WF4313/6613-Fisheries Management

Class 5 – Population dynamics

Announcements

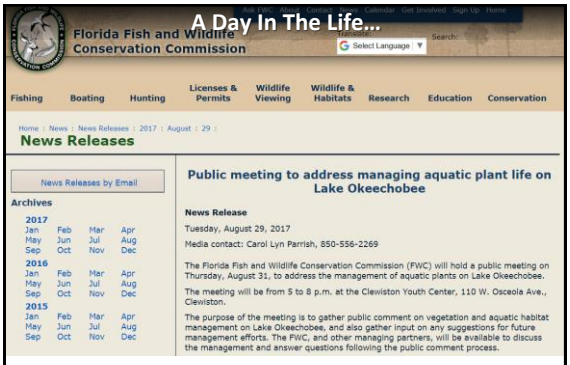
- Student sub-unit of the American Fisheries Society Meeting
- Tuesday September 5th @ 5 pm in TH118

Announcements

- Reminder to see website for content, links, and so on. https://mcolvin.github.io/WFA4313-Fisheries-Management/
- No class Monday, University Holiday

Hurricane Fishing

A Day In The Life…

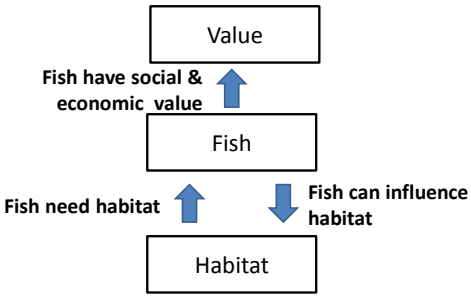


Class Topics

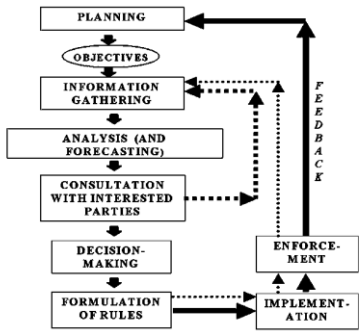
Analysis and forecasting

1. Population dynamics
2. Biomass versus abundance

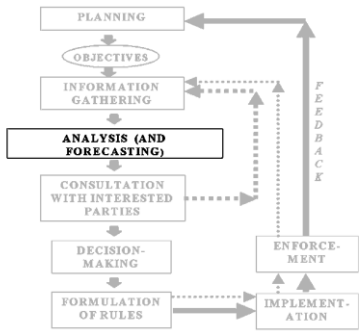
A fishery



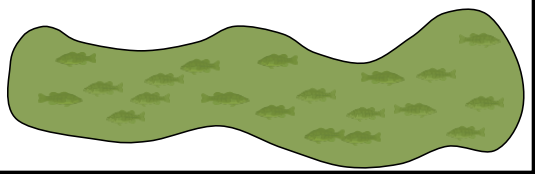
Fisheries Management Conceptually



Fisheries Management Conceptually



"The trouble with fish is that you never get to see the whole population. They're not like trees, whose numbers can be estimated by flying over a forest. Mostly you see fish only when they're caught…" Schnute 1987



Our "view" of fish populations comes from a variety of sources: anglers, commercial fisheries, and sampling gears. Each has inherent biases, and we rarely have complete information about the fishery of concern.

Thinking *inside* the box

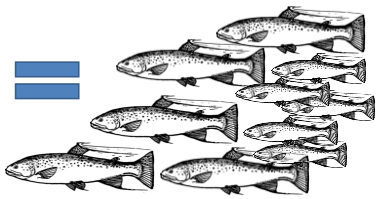
Fish	Value	Habitat

10 Fish or 28 Kilograms

Thinking *inside* the box

Fish	Value	Habitat

10 Fish or 28 Kilograms

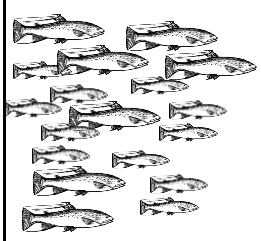


Thinking *outside* the box

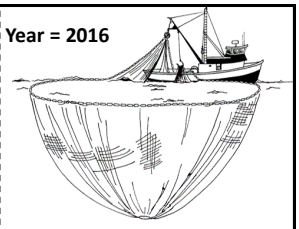
Population dynamics in a nutshell:

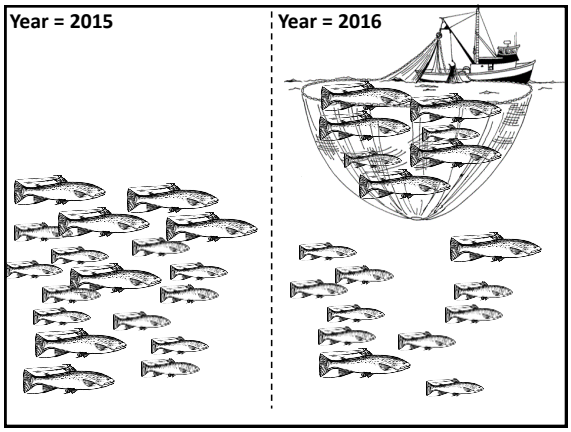
[Population change] = [Inputs] – [Outputs]

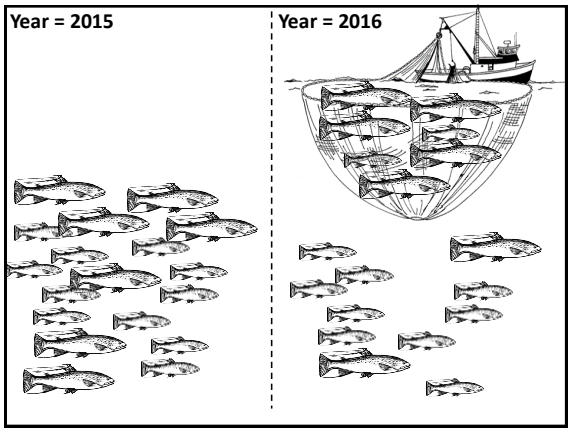
Year = 2015

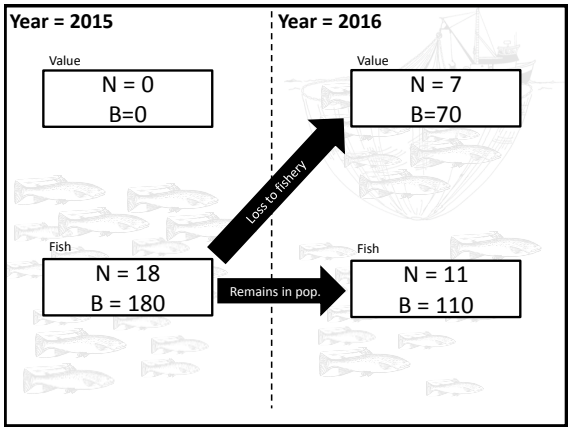


Year = 2016



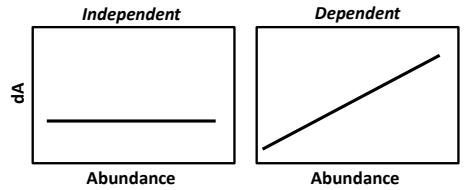






Revisiting gains and losses

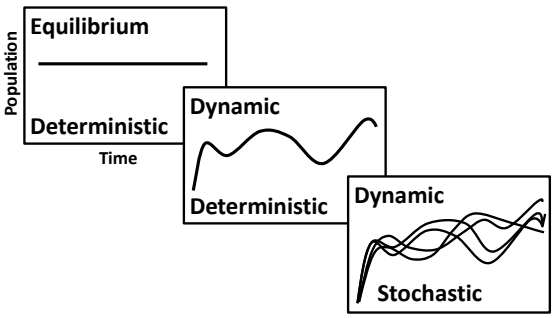
Change in abundance (dA=gains-losses) can be <u>independent</u> or <u>dependent</u> of population abundance

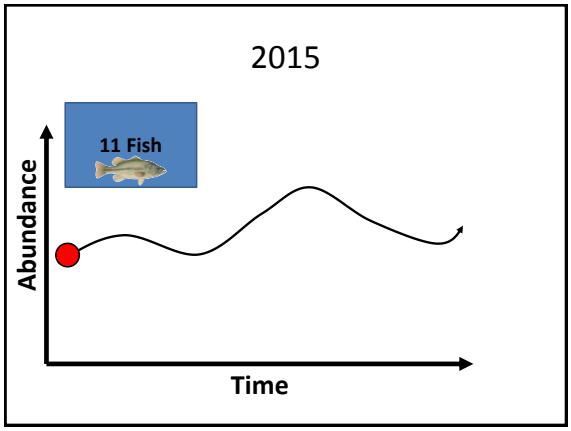


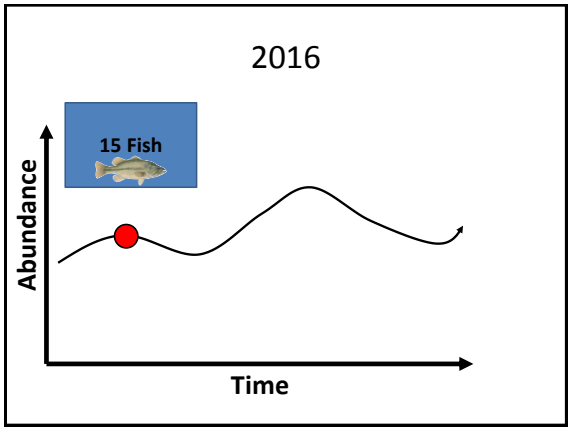
Population dynamics

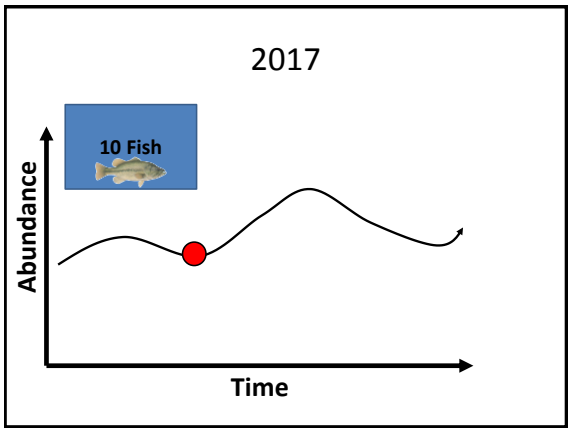
- What are population dynamics?
- Suppose in 2015 we have a pond with 11 Largemouth Bass in it.

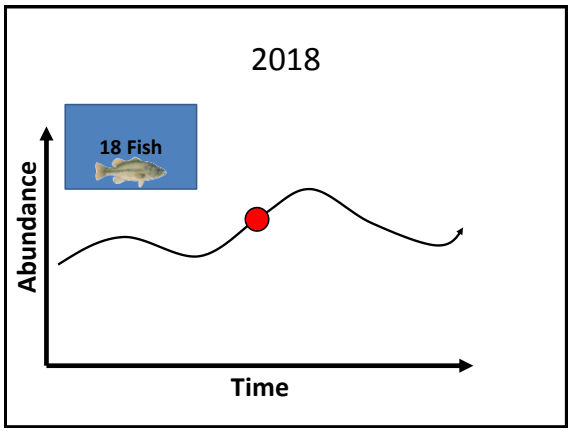
Population dynamics model types

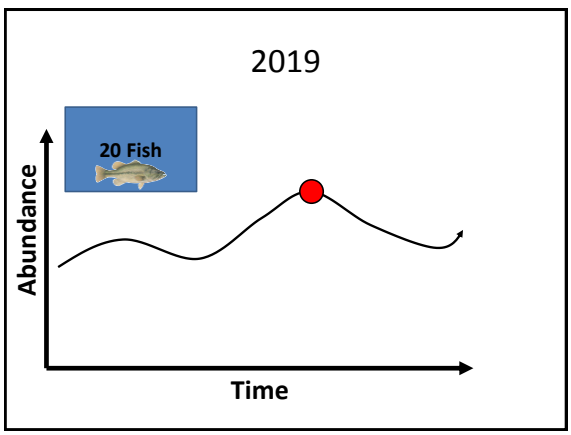


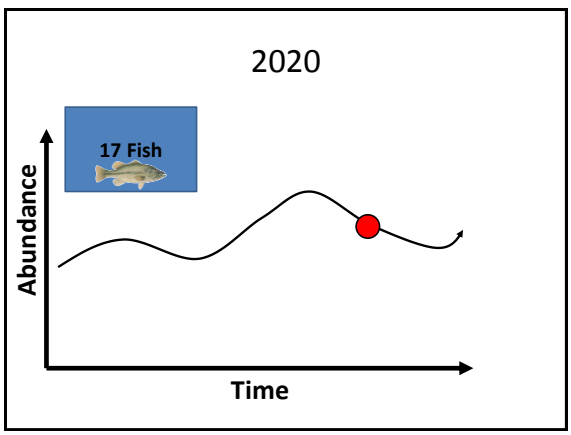

2015
11 Fish
Abundance
Time


2016
15 Fish
Abundance
Time

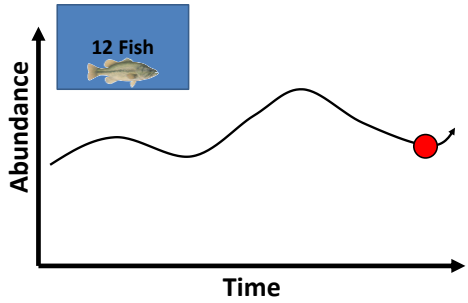

2017
10 Fish
Abundance
Time


2018
18 Fish
Abundance
Time

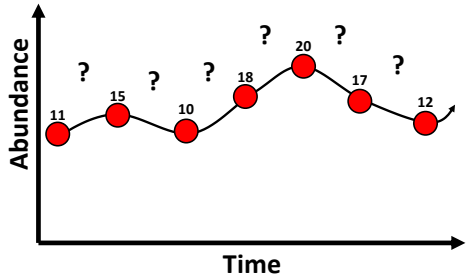

2019
20 Fish
Abundance
Time


2020
17 Fish
Abundance
Time

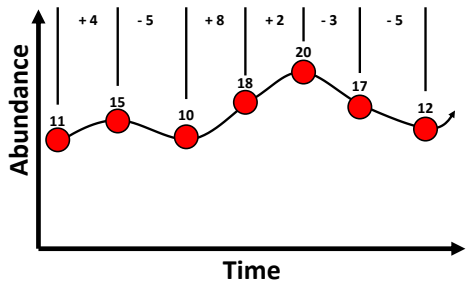
2021



2015 … 2021



Change in population abundance over time



Year	Abundance	$Abundance_{year+1}$-$Abundance_{year}$
2015	11	4 = 15-11
2016	15	-5 = 10 - 15
2017	10	3 = 18-10
2018	18	2 = 20-18
2019	20	3 = 17-20
2020	17	-5 = 12-17
2021	12	? = ?-12

Population changes (gains & losses)

Year	Abundance	$Abundance_{year+1}$-$Abundance_{year}$
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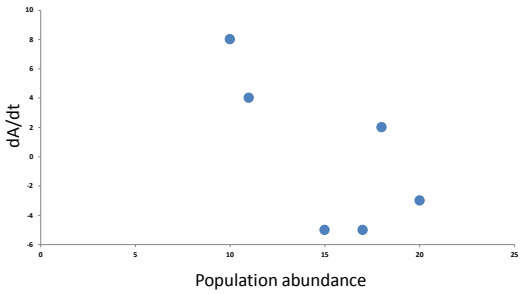
$$\frac{dAbundance}{dt} = Abundance_{year+1} - Abundance_{year}$$

Independent or dependent?



These are 'net changes' in the population over time

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Gains and losses

Reflect the balance of population gains and losses

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Gains and losses

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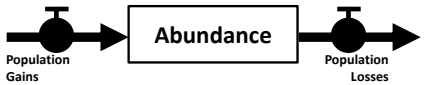
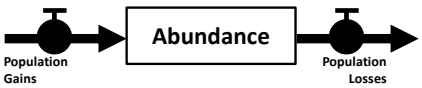


$$\frac{dAbundance}{dt} = gains - losses$$

Fish dynamics



Fish dynamics: state variables

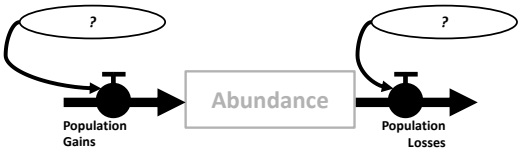
Abundance

State Variable: Something **measureable & can stored or lost over time**:

- Abundance
- Biomass

Fish dynamics: processes

Fish dynamics: Mechanisms



Fish dynamics: Mechanisms

Gains:	Losses:
Births	Deaths
Immigration	Harvest
Nearby System	Predation
Birds	Other mortality (habitat)
Storms and other events	Disease
Stocking	Emmigration
State agency (legal)	
Illegal stockings	

Fish dynamics: Mechanisms

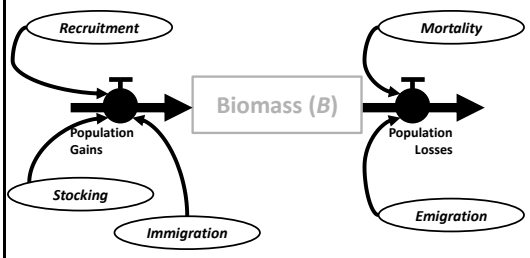
Gains:	Losses:
1. Recruitment	1. Mortality
2. Immigration	a) Fishing
3. Stocking	a) Commercial
4. Other(s)?	b) Recreational
	b) Natural
	a) Predation
	b) Pathogen
	2. Emigration
	3. Other(s)?

Processes & Mechanisms

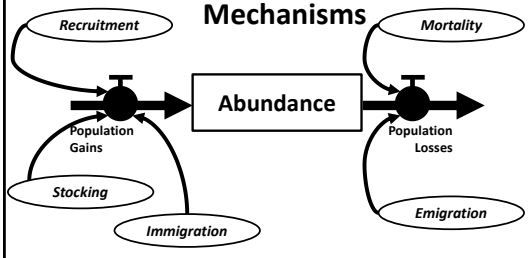
$$Gains = recruitment + stocking + immigration$$

$$Losses = mortality + emigration$$

Fish dynamics: States, Processes, & Mechanisms



Fish dynamics: States, Processes, & Mechanisms



$$\frac{dAbundance}{dt} = (recruitment + stocking + immigration) - (mortality + emigration)$$