



WRL reference	M05 D01
Module	M05 Natural Resource Use and Sustainability
Data set	D01 Identifying overfishing on Indonesian coral reefs

Background to the research:

Coral reefs are extremely productive ecosystems and can support highly diverse and plentiful fisheries. However, the declining ecosystem health of many coral reefs has reduced the size of fisheries they can support, while an extremely high demand for coral reef fish has further impacted them. Coral reefs cover less than 0.2% of the ocean's surface, yet approximately one billion people around the world rely on reef fish for their main protein source, and one billion in Asia alone are supported by reefs for at least part of their diet. This heavy reliance on reef fisheries is expected to double by 2050 due to population increases in the tropics, which will put even heavier demands on these already threatened ecosystems.

Just like any other natural resource, reef fisheries have the ability to replenish themselves, but only to a certain extent, making them a semi-renewable source of food. However, the rate of replenishment is controlled by the reproductive rate and survival success of fish within the fishery, and this is the key determining factor behind sustainability. Figure 1 below illustrates a standard effort-yield relationship for a semi-renewable food source. To begin with, the more effort that is put into fishing (by effort we mean time, size of net, number of fishermen etc.) the more fish will be caught, and this is why the graph begins with a positive relationship, and if effort is kept at this level you could continue catching that many fish indefinitely (providing there is no serious impact on the reef from elsewhere). However, eventually the amount of effort being put into fishing is so great that fish are being removed faster than they can replenish themselves. At this point the fishery will begin to decline and if the effort does not decrease, fish catches will grow smaller and smaller until they disappear completely, and this is known as unsustainable exploitation. The highest amount of effort which can be put into fishing without exceeding the potential for replenishment is the ideal effort, and the amount of fish caught at this point is known as the Maximum Sustainable Yield (MSY).

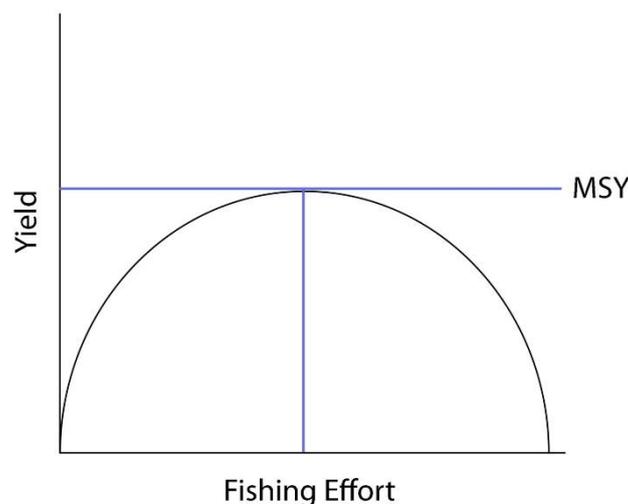


Figure 1. The standard relationship between fishing effort and yield, demonstrating the theory of maximum sustainable yield (MSY)





The job of fisheries scientists and conservation managers is to keep fishing to below MSY, which will protect food security as well as the fisheries and reefs themselves. However, the number of people who currently rely on coral reef fish is so great that this is impossible on many reefs, and unsustainable exploitation occurs. To identify whether a fishery is being under- or over-exploited, scientists will often monitor the catches of fishermen at a certain location over time to see how catch per unit effort (CPUE, the weight of fish caught for a set amount of effort put in). If catches remain stable or even increase over time, it is likely the fishery is being sustainably exploited. However, if CPUE is declining over time, it is likely overfishing is taking place and urgent management is needed to stop the fishery collapsing completely.

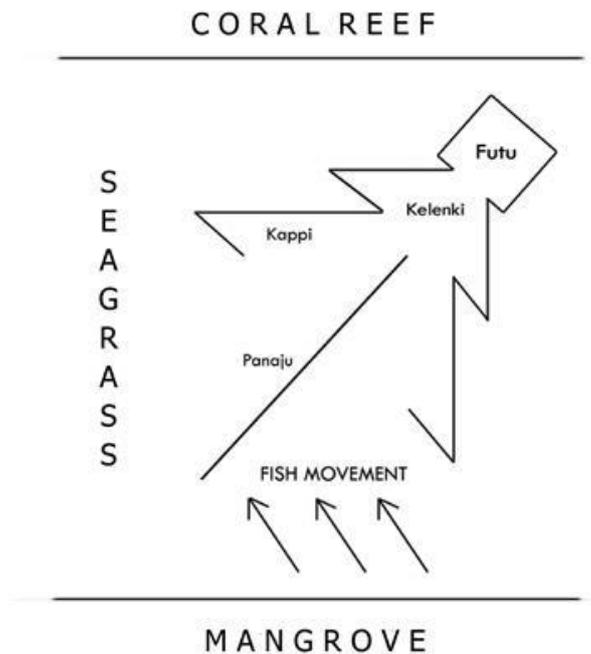


Figure 2. Diagram of an Indonesian fish fence, as used in this study.

In Indonesia, many different fishing techniques are used by local communities to catch fish on coral reefs, including nets, spear guns and even the use of illegal dynamite and poison. However, one widespread technique used throughout much of the Indian and Pacific Oceans are fish fences. These are stationary structures, often up to 200m long, made of bamboo and netting. They are funnel shaped, with the opening facing the shore (Figure 2). Many reef fish migrate between the reef and shallow water at high tide, and fish fences are designed to trap these fish as the tide goes out and they become trapped in the fence. Because they are stationary and used commonly across such a large area, they are a perfect fishing method to monitor catches from.

