from centralized, state-level policy processes while ecosystem needs have no voice at all.

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