Somali Piracy and the Monsoon

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ABSTRACT

Analysis of the weather and ocean conditions during recent pirate attacks in the Indian Ocean region suggests that the transition of the summer monsoon limits maritime piracy. A comparison of all known pirate attacks in the region in 2010–11 with surface observations from Socotra and the Somali jet index during the same period indicates that pirates attacking from skiffs are thwarted when winds blow in excess of 9 m s⁻¹. The wind speeds and sea states encountered by pirates during individual attacks were reconstructed using satellite altimetry data for 2010–11. Mean daily wind speeds of up to 20 m s⁻¹ during the two boreal summers resulted in consistently rough seas across the Arabian Sea and Indian Ocean. Surface wind speeds during pirate attacks were generally low (less than 8 m s⁻¹), and once wind speeds exceeded 9 m s⁻¹ no successful attacks occurred. The majority (94%) of pirate attacks took place in waves of sea state 4 or less (wave heights below 2.5 m), with pirates rarely attacking after the rough seas of the summer monsoon evolved. Wind speeds and wave heights during the winter monsoon, premonsoon [March–May (MAM)], and postmonsoon [September–November (SON)] seasons were not a deterrent for pirates operating in the Indian Ocean region.

1. Introduction and aims

Nearly half of all recorded maritime piracy worldwide in recent years has been attributed to Somali pirates, and Bowden (2011) estimates the cost of their activity to the international community as being over $8 billion (U.S. dollars) annually. The impact on society is equally severe, with 62 deaths and the injuries of over 3500 captives in the last four years attributed to Somali pirates (Bowden 2011). Unfortunately, these figures only tell part of the story of recent maritime piracy. For a myriad of political and commercial reasons, both governments and industry downplay and underestimate the scale of modern maritime piracy. The International Maritime Bureau (IMB 2011), for example, estimates that as many as half of all pirate attacks are unreported.

Somali pirates typically attack using two or more small, high-speed open boats or “skiffs.” By using larger vessels, or “mother ships,” pirates can greatly extend the distance from land that skiff attacks take place. There is an increasing awareness that piracy off East Africa may be limited by the rough seas and increased winds that accompany monsoons (Kingsley 2011; UKMTO 2011). Analysis of recent seasonal attack patterns, for example, suggests that pirates may alternate between the open waters of the Indian Ocean and the adjacent Gulf of Aden in response to the monsoon (Bergen Risk Solutions 2011). Although no detailed studies exist, maritime experts have suggested that wave heights greater than 2 m and wind speeds greater than 9 m s⁻¹ (roughly 20 mph) should make operating a skiff too difficult for attacks to be launched (MSCHOA 2009). However, to date no quantitative analysis on the ocean surface environment from where Somali pirates are attacking has been published. In a first attempt to address this topic, our present study revisits the weather and oceanographic conditions that accompanied pirate attacks in the Arabian Sea and Indian Ocean in 2010 and 2011. We seek to test the hypothesis of monsoon impacts on Somali piracy and to identify the environmental thresholds (if any) that might play a role in controlling the timing and location of piracy in this region.

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2. Methods

a. Study area

Attacks by Somali-based pirates in 2010–11 were recorded in the Gulf of Aden, the Indian Ocean, the Arabian Sea, the Red Sea, and the Gulf of Oman, at distances over 1000 km from the coast of Somalia (IMB 2010, 2011). Pirate attacks in this region have been subdivided into two classes based on their geography: “Africa (Somalia),” which includes the Arabian Sea and the greater Indian Ocean region, and “Africa (Gulf of Aden/Red Sea).” Our research focuses on the first of these groups for two interconnected reasons. First, large increases in policing the Gulf of Aden shipping lanes and eastern coastline of Somalia by multinational navies in recent years have led to a decline in pirate attacks in this region (Chalk 2010). These efforts are likely to have pushed piracy activities eastward into the less-patrolled, deep open waters of the Indian Ocean. By focusing on this region, with its large rises in piracy and limited policing, we may tease out the role that wind and waves have played in limiting recent piracy. Second, the waters east of Somalia are open to the full force of both summer and winter monsoon processes, with intense southwesterly surface winds and rough seas characterizing the boreal summer months. From a climatological perspective, the Arabian Sea and the Indian Ocean together make an excellent laboratory for us to examine the connections between maritime piracy and climate.

b. Piracy data and direct climate observations

We obtained records of pirate attacks in the Horn of Africa region from reports produced by the International Maritime Bureau (IMB) for 2010 and 2011. Although several incidents were excluded from our study because of incomplete records, 97% of the events in the IMB reports were included for further analysis. For each incident we recorded the date and time, location, and whether the attack was successful.

There are very few weather stations in the Horn of Africa region capable of providing continuous records of marine surface weather conditions during 2010–11. The most complete record comes from the island of Socotra, Yemen (about 300 km east–northeast off the northeast coast of Somalia; see Fig. 1). Mean daily wind speeds from this station were mined from the National Climatic Data Center’s Global Summary of the Day database. There are some gaps in the early 2010 data, although the Socotra record for the majority of this study is complete, with hourly weather observations recorded near sea level on the north coast of the island. Although ocean buoys and floats are an excellent source of marine weather data, there are at present very few examples reporting from anywhere between the Asian and African continents. This in itself is due to the presence of pirates in this region and has led to a major scientific data gap covering much of the Indian Ocean (Smith et al. 2011).

A regional-scale picture of wind speed during the summer monsoon may be gained by examining the surface expression of the Somali low-level jet (Boos and Emanuel 2009), a band of persistent strong winds running northeastward off the east African coast during the summer monsoon (Fig. 2). We focus here on daily variations in the strength of the Somali jet during the study period using the National Centers for Environmental Prediction–National Center for Atmospheric Research (NCEP–NCAR) reanalysis dataset (Kistler et al. 2001) over the Arabian Sea (5°S–20°N, 50°–70°E) to determine the Somali jet index (Boos and Emanuel 2009).

c. Satellite observations

Satellite observations provide a valuable alternative for oceanographic data east of Somalia. We used satellite estimates of significant wave height and wind speed, obtained from the European Space Agency GlobWave project (Snaith et al. 2010), to reconstruct surface
conditions during individual pirate attacks. We selected observations collected within six hours and 1000 km of an individual pirate attack. If more than one observation met these criteria, then we used the (spatially) nearest observation. A small number of satellite observations that matched pirate attack locations were either from land or nearshore areas \((n = 7)\). These have been excluded from our compilation, the latter due to limitations in the method used for coastal waters (Francis et al. 2011).

3. Results

a. Somali pirate attacks in 2010–11

From 1 January 2010 to 31 December 2011, 287 pirate attacks were recorded in the study area (Fig. 1). The average number of attacks per month increased from approximately 11 to 13 from 2010 to 2011. This trend is in line with the record of increasing pirate activity in the Horn of Africa region in recent years (IMB 2010). The majority of attacks during the 24-month period were unsuccessful (71%); that is, most vessels that came under attack by pirates were not hijacked. Although more pirate attacks were launched in 2011 than in 2010, these were also marginally less successful (75% of pirates were unsuccessful in hijacking vessels in 2011). Piracy was relatively well distributed throughout the study region in 2010 (Fig. 1); whereas in 2011, the majority of attacks were launched in the Arabian Sea, with 66% of all incidents recorded at locations above the 10th parallel north.

b. The Somali jet: Observations from Socotra (Yemen) and the Somali jet index

Large increases in mean daily wind speeds accompanied the onset of the summer monsoon (June–August)
at Socotra in 2010 and 2011, with smaller increases recorded because of the transit of the winter monsoon (December–March) (Fig. 3). The dominant direction of summertime surface winds over the study region is southerly; while winds at Socotra tend to blow from the southwest (Fig. 2). The onset of the summer monsoon off the coast of Somalia occurs at the end of May (25 May ± 5 days; Fieux and Stommel 1977). The impact of the summer monsoon on piracy here is swift and clear: in 2010 only one summertime attack took place in the study region after 25 May 2010. This single (unsuccessful) attack took place on 2 June 2010 off the southeast coast of Kenya (Fig. 1), an area much less impacted by the transit of the monsoon. When piracy resumed on 25 September 2010, mean daily wind speeds at Socotra had fallen below 9 m s\(^{-1}\).

The Somali jet index displays a very similar annual cycle to that recorded by the weather station on Socotra (Fig. 4). However, this record provides much greater detail, and is spatially more representative of the onset phase of the monsoon in May and June in our study area. No pirate attacks were recorded in 2010 following the onset of the Somalia jet (5 June ± 9 days). Instead, the bulk of all piracy (86%) took place during the transitional seasons and through the winter monsoon. Four pirate attacks recorded by the IMB took place following the onset of the Somali jet in June 2011 (Fig. 4), despite mean daily wind speeds exceeding 10 m s\(^{-1}\) on Socotra during this period (Fig. 3). Piracy resumed on 17 September 2011—a week earlier than in 2010—with five hijackings recorded as occurring during the month of September. Fifty-three more attacks were launched in the study area through the remainder of 2011; however, none of these attacks was successful.

c. Satellite observations 2010–11

The GlobWave database provided estimates of wave height (expressed as Douglas sea states) and surface wind speed for 54% of all pirate attacks in the study area (Fig. 5). Surface wind speeds during pirate attacks were generally low (less than 8 m s\(^{-1}\)), but once wind speeds exceeded 9 m s\(^{-1}\), no successful attacks occurred (Fig. 6). Once wind speeds exceeded 3 m s\(^{-1}\), attack success (expressed as the percentage of successful attacks) broadly declined with increasing wind speed, with a clear threshold reached once wind speeds exceed 9 m s\(^{-1}\) (Fig. 6). All piracy off the Horn of Africa was conducted in sea states of 4 and below (94% of paired observations) (Fig. 7), with most of these attacks launched in relatively calm oceans of sea state 3 and below (wave heights < 1.25 m). Attack success steadily declined as wave heights increased, with threshold behavior less conspicuous than that exhibited by the wind speed results (Fig. 7).

4. Discussion

During the boreal summers of 2010 and 2011, the Indian Ocean was very close to being free from piracy.
Only five attacks (0.02% of the 2010–11 total) were recorded in the study area during summer, and all these occurred in the month of June. Of these attacks, only one was successful (on 15 June 2011, at 45 km off the east coast of northern Somalia). One explanation for the strong seasonal trend in piracy is that maritime shipping may be limited during the summer months in the Indian Ocean region, and with fewer ships available to attack, the number of pirate attacks is reduced. Although data on ship movements through the study area in recent years are sparse, shipping records from the Suez Canal (through which Indian Ocean sailing ships must pass) suggest that peak ship traffic during 2010–11 was in the month of August (Suez Canal Authority 2011), when maritime piracy was at a minimum. A climatic control on piracy appears, in comparison, to be a more plausible explanation.

It is most likely that the strong and consistent surface winds and rough seas that follow the transition of the summer monsoon across the Indian Ocean were directly responsible for limiting Somali piracy in the summers of 2010 and 2011. Both weather station and satellite observations suggest that the critical wind speed threshold for pirates operating small boats in the Indian Ocean has been 9 m s\(^{-1}\). Once surface wind speeds exceeded 9 m s\(^{-1}\), attempts by pirates to attack were unsuccessful. When winds were blowing greater than 14 m s\(^{-1}\), our results indicated that Somali piracy halted altogether. These findings fit with the guidelines that have been produced by the maritime organizations that have been tasked with preventing piracy in the region (MSCHOA 2009).

In the waters off Socotra, this meant piracy was effectively shut down from the end of May to the end of September while the winds of the Somali jet battered the area. In practice, however, the higher sea states accompanying the winds of the summer monsoon disrupt pirates operating from small boats. Piracy flourished in the Indian Ocean region when sea states were less than 4, with attacks rarely launched in sea states greater than 4 (wave heights over 2.5 m). Further corroboration of this threshold by in situ wave buoy data would be an important addition to this work, but the great risk of attack from pirates in the Arabian Sea and Indian Ocean today has hampered the collection of direct observations (Smith et al. 2011).

The arrival of the winter monsoon in the region results in elevated wind speeds of up to 10 m s\(^{-1}\), approximately twice as strong as those recorded during the transitional seasons. From October to May, the open waters of the Indian Ocean are calm enough for Somali pirates to operate, with the majority of all attacks taking place in these months. In contrast to the summer months, the passing of the winter monsoon seems to present little obstacle to the pirates.

Although the analysis of pirate attack and climatic data very clearly shows the impact of the monsoon on Somali pirates, we must emphasize that this is a post-mortem study, with findings of relevance only to the current and recent past operations of small-boat piracy in offshore locations in the Indian Ocean region. For example, Kingsley (2011) notes that recent piracy in the Gulf of Guinea has remained fairly constant year-round. Summer monsoon winds may be less problematic to pirates operating in the Gulf of Guinea; however, it is more likely that the stark differences in the nature of piracy on either side of the African continent (Kingsley 2011) explain the contrasting annual patterns of attacks.

We should stress that the monsoon, although clearly an important first-order control on recent Somali piracy, is not the only influence on pirate activity in the region. Strong winds and rough seas cannot be invoked to explain the sharp decline in Somali piracy between January and March 2010 and in December 2011, for example (Fig. 3). For these periods, nonclimatic externalities (such as antipiracy operations, economic, social, or cultural influences) may have caused a brief decline in piracy. With so few data available for study, however, we may only speculate on such influences at this time.

**FIG. 5.** Location of pirate attacks (open circles) and matching satellite observations (n = 155) used in this study. Black lines mark the distance between the attack location and the corresponding satellite observation.
Finally, it is important to note that with only two years of observations in our study, the threshold values that we have observed for successful pirate attacks (wind speeds of 9 m s\(^{-1}\) and wave heights of 2.5 m) should not be considered infallible. With records of Somali pirate attacks extending back to at least 1999 (Kingsley 2011), there may be scope for testing our findings from 2010–11 against a longer time series if suitably matching climate and oceanographic data could be secured. Additional studies that reconstruct the environmental conditions experienced during pirate attacks will be needed to assess if these thresholds are valid for different locations and pirates, or for longer periods of time.

In coming years, the increasing use of larger mother ships may make long-distance travel during the summer monsoon easier for Somali pirates. This may, in time, diminish the important role that the monsoon appears to have in broadly controlling the timing and location of attacks. For now, however, pirates continue to launch attacks from small high-speed skiffs, which appear to have measurable and consistent operating limits that are controlling when and where piracy takes place. Our study has identified the baseline operating window of small-craft pirates. This will allow planning products to be developed that may help combat piracy in the waters east of Africa. For the present and foreseeable future, small-boat operations continue to be the primary means of attack by maritime pirates worldwide. As such, we hope that the applicability of our work from the Arabian Sea and Indian Ocean might be evaluated for other piracy hot spots where attacks using small boats are the modus operandi.

5. Conclusions

Somali-based piracy in the Indian Ocean has increased in recent years. Here, pirates typically attack using multiple small, high-speed skiffs that may be susceptible to the rough seas, inclement weather, and large distances found in the Indian Ocean. A direct comparison of pirate attacks in the Arabian Sea and Indian Ocean with the weather and ocean conditions in 2010–11 suggests that surface conditions associated with transition of the summer monsoon across the region have impacted piracy. Examination of the wind speed record offshore of Somalia and the Somali jet index shows that consistent, strong winds in the boreal summer coincide with a hiatus in piracy. We reconstructed the wind and wave conditions that existed during individual pirate attacks using the satellite altimetry data archive for the two-year
Our analysis of these data suggests that clear environmental thresholds in the Indian Ocean region exist, and that these control when and where piracy takes place. We propose that the transition of the summer monsoon is likely to have been an important suppressant of recent maritime piracy.

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