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CAN ENVIRONMENTAL PROBLEMS BE EFFECTIVELY SOLVED BY SCIENCE AND TECHNOLOGY?

The role of Science and technology in Tackling environmental Problems

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ABSTRACT

Science and technology play a crucial role in addressing and resolving various environmental problems. For starters, scientific research and technological advancements help in understanding the causes and impacts of these problems (Svendsen, 2021). Moreover, they provide valuable insights and data that can guide policymakers, businesses, and individuals in formulating effective strategies and solutions. Additionally, science and technology enable the development of innovative technologies and practices that can help mitigate environmental issues such as, ocean acidification, water pollution, garbage pollution, fast fashion and textile waste, soil degradation, overfishing, Exploring Garrette Hardin's "The Tragedy of the Commons"

Illustrates this proposition with the following story:

A village has common green for the grazing of cattle, and the green is surrounded by farmhouses, Initially, each farmer has one cow, the green can easily support the herd. Each farmer has one cow, and the green can easily support the herd. Each farmer realizes, however, that if he or she gets another cow, the cost of the additional cow to the farmer is negligible because the cost of maintaining the green is shared, but the s are the farmers alone. So, one farmer gets more cows and reaps more profit, until the common green can no longer support anyone's cow and the system collapses.

Hardin presents this as a parable for over population of the earth and consequent resource depletion. (Hardin,G. " The Tragedy of the Commons", Scienc;)

"To truly leverage the benefits of science and technology for sustainable development, we need to prioritize solutions that are pro-poor and equitable," Mr. Liu said. "Only in this way can we ensure that no one is left behind."

He stated that a rapidly warming planet was one of the greatest threats today, but a wide array of technological measures for climate change adaptation and mitigation can help the transition from carbon-intensive growth, towards more sustainable and resilient development. (https://www.un.org/hi/desa/can-science-and-technology-really-help-solve-global-problems-un-forum-debates)

Key Words: Environmental Pollution, Ocean acidification, Water pollution, Nanoparticles, soil degradation,

INTRODUCTION:

Destroying ecosystems that we only scarcely begin to understand can hardly be considered an acceptable way to meet climate targets. A real "green transition" cannot maintain the same extractive model that has driven climate change and biodiversity loss in the first place, the same mindset that has wiped out forests and dug craters into the earth. Mining the ocean floors could cause irreparable damage to nature, like it already does on land.

Among the currently investigated materials for water treatment, metal organic frameworks (MOFs), a developing class of porous materials, have provided excellent platforms for the separation of several pollutants from water. The structural modularity and the striking chemical/physical properties of MOFs have provided more room for target-specific environmental applications. However, MOFs limit their practical applications in water treatment due to poor processability issues of the intrinsically fragile and powdered crystalline forms. Nevertheless, growing efforts are recognized to impart macroscopic shapability to render easy handling shapes for real-time industrial applications. Furthermore, efforts have been devoted to improve the stabilities of MOFs that are subjected to fragile collapse in aqueous environments expanding their use in water treatment. Advances made in MOF based material design have headed towards the use of MOF based aerogels/hydrogels, MOF derived carbons (MDCs), hydrophobic MOFs and magnetic framework composites (MFCs) to remediate water from contaminants and for the separation of oils from water.

The fast fashion industry is growing very fast. The leading companies like H &M are using their economic power even to cause more consumption. The use of clever marketing, campaigns, and social media has enabled companies to change clothes' perceptions. Society today now treats clothes like they are perishable goods. The promotion of the 'throw away' campaign and use of Supply Chain Management have caused more considerable profits to the companies but at a cost to the environment.

LITERATURE REVIEW:

Several researchers have looked at the issue of environmental issues and Technological progress can effect quality of life. The potential benefits of nano technology are immense and so are the perceived risk which should be addressed early. the National Nanotechnology Initiative(NNI), in close collaboration with the professional community, has taken a proactive approach. The National Nanotechnology Initiative Strategic Plan is the framework that underpins the nanotechnology work of the NNI agencies. It aims to ensure that advancements in and applications of nanotechnology continue in this vital area of R&D, while addressing potential concerns about future and existing applications. On October 8, 2021, the National Nanotechnology Coordination Office (NNCO) announced the release of the 2021 National Nanotechnology strategic plan which outlines the goals, objectives, and actions for National Nanotechnology Initiative (NNI) over the next five years.(Lynn L. Bergeson, 2024)

Goal 1. Make sure that American research and development (R&D) in nanotechnology continues to lead the world: NNI states that NNI agencies will keep funding nanotechnology research and development by utilising all of their available tools and powers.

Goal 2. Encourage the commercialization of nanotechnology research and development: According to NNI, it will step up efforts to hasten the translation, commercial application, and scale-up of nanotechnology research and development into the market to guarantee that benefits to the economy, society, and environment are realised and to assist in the nation's recovery by creating well-paying jobs.

Goal 3. Provide the infrastructure necessary to enable the research, development, and use of nanotechnology in a sustainable manner. As per the NNI, one of the fundamental requirements for nanotechnology R&D is still the need for costly, specialised instruments.

Goal 4. Involve the public and increase the number of workers in nanotechnology: NNCO and NNI agencies will highlight opportunities and access to resources, particularly for those in historically underprivileged neighbourhoods, and will use a range of strategies to support public outreach and education from "K to grey.".

Goal 5. Assure the responsible development of nanotechnology: According to NNI, the framework for responsible development outlined in the Strategic Plan builds on ideas that were initially included in its responsible development initiatives while also embracing new ideas that have developed. (Lynn L. Bergeson, 2024)

This saves fishermen time and helps to avoid what's behaviour response to light to catch specific species. known as **Bycatch** – other fish or marine life that inadvertently gets caught in nets, including turtles, dolphins and juvenile fish. (Rooney, 2020)

Thirdly, The use of smart technology for better fishing outcomes is the focus of a European Union-led initiative, SMARTFISH2020– a multinational collaboration set up to use emerging technology, like AI, machine vision and acoustics, to help fishermen make more informed decisions. Lastly, CatchScanner uses machine vision to create 3Dimension images of fish can be detected as they hauled aboard a vessel,assisting crews on board to accurately determine species and relocate to waters where species are present in abundance.A hand held new version of CatchSnap, could even be used on mobile phones, enabling smaller vessels to make use of the technology. (Rooney, 2020)

METHODS

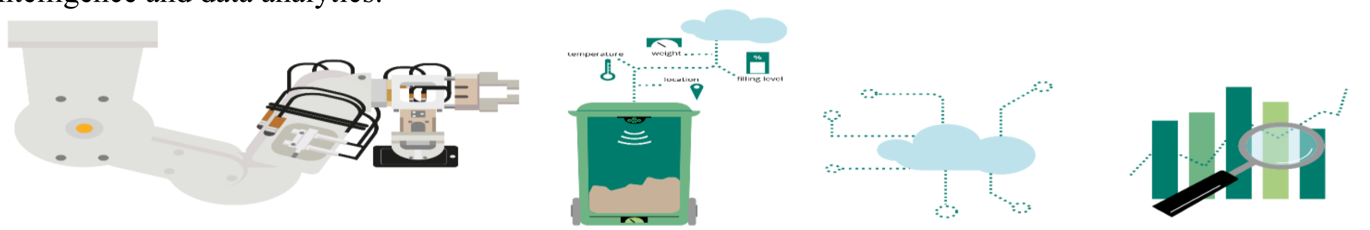
CONSERVATION OF RESOURCES

Internet of Things (IoT) devices and smart household appliances can alert users about excessive energy waste and use AI to turn off the power when they are not in use.
For example, smart bulbs and thermostats can automatically detect activity in the room and turn off the light when there's nobody around, to help preserve energy.

A smart deforestation, biodiversity loss, Acid Rain, Global warming from fossil fuels, food waste sprinkler system can adjust itself according to the weather and it regulates water consumption levels, optimizing its impact on the water supply and reducing water bills.

Modern green buildings utilize natural light to reduce the coal consumption required to power them, which also results in lower lighting bills.
In 2017, electric power accounted for 93% of coal consumption in the US. As a result of the implementation of smart technologies, **the power sector in the US consumed** 30% **coal in the first half of 2020 than in the same period in 2019.** (https://www.doforms.com/technologies-that-help-environment/)

Examples of specific digital technologies that are currently used and expected to have a major impact in future on the efficiency of the waste industry include robotics, the internet of things, cloud computing, artificial intelligence and data analytics.



	Robotics	Artificial intelligence and neural networks	Internet of things	Cloud computing	Data analytics
PROCESS	Advancements in the pneumatic sorting process as a result of automation technology allow producing defined waste streams of high purity (over 90 %).	Machine learning — using neural networks based on the use of data or examples to solve problems without explicit programming — is used for classification and pattern recognition in the waste management context, improving the efficiency of sorting.	As more and more devices are connected to the internet or other networks, sensor-supported containers can collect data and transfer it to central units.	Storing and processing of sensor data and cloud based software solutions make it easy to optimise workflows and document failure to collect, failure in sorting or detect waste bins that are not paid for.	Processing and analysing data plays an important role in the recycling industry in order to identify patterns, extract information, discover trends or calibrate models. This knowledge is important in order to evaluate different options for the transition to a recycling economy.
EXAMPLES	- Robots that are able to identify and sort recyclables and critical materials through image recognition/IR scanning/ AI vision systems when dismantling used phones/electronics	- Autonomous, self-driving street sweepers, refuse trucks	- Smart waste bins with identification systems, weighing systems, level sensors, temperature sensors, sofware for optimising logistics	Cloud based software for: - Connection, standardising and optimising internal procedures - Real-time order management, route planning and optimisation, customer self-service, order-tracking and evaluation	- Electronically supported diposition of waste collection vehicles - Evaluation of sensor data for automated sorting plants - Control of waste incineration plants - Drone based data collection on landfills

(Figure 1)

USING DIGITAL TECHNOLOGY IN WASTE MANAGEMENT

Digital technologies have had a greater impact on waste management system. Certain aspects of collection have been transformed by advances in digitalisation, especially logistics — the process of organising, scheduling, and dispatching tasks, personal and vehicles. Here, digital tools offer the potential to enhance the process by storing, processing, analysing, and optimising the necessary information. Information generated during the collection process, e.g. on task progress or incidents, can be monitored in real time. Another part of waste collection is the process of documentation, communication, and billing. Here, the ongoing switch from paper-based administration systems to digital systems, as seen in other industries, will further increase the efficiency of processes and flow of information.

Digitalisation also enables the development of advanced 'know-as-you-throw' schemes. In these schemes, waste management operators use radio-frequency identification (RFID) to monitor waste fractions at household level. Below diagram shows Environmental effects on Digitalisation. (Kinnaman, T. C., 2009) (How Industry 4.0 transforms the waste sector, 2020)as in Figure2

Figure 2

IMPROVEMENT OF OUR COGNITIVE ABILITIES

- Devices we use on a daily basis are equipped with technology that improve our own functioning. For example:
- **Health and fitness apps** help users preserve mental and physical wellness by reminding them to exercise, drink more water and eat healthier. The introduction of AI in medicine can lead to quicker health diagnoses and the accuracy of treatment suggestions. (Yixin Ma, 2023)
- **Smart home systems** that change or shut down light at certain times contribute to better sleep patterns and protected eyesight.
- **Today's smart classrooms** stimulate students' active participation and interaction with personal digital devices, smart whiteboards and smart projectors. Smart classrooms also conserve energy and include AI-based climate control and lighting to create a comfortable learning environment that improves alertness and responsiveness.
- **Workplace technology** like digital work management systems help us work smarter and more efficiently by improving processes and workflows, analysing data and identifying problems faster than humans.
- Healthier and more alert people have a better capacity to work, learn and think smarter, leading to more ways of preserving the environment.

A GREEN TRANSITION WITHOUT MINING THE OCEAN

This proposal was finally approved by Norwegian parliament– better known as Storting – on January 9, 2024, with 80 votes in favour and 20 against, making Norway, already Western Europe's largest oil and gas producer, one of the first countries in the world to open the door to deep-sea mining.

The decision to only allow exploration for the time being and not actual extraction offers a "small glimmer of hope," according to Lønne Fjærtoft, global policy lead for WWF's No Deep Seabed Mining Initiative. "**This gives parliament the opportunity to say no to exploitation, which is a significant change to the government's proposal**", she said in a statement.

Due to the logical complexity of exploring the deep sea, data assessing the potential impacts on deep-sea mining is scarce and requires more research. There are still many uncertainties surrounding deep-sea ecosystems and their vulnerability to mining activities, and scientists are concerned that mining would have dramatic effects on marine biodiversity.

The Norwegian government's main argument to allow deep-sea mining is that the minerals it would provide are essential to the green energy transition, though studies show the opposite.

According to a 2024 report by the Environmental Justice Foundation, seabed mining is not needed for clean energy. Instead, more investment should go into a circular economy that recycles and reuses the minerals we already have, which could cut mineral demand by 58% between 2022 and 2050. In order to extract minerals, enormous mining machines would scrap the seafloor like combine-harvesters. It is quite likely that many deep-sea organisms will be directly crushed and killed by the mining equipment. In addition, the machines would release sediment plumes in the water, poisoning and suffocating aquatic animals. Deep-sea mining could potentially destroy species and genetic resources before they have been fully studied or even discovered. (MARION BESSOL, 2024)

OCEAN ACIDIFICATION:

The ocean is a great ally against climate change, absorbing around 30% of anthropogenic carbon dioxide emissions. Microorganisms play a significant role in carbon sequestration in the deep sea, and their loss following mining activities might impact the ocean's carbon cycle and reduce its ability to mitigate global warming. Not to mention the fact that mining activities will themselves emit planet-warming greenhouse gases as vessels and mining machines will require fuel consumption.

Mining activities could disrupt ecosystems in the long run, by impairing processes associated with feeding, growth and reproduction. The machines will generate sound and light pollution in the silent, dark world of the deep sea. Bioluminescence, light produced directly by deep-sea animals, is the only natural source of light in these ecosystems. The bright lights of the engines risk masking the ecological functions of bioluminescence and may even irreversibly damage the eyes of local organisms. Noise generated by mineral extraction is likely to reach the upper water column, thus potentially affecting many marine animals like certain species of whales and dolphins that rely on echolocation.

COMBATING WATER POLLUTION THROUGH INNOVATIVE TECHNOLOGY:

Science and technology have a crucial role to play in combatting water pollution through the development and implementation of innovative technologies.(Svendsen, 2021) Science and technology are instrumental in addressing garbage pollution and promoting recycling. (The Nature of Science and Technology in Teacher Education, 2021).

New Studies have found that 1 Litre of Water contains about 240,000 plastic particles. The trailblazing study, published Monday in the scientific journal PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (PNAS), looked at five different water bottles from three popular brands, which researchers declined to identify. They found, on average, 240,000 particles from seven different types of plastic, mostly in the form of nano plastics.

In a statement in response to the study, the International Bottled Water Association said there is still a "lack of standardized methods and no scientific consensus on the potential health impacts of nano- and microplastic particles," and that "media reports about these particles in drinking water do nothing more than unnecessarily scare consumers." The Association did not comment on the findings of the study citing "very limited notice and time to review it. (Martina Igni, 2024)

METALS THAT ARE TOXIC ARE FOUND IN THE WATER SUPPLY

Heavy metals (HMs) are often distributed unevenly between the water and the sediments of the riverbed. To what extent metals are transported across the sediment–water interface depends on the physical and chemical properties of the water as well as the sediment. The accumulation of HMs in river environments leads to harmful amounts that biota can absorb because these contaminants are neither biodegradable nor thermodegradable (Yixin Ma, 2023)

Extreme hydrometeorology provides a window into the ever-changing balance between HMs in sediments and water flow. River flows are rising due to climate change, which is washing silt from riverbeds into the higher reaches of rivers. Because of this, the composition and quality of the water can be altered over time by pollution deposits that are buried deep underground (Frogner, Paul; Gíslason, Sigurdur Reynir; Óskarsson, Niels).

The increasing number of megacities, together with urbanization's other effects such as population increase and migration, provide a problem for clean water supplies [(TOVE A. LARSEN, 2016). Emerging concerns to the supply of safe drinking water pose serious dangers to human health and have broad public health implications (Chowdhury S, 2016). Polluted urban waters affect the quality of drinking water and pose a threat to urban residents since these metal contaminants are carried throughout the city via the air, surface runoffs, and groundwater flow. The correct methods and equipment can be used to control water contamination from point sources such factories, sewage systems, power plants, underground coalmines, and oil wells.

Heavy metal contamination surrounding mines can range from mild to severe, depending on factors including mineralization of tailings and geochemical properties. Generation of millions of tons of sulfide-rich tailings by opencast mining activities has a significant negative effect on soils and water streams. There is a high probability that wind and water will distribute, incorporate into particle matter, or dissolve trace elements in mining and metallurgical waste following disposal. When the transportation process was on then the pollution can arise from three sources: primary contamination, which is caused by residues near the sources of contamination; secondary contamination, which occurs when trace elements spread out from their production areas through water and wind and tertiary contamination, which signifies the mobilization of trace elements (Swain, 2024)

Heavy metals can enter the aquatic environment in one of two ways: naturally or artificially. Indirect channels include dry and wet deposition and land run-off in addition to direct discharges into fresh and marine habitats [Significant natural sources also come from forest fires, continental weathering, and volcanic activity. Either high, intermittent emissions from explosive volcanism or low, continuous emissions from processes like geothermal heat flow or magma degassing can be attributed to volcanic activity. (Wenjie Tian, 2023). Groundwater contamination is a major environmental issue. Groundwater has always been safe to drink because the land above the aquifer filters it. Surface leaks from trash or bulk liquid storage (like gasoline) are the main source of groundwater contamination. Chemical wastes dumped on the ground may contaminate the underlying groundwater over time. The pollution of groundwater is also worsened by the leaching of fertilisers and pesticides from the agriculture sector too (Alaa J. Dakheel Almaliki, 2022)

MOF'S AS AN EFFICIENT FUNCTIONAL MATERIAL TO CONTROL ENVIRONMENTAL POLLUTION

In this context, Metal-Organic Frameworks (MOFs) are demonstrated to be an efficient functional material to control environmental pollution by functioning as a promising adsorbent. MOFs are a novel class of crystalline porous material having a hybrid framework of the organic linker and inorganic nodes. This framework structure enables many features such as high surface area, porosity, stability, and, tuneable pore size that are used for various applications , In terms of water remediation, MOFs are highly capable of adsorbing heavy metals and organic pollutants (such as dyes, pharmaceutical waste, etc.) . Additionally, MOFs such as Zr-based UiO-66 , Zn-based ZIF-8 , ZIF-67 , Cr-based MIL series , and Fe-based MIL-100 are utilized and studied significantly for the removal of water contaminants. Among these, the UiO-66 MOFs have received considerable attention as they exhibit excellent chemical and physical properties. These properties project the material to the forefront due to its high stability in acidic, basic, aqueous, and, thermal conditions along with mechanical stability. Due to the delicate nature of the powdered form, MOFs lack the research gap that prevents practical. In addition, the disintegration of the framework would pollute the water by releasing metal ions back into it.

Therefore, to use MOFs practically for water remediation, we must come up with methods to form a composite of MOFs with other materials like a membrane, polymers, aerogel, hydrogel, graphene oxides, etc. When working on water remediation, it is typically preferred to use environmentally friendly materials, such as biopolymers, to avoid toxicity. Recently, Ni et al, have synthesized a composite of HKUST-1 MOF with cellulose along with iron oxide (Fe_3O_4) for the removal of Methylene blue dye Wherein, the MOF and Fe_3O_4 adhere to the cellulose fibres, and once the dyes are adsorbed, the composite can be effectively removed using a magnet. Similarly, Alkordi et al. synthesized a mixed matrix membrane consisting of UiO-66-NH_2 MOF and cellulose acetate polymer for the removal of organic dyes as well as heavy metals. This composite absorbs a wide range of pollutants, and because the polymer forms a cage around MOF to protect it physically, the composite's removal efficiency of MOF is better. These composites thus show that MOFs, when used along with natural fibres, act as a reinforcing agent to increase adsorption efficiency.

THE GLOBAL ENVIRONMENTAL INJUSTICE OF FAST FASHION

In this paper, we posit that negative externalities at each step of the fast fashion supply chain have created a global environmental justice dilemma. While fast fashion offers consumers an opportunity to buy more clothes for less, those who work in or live near textile manufacturing facilities bear a disproportionate burden of environmental health hazards. Furthermore, increased consumption patterns have also created millions of tons of textile waste in landfills and unregulated settings. This is particularly applicable to low and middle-income countries (LMICs) as much of this waste ends up in second-hand clothing markets. These LMICs often lack the supports and resources necessary to develop and enforce environmental and occupational safeguards to protect human health. We discuss the role of industry, policymakers, consumers, and scientists in promoting sustainable production and ethical consumption in an equitable manner.

The global health costs associated with the production of cheap clothing are substantial. While industrial disasters such as the 1911 Triangle Shirtwaist Factory fire have led to improved occupational protections and work standards in the United States, the same cannot be said for LMICs. The hazardous working conditions that attracted regulatory attention in the United States and European Union have not been eliminated, but merely shifted overseas. The social costs associated with the global textile and garment industry are significant as well. Defined as "all direct and indirect losses sustained by third persons or the general public as a result of unrestrained economic activities," the social costs involved in the production of fast fashion include damages to the environment, human health, and human rights at each step along the production chain. (Rachel Bick, 2018)

ENVIRONMENTAL HAZARDS DURING PRODUCTION

The first step in the global textile supply chain is textile production, the process by which both natural and synthetic fibers are made. Approximately 90 % of clothing sold in the United States is made with cotton or polyester, both associated with significant health impacts from the manufacturing and production processes . Polyester, a synthetic textile, is derived from oil, while cotton requires large amounts of water and pesticides to grow. Textile dyeing results in additional hazards as untreated wastewater from dyes are often discharged into local water systems, releasing heavy metals and other toxicants that can adversely impact the health of animals in addition to nearby residents. (Rachel Bick, 2018)

SUSTAINABLE FIBRES

The sustainability of a fiber refers to the practices and policies that reduce environmental pollution and minimize the exploitation of people or natural resources in meeting lifestyle needs. Across the board, natural cellulosic and protein fibers are thought to be better for the environment and for human health, but in some cases manufactured fibers are thought to be more sustainable. Fabrics such as Lyocell, made from the cellulose of bamboo, are made in a closed loop production cycle in which 99% of the chemicals used to develop fabric fibers are recycled. The use of sustainable corporate sustainability. (Rachel Bick, 2018)

CORPORATE SUSTAINABILITY

Oversight and certification organizations such as Fair Trade America and the National Council of Textiles Organization offer evaluation and auditing tools for fair trade and production standards. While some companies do elect to get certified in one or more of these independent accrediting programs, others are engaged in the process of "greenwashing." Capitalizing on the emotional appeal of eco-friendly and fair trade goods, companies market their products as "green" without adhering to any criteria To combat these practices, industry-wide adoption of internationally recognized certification criteria should be adopted to encourage eco-friendly practices that promote health and safety across the supply chain. (Rachel Bick, 2018)

STRATEGIES FOR PREVENTING SOIL DEGRADATION

Science and technology provide essential tools and strategies for preventing soil degradation.
Global deterioration of soil degradation is the result of human intervention. Although soil degradation was and is recognized as a serious and widespread problem, its geographical distribution, total areas affected and the severity of the problem was only very roughly known. In 1974,Biswas and Biswas(1974) estimated that already some 10% of the worlds arable land was despoiled by human activities. The GLASOD figures indicate that almost 40% of the agricultural land has been affected by human induced soil degradation and that 6% is degraded to such a degree that restoration to its original productivity is only possible through major capital investment. However, for sustainable economic and agricultural development, stabilizing inputs would have to be applied in moderately degraded areas.

GLASOD had as its main objective to increase the awareness of policy-makers and decision-makers of the dangers resulting from inappropriate land and soil management. A computerized land resource information system has now become a prerequisite for policy formulation, development planning at all levels, efficient use of both internal and external resources, and for the implementation of a programme for soil resilience and sustainable land use. (Oldeman, 1991-1992)

IMPLEMENTING A SCIENCE-BASED SYSTEM FOR PREVENTING OVERFISHING AND GUIDING SUSTAINABLE FISHERIES IN THE UNITED STATES

NMFS and the Councils have been working to address the management problem of ending overfishing and rebuilding overfished stocks ever since the FCMA was adopted in 1976. "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield [OY] from each fishery for the United States fishing industry," states the MSA's NS1 in reference to this requirement. Guidelines for NS1 were initially developed by NMFS in 1977 (Federal Register, 1977). The 1977 NS1 guidelines gave generic descriptions of MSY, OY, and overfishing and were comparatively brief—less than a page. The MSA uses the word "MSY," but it doesn't define it. MSY was described as "the largest average annual catch or yield in terms of weight of fish caught by both commercial and recreational fishermen that can be taken continuously from a stock under existing environmental conditions".

The MSY principle, as it relates to population dynamics, basically states that, if a consistent yearly catch rate of fishing mortality (FMSY) is applied to a stock that fluctuates, the resulting annual catch will also fluctuate above and below MSY. The average stock size, or BMSY, would be defined as the average of this time stream of catches and would normally be between one-third and one-half of the unfished stock size. of the maximum sustainable yield from the fishery, as modified by [emphasis added] any relevant economic, social, or ecological factor. The MSY principle, as it relates to population dynamics, basically states that, if a consistent yearly catch rate of fishing mortality (FMSY) is applied to a stock that fluctuates, the resulting annual catch will also fluctuate above and below MSY. The average stock size, or BMSY, would be defined as the average of this time stream of catches and would normally be between one-third and one-half of the unfished stock size, as in Figure 1

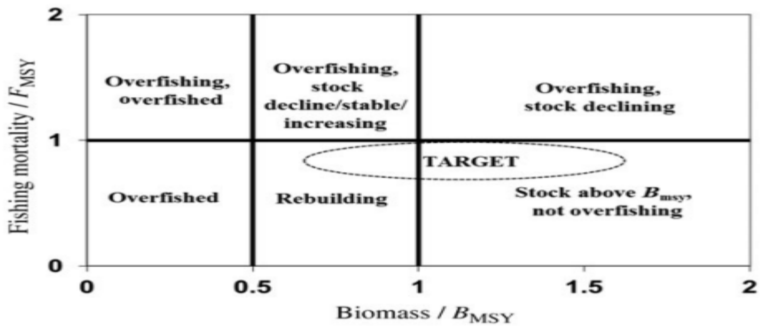


Figure 1. Criteria for the determination of overfishing and overfished status of fish stocks are presented in this figure. Overfishing is occurring if the fishing mortality rate exceeds the rate that would produce MSY. A stock is considered overfished if its reproductive potential (shown here as biomass) falls below a specified biomass limit, which is typically set at half of the biomass level that would produce MSY.

Because overfishing can be determined at different stages of the process and on different time frames, the reality is more nuanced.

(i) When the catch objective for fishery management is set higher than the OFL, intentional overfishing takes place. The United States has stopped this kind of overfishing through the deployment of measures that are in line with the 2009 NS1 guidelines by the Councils and the MSRA.

(ii) When fishery management practices fail to maintain the catch below the OFL, even when the target level of catch was set below the OFL, overfishing as a result of management shortcomings takes place. This could be structural (for example, no credible AMs were in place to keep catch under control within the fishing season, or lags in the monitoring of landings data could result in managers not knowing until months after the fact that an ACL has been exceeded) or accidental (for example, in-season management procedures were in place but were implemented too late or failed to slow fishing effort sufficiently).

(iii) A retroactive conclusion of overfishing may result from scientific ambiguity. This happens when previous estimates of fishing mortality rates are revised upward or the fishing mortality limit is revised reduced as a result of a subsequent assessment update.

(iv) The fourth degree of overfishing, is not yet officially recognised. This happens when the tactical, single-species estimations of OFLs are computed using an inaccurate, biassed, or insufficient model or paradigm.

(v) Despite these accomplishments, challenges do remain. Some challenges include developing and promoting the understanding of how to determine appropriate catch levels and management approaches for data poor stocks; improving data collection and assessment programmes to be able to assess more stocks; addressing differences between managing stocks as a complex vs. managing individual stocks in a multistock fishery; and incorporating social and economic factors in determining the appropriate response to scientific uncertainty. Ecosystem overfishing, or the fourth degree of overfishing, is not yet officially recognised. This happens when the tactical, single-species estimations of OFLs are computed using an inaccurate, biassed, or insufficient model or paradigm. (R. D. Methot, 2013)

CONCLUSION:

Environmental health scientists play a key role in supporting evidence-based public health. Similar to historical cases of environmental injustice in the United States, the unequal distribution of environmental exposures disproportionally impact communities in LMICs. There is an emerging need for research that examines the adverse health outcomes associated with fast fashion at each stage of the supply chain and post-consumer process, particularly in LMICs. Advancing work in this area will inform the translation of research findings to public health policies and practices that lead to sustainable production and ethical consumption. (Rachel Bick, 2018)

Since 1976, there have been numerous modifications to the US fisheries management system. The MSA created the area that is currently known as the EEZ, outlawed foreign fishing vessels in US territorial seas, and established eight Regional Fishery Management Councils and the NMFS as joint managers of the nation's fisheries. Since its establishment, the MSA has relied on the idea of MSY to establish a framework for the permissible degree of influence that a fishery may have on a stock. There has been overfishing by US vessels on several species, some for decades, despite the emphasis on conservation and management of our natural resources. The difficulty of concluding the MSA and the NS1 standards was one of the many issues that led to revisions.

Among other things, the problem of stopping and preventing overfishing and restoring stocks prompted numerous revisions to the MSA and the NS1 standards, which led to the following significant changes:

(i) A number of amendments to the MSA and the NS1 standards were necessary, among other things, to address the issue of stopping and preventing overfishing and rebuilding stocks. These revisions resulted in the following important changes: (Rosenberg et al., 1994).

(ii) The statutory requirement that each FMP have "objective and measurable criteria" for figuring out when a fishery is overfished was created by the SFA in 1996. Consequently, NMFS mandated that bivariate SDC be constructed for stocks to identify both overfishing and overfished status in the 1998 NS1 recommendations.

(iii) The SFA also instituted the need to replenish overfished stocks to a degree that, barring certain circumstances, can sustain MSY within a decade. (iv) In order to prevent overfishing, the MSRA mandated ACLs in every fishery in 2007. The ACL framework is outlined in the 2009 NS1 recommendations. (R. D. Methot, 2013)

The current environmental issues can be resolved with the aid of scientific and technological advancements. It should be highlighted, in order for actions to support various scientific theories, they must all be consistent with the values that society upholds.

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