



Title: M05D01-A: Identifying overfishing on Indonesian coral reefs.

Keywords: Ecosystem; coral reef; sustainable: over-fishing; statistics; case study; human impact; populations

Skills: Graphs, means, analysis and percentage change.

Coral reefs are extremely productive ecosystems that support highly diverse and plentiful fisheries. However, the declining ecosystem health of many coral reefs has reduced the size of fisheries they are able to support. This fact, coupled with an extremely high and ever growing demand for coral reef fish is causing many global fisheries to collapse. To identify whether a fishery is being under or over-exploited, scientists will often monitor the catches of fishermen at a certain location to see how catch per unit effort (CPUE), the weight of fish caught for a set amount of effort put in, is changing over time. 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 that overfishing is taking place and urgent management is needed to stop the fishery collapsing completely.



The diagram above depicts a fish fence; these are a highly effective artisanal fishing structures used to capture reef fish and they are the subject of this study.

One widespread fishing 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.

The table below shows the CPUE (kg of fish caught per fence per day) for 12 catches in 2005 and 2011. It also shows the proportion of juvenile fish caught. The data was collected for daily catches between July and August 2005 and 2011 on the island of Kaledupa in Indonesia. Each catch value represents 100 fences in 2005 and 140 fences in 2011. The average fence length in 2005 was 105m, and in 2011 it was 133m.





Catch number	CPUE (kg per fence per day)		Proportion of juveniles (%)	
	2005	2011	2005	2011
1	12.0	1.0	2	41
2	2.0	3.5	0	35
3	7.0	5.0	21	35
4	3.0	0.5	20	50
5	18.5	3.0	1	38
6	19.0	8.0	2	8
7	25.5	3.5	3	90
8	12.0	6.0	4	29
9	28.0	5.0	3	19
10	15.0	1.5	3	36
11	4.0	9.0	34	35
12	7.0	3.5	24	57
Mean				

Tasks and questions:

1. Plot a suitable graph(s) to compare the catches for 2005 and 2011.
2. Calculate the mean CPUE figures for 2005 and 2011 and add them to the table above
3. Calculate the mean figures for proportion of juvenile fish caught for 2005 and 2011 and add them to the table above.
4. Describe the trends for CPUE and the number of juvenile fish caught between 2005 and 2011.
5. What was the percentage change in CPUE between 2005 and 2011?
6. What was the percentage change in the number of juvenile fish caught between 2005 and 2011?
7. Do the data suggest that the fisheries in this part of Indonesia are sustainable?

