MARITIME STRATEGIC EVALUATION FOR ISRAEL 2020/21

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Oceans and Pandemics: Lessons to learn to address Climate Change

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Introduction

Oceans that provide global mobility to trade and humans have been responsible for the spread of pandemics since ships have moved on the seas. Be it the infamous plague (1347–1352), cholera (1817), yellow fever (1845–1846), typhus (1892), tuberculosis or influenza (1918), they all have spread through ships moving on the oceans. Unlike the earlier episodes, the recent pandemic,[1] COVID-19, has not spread through ships. However, there have been some incidents wherein ships were quarantined or disallowed entry to ports due to COVID-19 cases onboard. As the number of affected nations increased, international borders were closed and lockdowns enforced to prevent a spread that brought businesses to a grinding halt. This notwithstanding, lockdowns provided a unique window of opportunity to scientists and environmentalist alike to study the environmental changes using automated monitoring techniques such as information technology and remote sensing technology. Of these, only a few of studies have focused on the environmental changes in the maritime domain. It is with this understanding that the paper aims to discuss the maritime domains impacted by COVID-19 (GHG and oil pollution, marine litter, fisheries, marine tourism, underwater noise and waste water discharge) to highlight the lessons to learn from the public-health-emergency, COVID-19, to address climate change, a public-health-emergency-in-waiting.

Background

There have been numerous events of climate change on Earth since the Precambrian times[2]. These are all considered *normal* system behavior. However, anthropogenic activities such as burning of fossil fuels (from transportation, energy production),

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1 An *epidemic* that has spread over a large area and is prevalent throughout an entire country, continent, or the whole world. Epidemic is the temporary prevalence of a disease affecting many persons at the same time, and spreading from person to person in a locality where the disease is not permanently prevalent and occurs at the level of a region or community.

2 The Earth naturally undergoes cyclical climate change which is a significant variation of average weather conditions—say, conditions becoming warmer, wetter, or drier—over several decades or more.

cement manufacture, land use (through agriculture, livestock farming, forestry), and aerosols (such as chlorofluorocarbons [CFCs]) generate greenhouse gas (GHG) emissions that create a deviation from this normal system behavior. To appreciate the anthropogenic contribution to climate change, several scientific studies such as the study of ice-cores and geological samples (Etheddge et al., 1996; Lüthi et al., 2008; Friedlingstein et al., 2019) and the cumulative impact of different types of anthropogenic stresses[3] on various global marine ecosystems types[4] have been performed (Halpern et al., 2008, 2015, 2015a). Though these studies confirm anthropogenic contribution to climate change, this fact continues to be hotly debated in political circles.

On a similar note, bacteria and virus, considered the basic building blocks of life have been around since life begun on Earth. It is only when humans began to live with plants and animals, bacteria and viruses began to cross over and humanity saw epidemics. As globalization and population growth increase the average global mean surface temperature (GMST) due to anthropogenic activities (Huppert & Sparks, 2006; IPCC, 2018), the habitat of various common disease vectors[5] is increasing (Reinhold et al., 2018; Ryan et al., 2019) and spreading from the Tropics to colder regions (which are warmer now) to create fresh strains of epidemics (Githeko et al., 2000). These epidemics cause death (at times nearly 80% of a country's population and billions in global figures), alter the lifestyle of people (to contain the spread) and bring shrinkage to the economy (due to slowing/stopping of commercial activities). When recovery happens, individual lives change and the economy recovers (Conis, 2020) but all at the cost of the environment (Delivorias & Scholz, 2020).

This said, if the epidemic is treated as a health-emergency it brings about improvement in living standards as seen with the *Plague, Cholera*, and *Typhoid* of the nineteenth century that gave us tapped water in houses, sewage systems, piped gas, electricity, and health and safety standards. However, if the epidemic

3 Artisanal fishing, Demersal destructive fishing, Demersal non-destructive high by catch fishing, Demersal non-destructive low by catch fishing, Direct human impact, Inorganic pollution, Invasive species, Light pollution, Nutrient Pollution, Oil rigs, Ocean acidification, Ocean-based pollution, Organic pollution, Palegic-high by catch fishing, Palegic-low by catch fishing, Sea level rise, Sea surface temperature, Shipping and UV.

4 Coral reefs, Seagrass, Rocky reefs, Palegic Surface water, Palegic Deep water, Mangroves, Seamounts, Hard Shallow, Soft Shallow, Hard shelf, Hard slope, Hard Deep, Soft Shelf, Soft Slope, Soft Deep, Deep Water, Surface Water, Nearshore ecosystem, Deep ecosystem, Shallow ecosystem.

5 Such as the *Aedes aegypti* mosquito, which can spread dengue, chikungunya, Zika, and Yellow fever.

is considered an economic/ financial crisis, it increases global CO_2 emissions and hence deterioration of the environment as seen in Figure 1, due to unsustainable rebounding methods (Agarwala & Polinov, 2020).

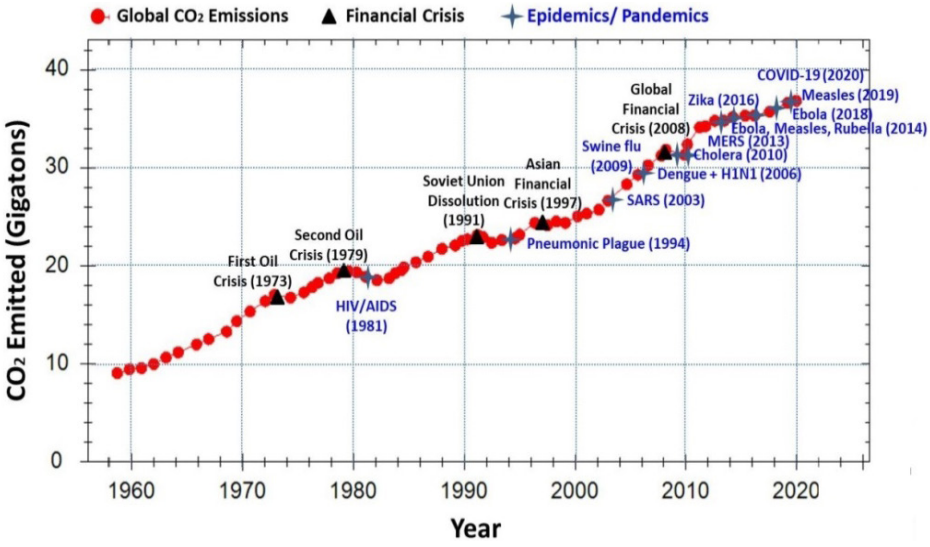


Figure 1: Global fossil CO_2 emissions (in Gigatons of CO_2), with the most important world financial crises and epidemics/ pandemics. (Source: Agarwala & Polinov, 2020)

Another area that is fast becoming a growing cause of concern for the spread of epidemic is 'climate change'. As climate change impact increases, the number of climate refugees[6] are increasing thereby causing unplanned urbanization, poor sanitation, poor access to clean water, increased transmission of contagious diseases (Bloom et al., 2018) and multiple types of conflicts (Marshall, Hsiang & Edward, 2012). In addition, variations in precipitation[7] due to climate change (Trenberth, 2011) creates undue stress on the existing sources of clean water causing water-borne epidemics and growth of water-borne vectors (Hunter, 2003). It has also been shown that as ocean currents increase, the number of cholera cases increase (Colwell, 1996; Lipp et al., 2002). If these were not enough, air pollution kills an estimated seven million people globally each year (Seaton et al., 1995; Isaifan, 2020). This effectively means that climate change needs to be categorized as a 'public-health-emergency' as it has the potential to spread several epidemics.

6 *Climate refugees* are people who are forced to leave their home region due to sudden or long-term changes to their local environment. These are changes which compromise their well-being or secure livelihood.

7 High precipitation causes floods and low precipitation causes droughts.

To add to all this, the universal 'sink' – the oceans – are shouldering the outcome of events that happen on land. Since both the land and the ocean are interconnected, events such as a landfill, a land based pollution, or deforestation of land all eventually result in a negative impact on the oceans as does the economic slowdown or changed lifestyle as a result of epidemics.

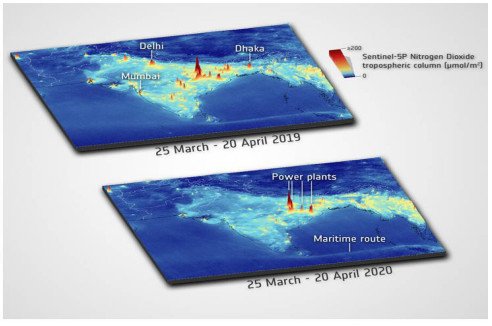
Effect of Lockdown on Oceans

COVID-19 has shown that the Earth has a limited capacity and if these capacities are stretched, nature will reset itself causing mass-extinction as seen many times since the Precambrian times. Accordingly, we will discuss the impact of lockdown on the maritime domain and some lessons to learn to address climate change.

Pollution levels

Of the first few studies related to the marine environment, using space-based imagery, the European Space Agency's Copernicus Sentinel-5P mission (ESA, 2020) has shown that the shipping lanes have recorded reduced noise and pollution levels (see Figure 2). Similarly, due to reduced tourism and boat traffic in Venice, the waters are clearer and marine life has been sighted (see Figure 2).

Venice – reduced boat traffic leading to clearer waters (seen as lighter colour in the top image of 13 April 20)



Indian Ocean – reduced pollution levels on maritime routes

Figure 2: Water pollution levels – before and after – outbreak of COVID-19 (Source: ESA, 2020)

Ocean noise

The oceans are called as the 'silent world' as little is known about the sounds that exist there. The oceans are actually a noisy place with humans greatly adding to this noise by using sonars, seismic surveys, oil drilling, dredging, and the ships' engines. Such noises cause physical damage, alter behaviour, communication and feeding of marine life resulting in increased whale stranding, killing of zooplankton (McCauley

et al., 2017) and change relationship with other species due to an altered singing frequency. While no map for the ocean noise exists to date, it is known that growing ship traffic has increased sound contribution by nearly 3 dB per decade (or doubled the noise intensity every 10 years on a log scale) between 1950 to 2000 (Jones, 2019). These increased sound levels have led to a highly stressed marine life (Rolland et. al., 2012) that has shown reduced reproduction, reduced caring for offspring and greater chance of being hunted.

Studies (Thomas & Barclay, 2020) made at the NEPTUNE nodes (see Figure 3) show an average reduction of 1.5 dB in year-over-year mean weekly noise power spectral density at 100 Hz, while near the shipping channels off the Port of Vancouver it was 4 to 5 dB due to limited shipping during the lockdown. Similarly, in the Indian Ocean Region (IOR) a reduction of nearly 29 dB was recorded by the Maritime Research Centre in India (HT, 2020). It may be noted that after the 9/11 attacks, noise levels decreased in the Bay of Fundy, Canada by nearly 6 dB in the 20-200 kHz range with a significant reduction below 150 Hz (DOSIT, 2020). Such an acoustic reduction creates a healthy marine ecosystem and a healthier ocean.

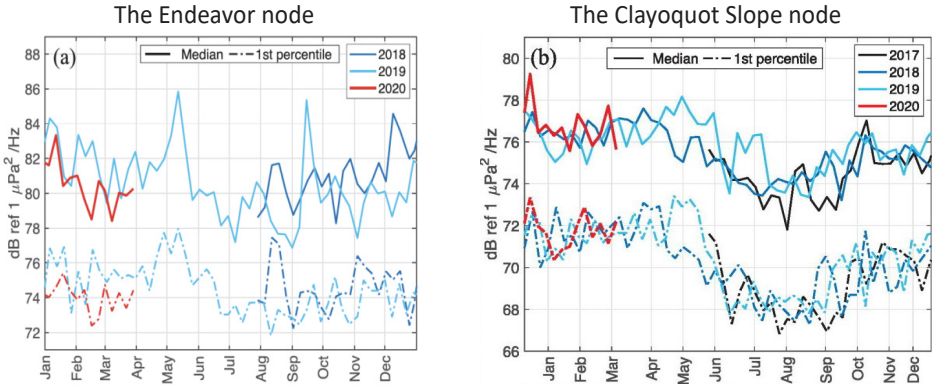


Figure 3: Sound reduction year-over-year at nodes of NEPTUNE observatory (Source: Thomas & Barclay, 2020)

Fisheries

The lockdown has reduced the global fishing hours as seen in Figure 4. Such reduction has helped create 'marine protected areas' thereby increasing the availability of the otherwise overexploited fishes. While the economic impact on fishing community due to unsold catch, lack of transportation and reduced demand have impacted the industry, such MPAs have rejuvenated the ocean space. This would help maintain long-term productivity of fisheries, an area greatly affected by overfishing (Stewart

& Wentworth, 2019) and ensure that current fishing trends of 34% below the biologically sustainable levels (FAO, 2020) can be reversed.

Figure 4: Global Fishing Activity from 2018 to 2020 (Source: Authors; Data from Global Fishing Watch)

Marine tourism

The lockdown has given the nature an opportunity to recover after being exploited by marine tourism with cleaner beaches and waters, lesser litter and increased sea animal sighting due to reduced noise from tourists (Ormaza-González et. al., 2020) in many marine tourist destinations across the globe, including Venice as seen in Figure 1. In addition, lesser fishing activities have contributed to healthier and cleaner beaches.

Marine litter and waste water discharge

It is not that on every front, COVID-19 has shown positives for the health of the ocean. For marine litter and waste water management, the impact has been negative. COVID-19 has increased the quantum of plastic waste reaching the oceans due to increased use of disposable masks and personal protective equipment used to fight the pandemic. The stoppage of recycling activity of the plastic waste during lockdown has compounded and worsened the problem. Similarly, COVID-19 has increased the quantum of polluted water due to frequent washing of hand with soap, which in most cases is being discharged untreated.

Weather related events and epidemics

When weather-related events and epidemics are seen together, one notices that both have a tendency of an increase over the years (Agarwala & Polinov, 2020) as seen in Figure 5. This shows that the occurrence of weather-related events and epidemics are directly related to each other and are a direct reflection of climate change due to anthropogenic factors. Effectively, if the anthropogenic factors are reduced, both epidemic events and weather-related events will reduce.

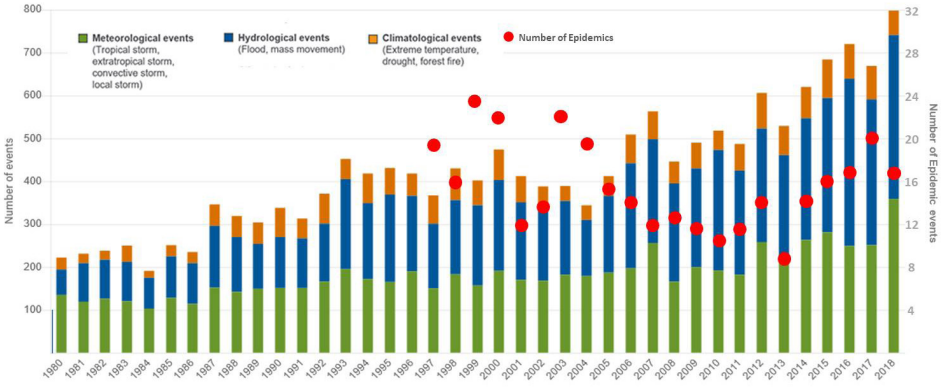


Figure 5: Number of weather-related events worldwide 1980–2018 (Source: Agarwala & Polinov, 2020)

Way Ahead

In the preceding section we have discussed the positive and negative impacts of COVID-19 on the marine environment. While the positive impacts are encouraging, they cannot be considered permanent as once humanity returns to business-as-usual these levels will see new highs due to existing unsustainable procedures for economic recovery. One realises that both epidemics and climate change are here to stay if business-as-usual continues. Since both impact life and economies, they need to be addressed urgently. While pandemics have united the world in finding a cure, climate change is unable to do so. This is primarily due to the varied effects of climate change on different parts of the world and the added cost to resolve the issue with the onus being put on developing and underdeveloped nations. This has disallowed nations to think as one for a solution. Furthermore, since the impact of climate change is hard to see, they are out of the mind and usually ‘not in my term’ resulting in no actionable attention of world leaders.

This said, if overlooked, the damage done may cause serious and irreversible economic and life loss (Kompas, et al., 2018; Doelle and Seck, 2020). With globalized economies, a destroyed economy of a developing nation, as a manufacturing house for the developed nations, will eventually destroy the economy of the developed nations. It is time that the world considers COVID-19 as a wake-up call for overdue actions towards 'climate change'. Eventually, the way ahead will depend entirely on the decision of today that will change our response to future disasters. These decisions need to be based on the lessons learnt from this pandemic to move away from certain destruction. Some of these lessons are:

Lessons Learnt

(a) A more cautious approach is required when interacting with "Mother Nature" as it is a perfect system that is being upset by humans.

(b) Scientific data and advice need to be given their due when taking political decisions.

(c) Nature has the ability to heal itself. This means that nature needs to be exploited sustainably[8] or else we may force her reboot. Accordingly, the decisions for an exit policy from the present health-emergency must be sustainable ones to help reduce GHG emissions (IPCC, 2013; Oreskes, 2004).

(d) With 'political will' enormous funds can be mobilized to address any issue, including 'climate change'.

(e) Humanity needs to adopt planet-healthy work-ethics. During this confinement, offices, research, networking, and the likes were managed efficiently using online meetings and video conferences (Viglione, 2020) so why can't it become the new normal.

(f) Health emergencies cause economic downsides, job loss and deaths, curtailment of human rights and freedom (Toussaint and Martínez Blanco, 2019), increase the divide between the rich and the poor, and increase marine litter and waste water. These must be avoided.

(g) Human interaction with the animal kingdom has always been disastrous and has caused anthropogenic stresses such as IUU fishing that causes unsustainable fishing leading to destruction of ocean health and climate change.

(h) Reduced sale of luxury items are the cause of economic slowdown. They also are a cause of GHG emissions that causes climate change.

8 Such that it meets the needs of the present without compromising the ability of future generations to meet their own needs.

(j) Today, human life is not a priority or else efforts to control and minimize health emergencies and health-emergencies-in-waiting such as climate change would have been given the required impetus.

(k) Even after being hit by the pandemic, the human approach to environment is lax and unsustainable. It is essential that impetus is placed on correcting this incorrect approach.

Recommended actions

A healthy planet is one with lesser diseases. While we need to rebuild our economy, however, this needs to be done by investing in 'cleaner and greener' technology paradigms using at least a small portion of the economic bailout package committed by nations for this pandemic bailout and not to give in to pressures of rolling back environmental standards to stimulate the economy. Studies indicate that climate change can cause over 500,000 extra deaths in 2050 from illnesses including cancer, heart disease, and stroke as a result of lack of food alone (Springmann et al., 2016). It is because of this that climate change has been described as the *biggest global health threat* of the 21st century (Costello et al., 2009) and needs to be addressed. Some recommended actions to address climate change for consideration are:

(a) Sustainability while exploiting flora, fauna and wildlife must be ensured and monitored.

(b) Scientific data and advice should be given due consideration when making decisions.

(c) Human intervention to modify nature must be minimized and exercised only in extreme cases.

(d) Climate change is a public-health-emergency-in-waiting. Political will and unanimity must be created to mobilize both monetary and technological resources to address the anthropogenic causes of climate change.

(e) Planet-healthy work-ethics must be encouraged and unnecessary travel should be discouraged to reduce GHG emissions.

(f) Polluting luxury items must be phased out and replaced with greener and cleaner technology items.

(g) Saving human lives from natural disasters pro-actively should be a priority for governments. Such an approach will help tackle epidemics and climate change better.

(h) Rebuild the economy by investing in 'cleaner and greener' technologies to reduce anthropogenic causes of climate change.

(j) Utilise at least a small portion of the economic bailout package for COVID-19 to fight climate change.

(k) Do not roll back environmental standards to stimulate the economy for recovery.

(l) The current pandemic should be addressed as a health emergency to bring about environmentally beneficial changes in health and safety standards and achieve the committed goals of the Paris Agreement.

(m) Marine litter must be checked regularly using technology such as AI (Agarwala, 2020) to ensure a healthier ocean.

Conclusion

The article discusses the maritime domains impacted by COVID-19 to highlight the lessons to learn to address climate change. Accordingly, lessons learnt and some recommendations to address global and long-term climate change issues have been discussed.

One notes that changes due to the forced confinement in the maritime setup have been both positive and negative with regard to the ocean health. This notwithstanding, it is clear that humanity is destroying the ecology and the environment for his personal gain. It is hence important that sustainable means of exploitation are employed or the destruction of the Earth is not far. With climate change being one of the biggest risks and danger looming on humanity, some recommendations have been made to slow down if not roll back the impact of climate change.

Like previous episodes, humans will recover from the present setback. However, this recovery should be on sustainable lines and not by rolling back environmental standards to stimulate the economy. The need exists to evolve new mechanisms to boost the resilience of people and communities (International Federation of Red Cross & Red Crescent Societies, 2004; Broberg, 2019). Though one cannot make predictions, however, the future will be governed by the decisions we make today. The time to act is now. We have been postponing the action against climate change for way too long. We may develop immunity or a vaccine against a virus, but we will never have a vaccine against climate change. For that, we will have to create provisions in the right direction with the know-how we have and the know-how we develop. This will eventually define the future for us Earthlings.

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