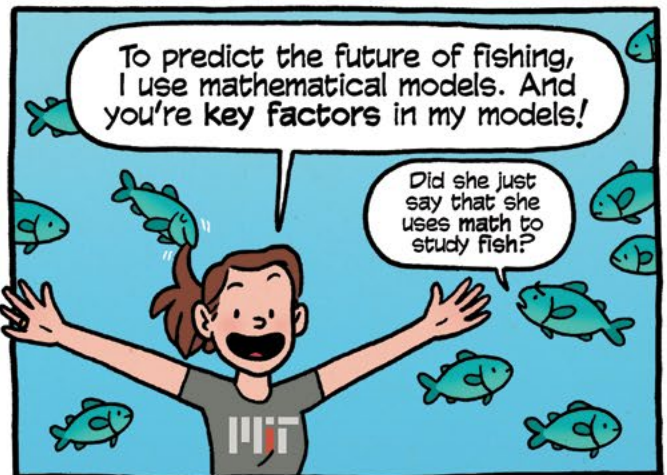
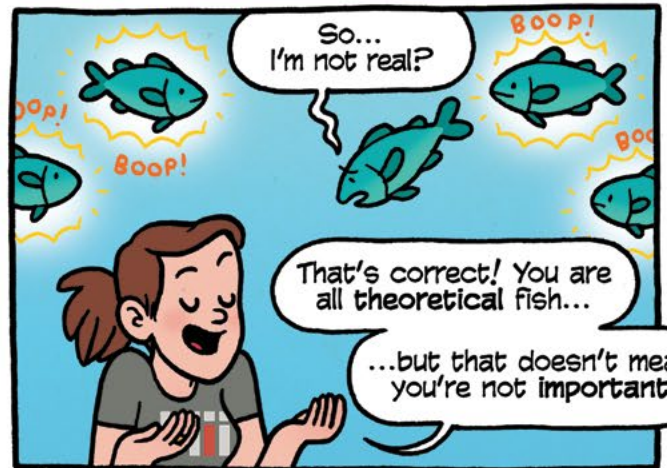
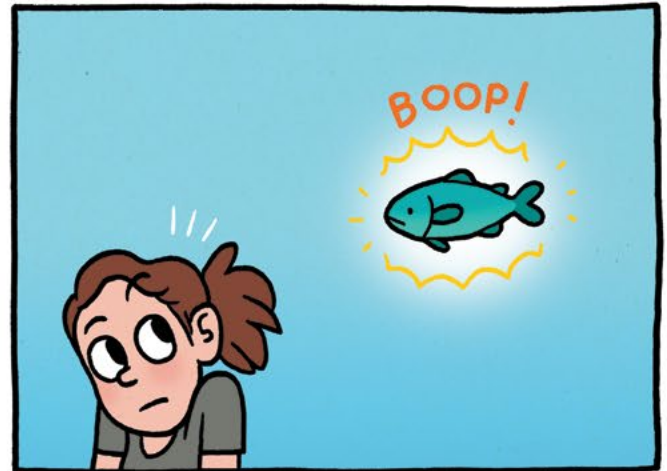


# FORGASTING THE FUTURE OF FISH

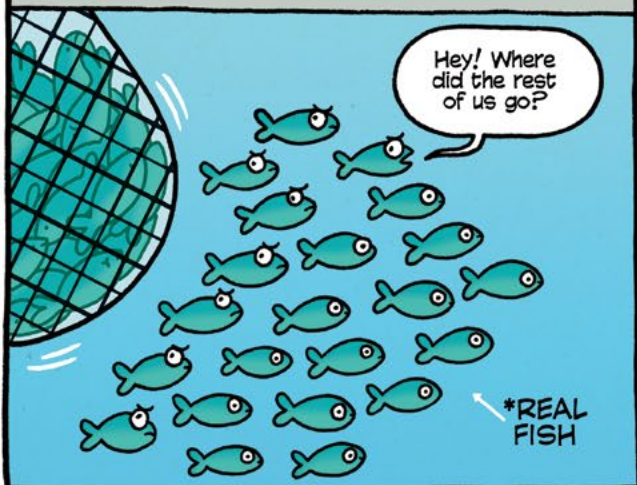
by Maris Wicks

Hi! My name is Emily Moberg. I am a Ph.D student in the MIT/WHOI Joint Program...  
...and I study imaginary fish.

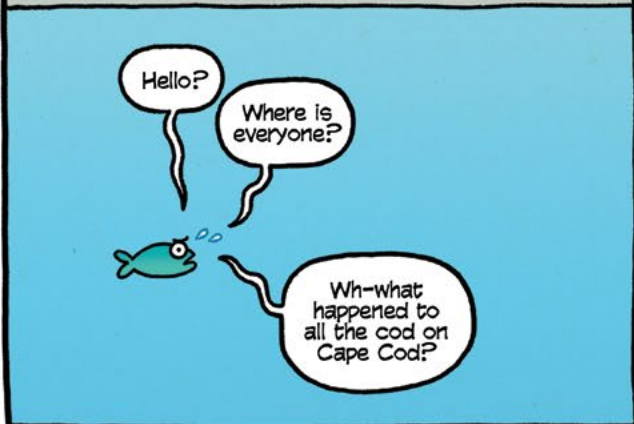




People love to eat "real" fish. Much of the world depends on fish for food. But fish stocks are rapidly diminishing.



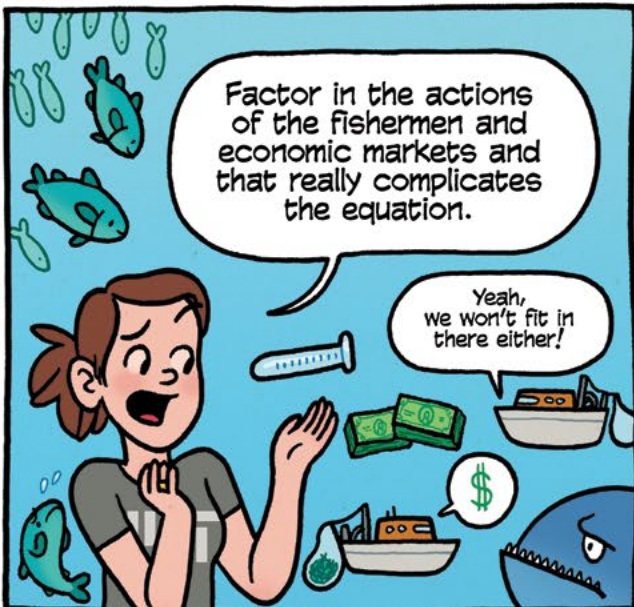
We've got to find ways to ensure that we don't overfish. If fish populations get too low, they can't replenish their numbers and their disappearance can have far-reaching impacts on the larger ecosystem.



How can you figure that out? The ocean is full of complex relationships, with organisms interacting with one another and their environment... You can't just put it all in a test tube and watch!



Factor in the actions of the fishermen and economic markets and that really complicates the equation.



Equations - that's the ticket! Mathematical models are just equations that describe relationships between different variables. Here's the equation for population growth:

$$\frac{dN}{dt} = rN \left(1 - \frac{N}{K}\right) - hN$$

$N$  = number of fish



$t$  = time ⌚

$K$  = total number of fish that the environment can support



$r$  = growth rate when there are few fish



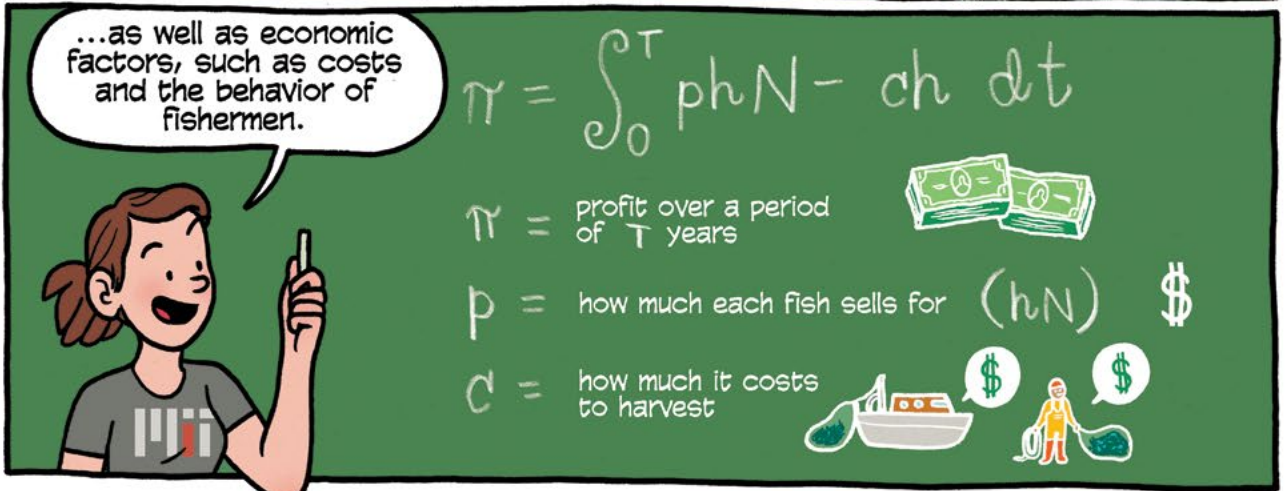
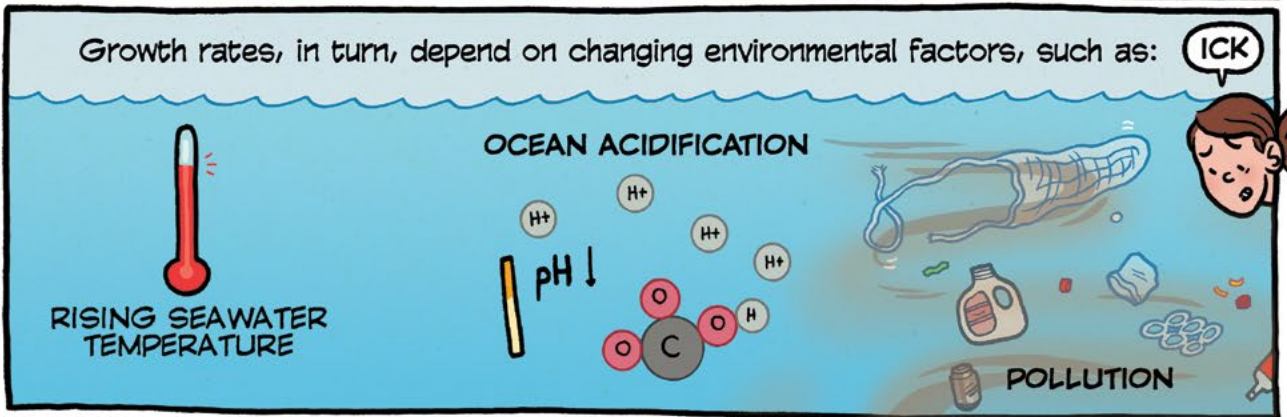
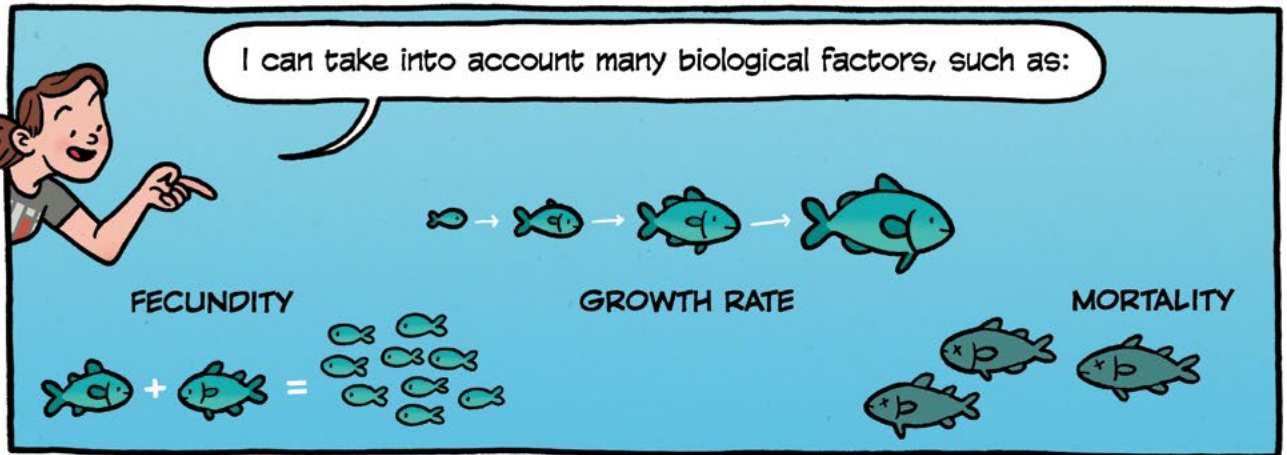
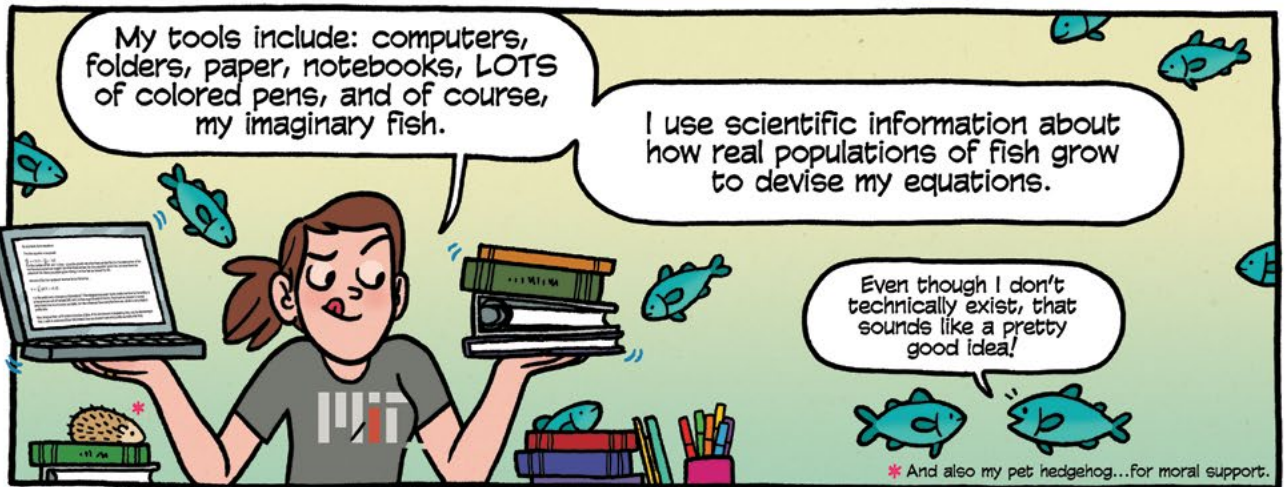
$h$  = how fast we harvest the fish



Okay! That's it, we're at capacity!

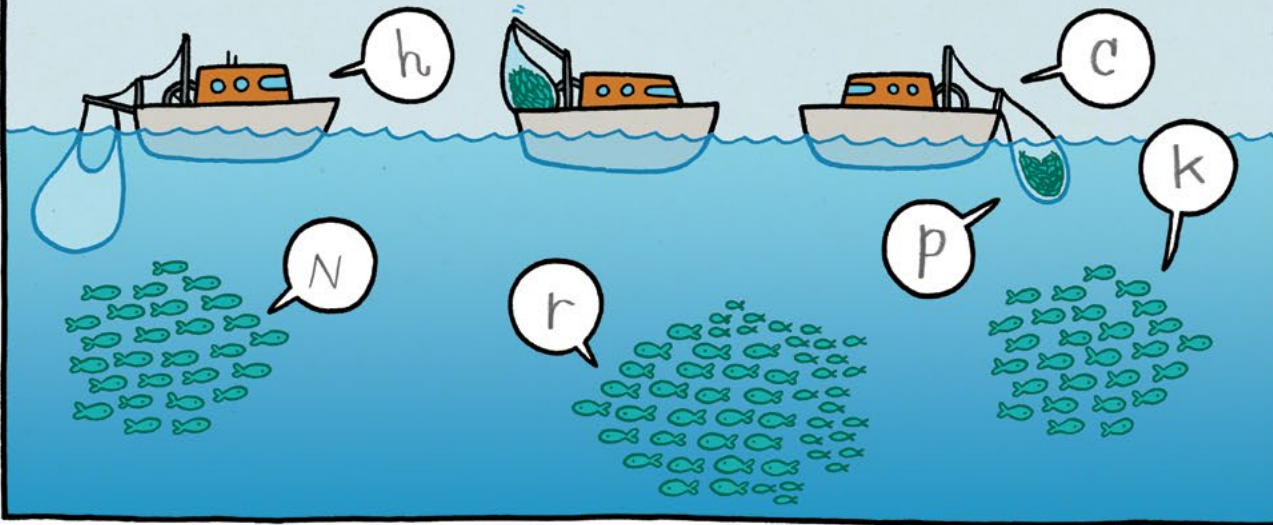
\* Well, drawings of real fish, actually.







How much fish we choose to harvest determines how much money we make. But it also influences how many fish there will be, which, in turn, affects future profits.



These models help improve our understanding of the relationships between us, the ocean, and its resources.



By making these models, we can better understand how to wisely balance the ecology and the economy.

...and manage our fish stocks over the long haul...



...so we don't actually become imaginary.

**BOOP!**

Emily Moberg  
Biology



Early in life, Emily Moberg's love of nature was nurtured by frequent run-ins with salamanders in her backyard, unsanctioned late-night PBS documentaries, and healthy dosage of *The Lorax* and *The Great Kapok Tree*. Her later fixation on math and science led to her pursue environmental engineering at MIT for her undergraduate studies, before the biology world sucked her back in. When she isn't squishing math and fish together, she dances, sews, reads, sings, and hangs out with her super-powered hedgehog.

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