

# Basic Statistical Concepts



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# Introduction

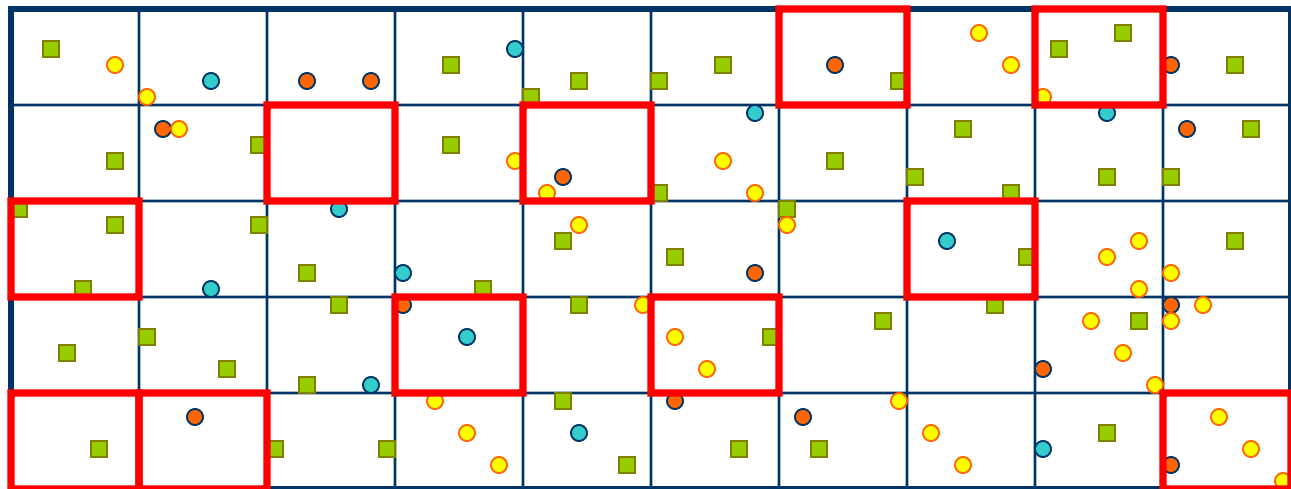
- Representative sample
  - Removes subjectivity / bias
  - Increased confidence in data
- Needed for estimating population size / assessing health
- Needed for managing fisheries

# Objectives

- Define random sampling & explain it's importance
- List three levels where sampling occurs
- Describe how to use the random sample and random number tables
- Explain the difference between a random sample and a systematic random sample
- Demonstrate ability to choose a random sample and document sampling methodology

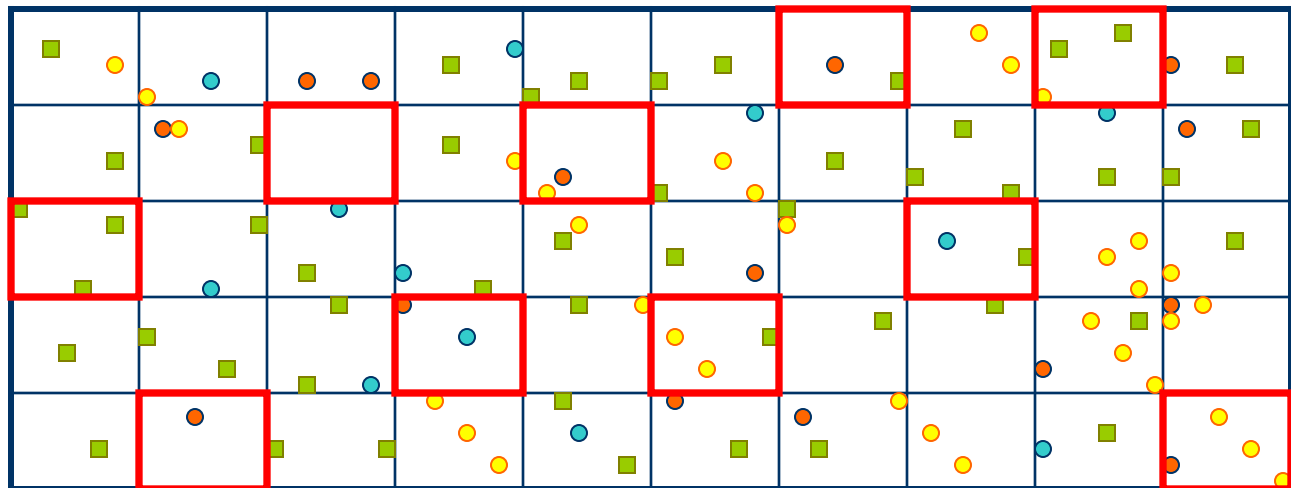
# What is a “statistically representative sample?”

- General – “selection of individual observations intended to yield some knowledge about a population of concern”
- Subset – used to make reliable predictions of population



# What is a “statistically representative sample”?

Symbol	Count in Sample	Extrapolated (sample * 5)	Actual
Green square	8	40	50
Red circle	5	25	15
Yellow circle	7	35	33
Blue circle	2	10	12



# What is a “statistically representative sample?”

- General – “selection of individual observations intended to yield some knowledge about a population of concern”
- Fisheries context – collect information on commercial catch in order to have knowledge about fish populations and health
- Random - every member of the population (catch) has an equal probability of occurring in the sample

# Sampling levels (strata)

- Fishery / gear type
  - Vessel
  - Trip
  - Haul or net
  - Species
- Agency
- Observer



# Sampling guidelines

- Collect before sorting
- Do not hand pick
- Collect from multiple points
- Larger sample better
- Selecting hauls – Random sample table (RST)

Hauls per day	RST	Target sample rate
1-2	None	100%
3-4	#1	70-75%
5+	#2	65%-70%



# Random sample table

- Choose one table per trip
- Complete for each haul

Random Sample Table #2

Date	Haul #	Samp?	Notes	Date	Haul #	Samp?	Notes
11-Nov-09	1	<del>Y</del> N	watched 1st haul	12 NOV	9	Y	
11-Nov-09	2	Y		12 NOV	10	N	
11-NOV	3	Y		12 NOV	11	Y	
11-NOV	4	Y		13 NOV	12	Y	
11-NOV	5	N	Caught up on paper work	13 NOV	13	Y	
12-NOV	6	N		13 NOV	14	<del>Y</del> N	Seasick - weather
12 NOV	7	Y		13 NOV	15	N	
12 NOV	8	Y		13 NOV	16	N	

# Sampling Description

- Complete for each vessel and each change in sampling strategy
- Flow of fish
- Sample design
  - Selecting hauls
  - Within-haul sampling
  - Lengths/weights/age structures
  - Specimen samples

# Steps in Taking a Random Sample

1. Define population
2. Define sampling frame
  - Spatial – space or gear
  - Temporal
3. Define sample units
4. Number sample units
5. Decide how many units to sample
6. Randomly choose units (random numbers)

# Random Systematic Sampling

- Knowledge of total sampling units ideal
- Determine how many units you want to sample
- Divide total units by # units you want to sample
- Select a random number between 1 and result of above
- Sample every  $n^{\text{th}}$  unit thereafter

# Random number table

- Appendix 11 in manual
- Enter at random point
- Determine # digits
- Determine direction
- Example

4	6	2	3	9	3	2	4	3	5	1	4	7	2	9
9	7	6	9	7	6	4	1	9	9	2	1	9	0	8
8	0	5	4	3	0	8	6	3	2	7	6	1	1	6
4	7	4	6	6	9	3	2	1	6	6	0	6	3	8
1	8	6	2	1	3	7	7	1	5	3	5	4	4	1
0	8	2	8	4	6	3	8	9	2	9	0	7	0	2
4	0	5	4	5	0	0	7	9	9	1	1	1	6	4
4	8	8	8	8	8	6	1	4	4	4	2	1	0	0
8	4	8	6	9	7	3	4	8	8	8	7	5	3	6
					2	6	2	6	7	3	7	0	9	8
8	0	8	1	3	8	4	3	4	7	4	1	7	3	2
8	3	9	5	9	7	5	8	2	2	3	9	8	8	8
6	3	2	6	0	1	7	5	6	6	6	6	6	2	3
3	1	0	9	0	8	9	3	0	5	5	6	5	7	6
3	2	5	4	9	9	0	8	3	9	4	4	1	6	7

# Random sample - example

- 30 units – number in advance
- Target sample rate 20%
  - How many units? **6**
- Select 6 random numbers between 1 and 30

1	3	4	4	1	3	7	5	1	1	9	1	3	4	7
0	1	4	1	4	4	5	1	0	4	8	9	6	0	8
0	2	5	8	9	6	6	5	5	5	4	0	6	2	7
1	7	5	1	3	4	4	0	3	5	9	0	9	9	5
9	8	4	4	2	3	5	7	1	6	4	9	5	0	8

2	9	8	8	8	9	6	8	1	3	6	0	9	1	6
8	0	1	0	5	6	7	1	2	9	3	0	0	8	1
7	8	8	4	4	4	1	7	8	1	1	9	1		
1	0	0	1	7	2	2	9	8	1	1	5	3	4	7
7	2	1	9	4	2	8	3	8	1	8	0	8	4	0



# Random systematic sample - example

- 30 units – number in advance
- Target sample rate 20%
  - **30 units / 6 units = 5**
- Select random number between 1 and 5 > **1**
- Sample 1<sup>st</sup> unit & every 5<sup>th</sup> unit thereafter
  - Units **1, 6 (1+5), 11 (6+5), 16 (11+5), 21 (16+5), 26 (21+5)**



# Sample bias

- Catch stratification
  - In nets or bins
  - Across depth strata
- Crew sorting
- Collection location / mechanical bias – selection by hand, size of shovels, incline belts/doors
- Sample size





# Activity #1

- Work in groups of 2
- Label units on handout 1 to 100 (this can be a mental label)
- Create a sampling plan based on the sample rate and type being handed out
- Circle the quadrants you sample
- Answer the questions on handout

## Activity #2

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- To be determined

# Summary

- What is random sampling
- Why is random sampling important?
- List three levels where sampling occurs
- Describe how to use the random sample table
- When should you use a random number table?
- What is the difference between a random sample and a systematic random sample?