



## Oregon Marine Reserves

### NEOLI FACTORS

#### Lesson Objective

Students will apply the NEOLI factors to assess Oregon marine reserves.

#### Background:

Review what fish need to survive (habitat, food, space, etc.)

Similarly, what do fish need protection from (fishing, predators, pollution, habitat destruction, etc.)?

Of these, what do marine reserves protect fish from / provide for fish?

- Fishing - yes
- Predators - no
- Pollution - no
- Habitat destruction - yes
- Food - maybe (if prey species are also protected by MPA so there is more)

#### Science

##### [Edgar et al. 2014](#)

- Analyzed results from 87 different MPAs around the world
- Found five different factors that increase how successful MPAs are
  - Measured success by looking at
    - Numbers of large fish (density)
    - Biomass of large fish
    - Shark biomass
      - Sharks are important because they are predators, at the top of the food web - if there are problems with other species of fish, the large predators at the top usually run out of food first, because they need so much of it. If shark species aren't doing well, that usually means something isn't going well with other fish species, even if we haven't noticed something is wrong yet.

**NEOLI factors:**

- No-take
- Enforcement
- Old
- Large
- Isolated

**No-take** - MPAs are more successful when they are fully protected, so that there is no fishing at all, compared to some MPAs where some fishing is allowed, or some species can be fished but not others

**Enforcement** - MPAs are more successful if people don't cheat, or fish illegally in the MPA

**Old** - MPAs are more successful if they are old, where old means 10 years old or more

**Large** - MPAs work better if they are large, where large means at least 100 square kilometers, or about 40 square miles

**Isolated** – An MPA works better if covers the entire area to be protected, such as a rocky reef or kelp forest, and is also bounded by sand or deep water, effectively sequestering fish inside the protected area. If an MPA only covered part of a reef, fish swimming around the whole reef habitat would not be fully protected since they could still be fished in some parts of their range.

**Other factors (less influential)**

- Distance from dense human populations
  - Species richness (the more species there are, the better) of large species increase the further the MPA is from densely human populated areas

**Results of the study:**

- MPAs that only had 1 or 2 NEOLI factors were not different from fished areas = were not protecting fish successfully
- MPAs with 3 NEOLI factors had good increases in total fish biomass (30%), total large fish biomass (66%), and shark biomass (104%)
- MPAs with 5 NEOLI factors had incredible increases in total fish biomass (244%), total large fish biomass (840%), and shark biomass (1990%)

**Apply these factors to Oregon marine reserves to see how many factors they display.**

## Additional Discussion Questions

### How can the reserves be improved to have more factors?

- Make them older?
- Make them bigger
  - Turn buffer areas into fully protected reserve slowly over time (has been shown to minimize negative economic consequences for fishermen, compared to implementing more marine reserves, or starting with big ones)
- Better enforcement
  - More funds for observers on board vessels\
  - Get more community support - if community members and fishermen are invested, they're more likely to report illegal fishing in the reserves and peer pressure each other not to fish in them illegally themselves
    - This requires more communication with them throughout the design and implementation process - make sure you're addressing their wants and needs in the short and long term
- Cover more rocky reef habitat so it's more isolated
- They are already no-take, so you can't improve that factor

### Are there any negative consequences to those "improvements"?

- Hint: think about the fishermen who need to fish for their jobs

### What are other important factors that were not considered in this research?

- Habitat quality - rocky reefs vs. just empty, sandy bottoms
- Habitat degradation
  - Pollution
  - Toxic chemicals
  - Plastic
  - Human / animal waste
  - Destruction from trawling / development
- Changing conditions due to climate change
  - Maybe some areas are more protected from the increased frequency and severity of tropical storms
  - Maybe some areas of deeper water are less likely to heat up as quickly
  - Maybe some areas are less susceptible to ocean acidification