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**Replacing Single Species Stock Assessments with an
Ecosystem-Based Approach**

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Fishing catches aquatic wildlife. This is the equivalent of hunting bison, deer and rabbits on land. Since the exploitation of animals on an industrial scale on land is not sustainable, it should not be expected to be in the oceans either. Humans, since time immemorial, have had an impact on ecosystems and target species in the seas and

oceans. Archaeological literature has shown that overall the size of fish has been decreased gradually with time and that target species have gone extinct as a result of overexploitation. Sustainable fisheries have been seen where fish populations have been far greater than human populations, where climate has generally been unfavorable for fishing practices or where fish populations have been out of reach.

Industrialization of the fishing sector has begun in the early nineteenth century when English fishers started operating steam trawlers, they were soon replaced by power winches and after the First World War by diesel engines. After the Second World War, freezer trawlers, radar, and acoustic fish finders came into the picture. In a period of war, highly exploited fish stocks in the North Sea were observed to recover. The two world wars, therefore, proved that forfeiting fishing for a period of time could lead to the revival of species. This led to the construction of models of single-species fish populations; which would only take into account fishing pressure as a factor for fish mortality.

The 1950s were a crucial period in fisheries science. During the early 1950s, the United Nation's Food and Agriculture Organization started the collection of statistics from sources Worldwide. Industrial scale fishing began competing with artisanal fisheries, especially in tropical shallow waters. Technological advancements in fisheries including global positioning systems and maps of the sea floor can now be used to extract fish that were previously hidden due to rough terrain. Due to technological

advancements, fishers often remain oblivious to the harm they are causing to these pristine ecosystems.

Fisheries worldwide are showing signs of overfishing. The world's fisheries are over-capitalized due to several reasons; one of these is due to the open-access to these fisheries; others may be due to the non-cooperative management of common-pool fisheries, sole-ownership fisheries with high discount rates, replacing small fishing-vessels with larger ones and finally due to the government paying the fishers subsidies even when resources are over-exploited. The most affected and vulnerable fisheries are found in developing countries and Pakistan has been no exception to this.

As a means to conserve the fish stocks in Pakistan, researchers have adopted single species stock assessments; these types of assessments face four main problems. The first is 'the burden of a proof problem' - single species stock assessment results are often ignored with the excuse that they are not precise enough and that causing harm to the economy based on these results would be foolish. Secondly, these assessment methods have been underestimating the decline in some very crucial cases where stocks were rapidly declining due to fishing activities. The third problem arises due to the lack of attention to regulatory tactics - assessments and models have provided long-term targets but have not put together short-term plans to achieve those targets. Finally, trying to replenish some stocks by focusing on the early life stages of fish after severe decline in adults, has not always been successful; Predatory fish such as cod, protect their offspring by engulfing fish that prey on or compete with their offspring;

however, when the number of adults decline, limiting these predators and competitors also becomes difficult, leading to a lower juvenile survival rate.

These issues can be tackled by taking into consideration environmental factors along with single-species assessments. This will lead to ecosystem-based management, where factors such as the trophic interaction between species, the gear impact on habitats and the size and place of the marine reserves will be taken into consideration. An example of a widespread tool used for an ecosystem based modeling approach is Ecopath and Ecoism (EwE).

Researchers also suggest investigating the sustainability of marine ecosystems by calculating the average trophic level in fisheries landings. Fisheries initially tend to extract larger, slower-growing fish; therefore, with time, the mean trophic level number decreases. This process is known as 'fishing down marine food webs'. Declining trophic levels happen both within and between species; therefore, using biomass as an indicator for species health can be misleading as well; as seen in the case of groupers along Pakistan's coast, where larger, slower growing yet more valuable species of groupers were replaced by smaller opportunistic and less valuable groupers which were abundant in numbers. At early life stages, fish have a trophic level of around 3, however, as they age, the trophic level increases with size; this is especially true for piscivorous species.

As a nation, we have disregarded our seas and oceans for far too long. While trying to manage our valuable living resources, it is vital that we should use the most state of the

art techniques available globally. It is therefore suggested that the next marine fisheries stock assessments be conducted through an ecosystem-based approach rather than single species stock assessments.

