Random Sampling - Concepts

- How many beans are in this 5-gallon jar?
- how many by type?

Introduction

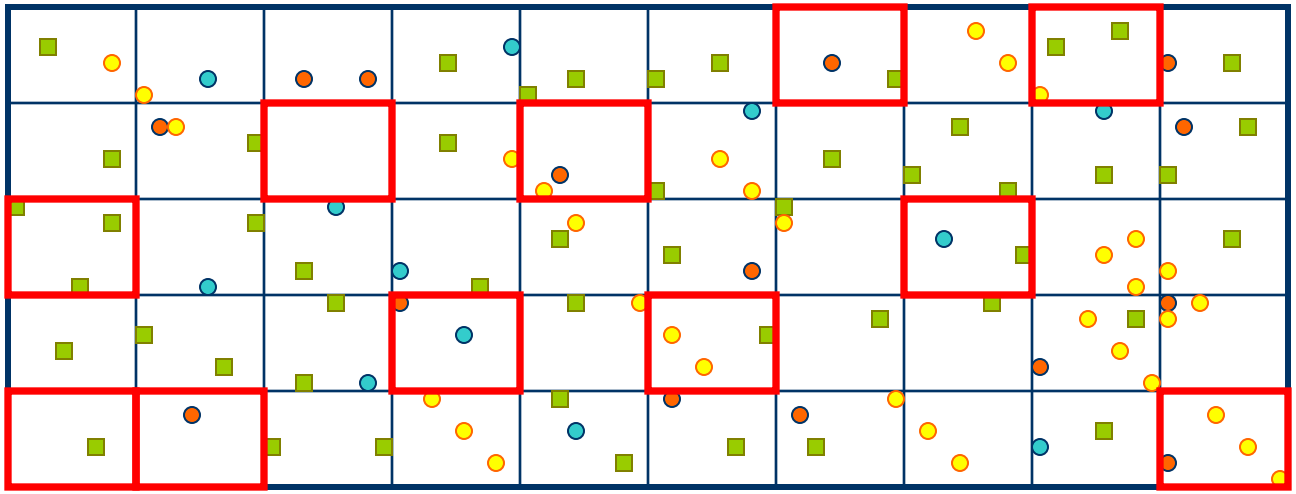
- Representative (random) sample
  - Removes subjectivity / bias
  - Increased confidence in data
- Needed for estimating population size / assessing health of fishery
- Needed for managing fisheries

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

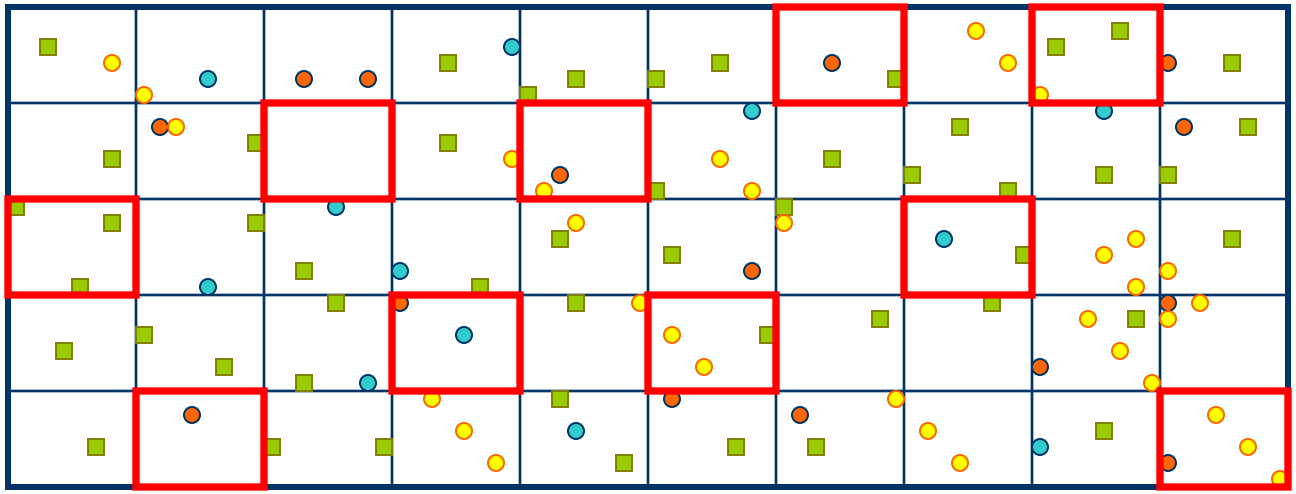
What is a “statistically representative” sample?

- 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	Estimated (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?

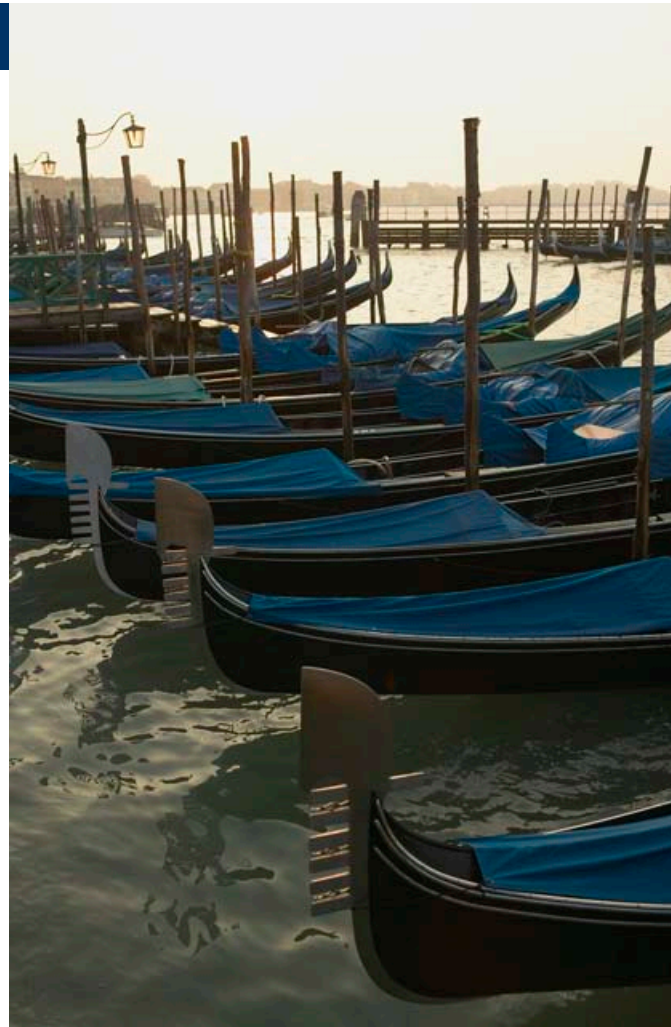
- General – “selection of individual observations intended to yield some knowledge about a population of concern”
- Fisheries context –
  - Population = all commercial catch
  - Provides knowledge about fish population status
- Random sample - every member of the population (catch) has an equal probability of occurring in the sample

Sampling levels (strata)

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

Agency

Observer



Sampling guidelines

- Collect sample before sorting
- Do not hand pick
- Collect from multiple points
- Larger sample better (with exceptions)
- 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 (Logbook)

- Choose one table per trip
- Complete for each haul

Random Sample Table #2

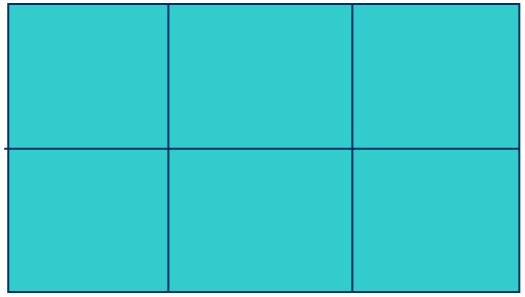
Date	Haul #	Samp?	Notes	Date	Haul #	Samp?	Notes 440
11 - Nov-09	1	~~Y~~ N	watched 1st haul	12 NOV	9	Y	
11- Nov-09	2	Y		12 NOV	10	N	
11-NOV	3	Y		12 NOV	11	Y	
11-NOV	4	Y		13 NOV	12	Y	
11-NOV	5	N	Caught up on paper work	13 NOV	13	Y	
12-NOV	6	N		13 NOV	14	~~Y~~ N	Seasick - weather
12 NOV	7	Y		13 NOV	15	N	
12 NOV	8	Y		13 NOV	16	N	

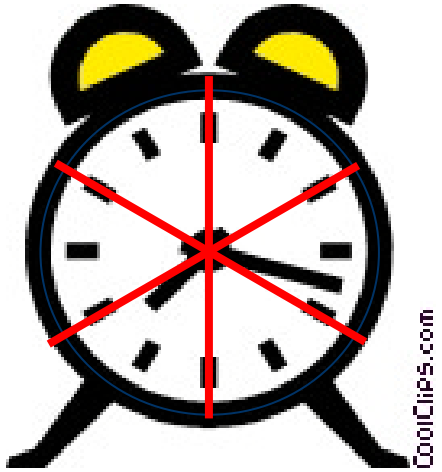
Sampling Description (Logbook)

- 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

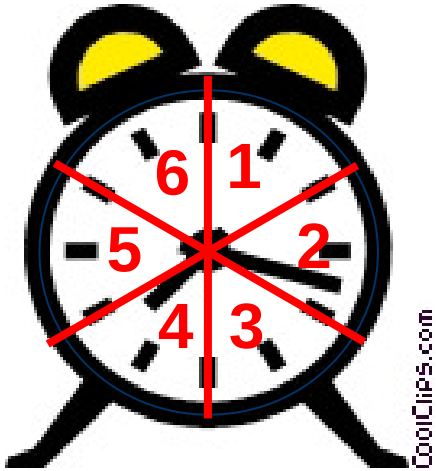




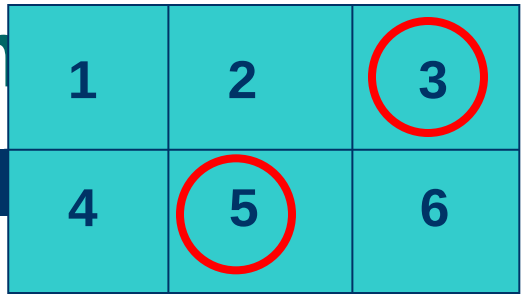
Steps in Taking a Random Sample

1. Define population
2. Define sampling frame
   - Spatial – space or gear
   - Temporal
3. Define sample units
4. Number sample units

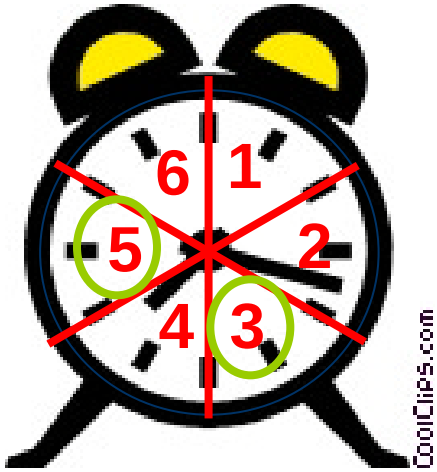
1	2	3
4	5	6



Steps in Taking a Random



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)



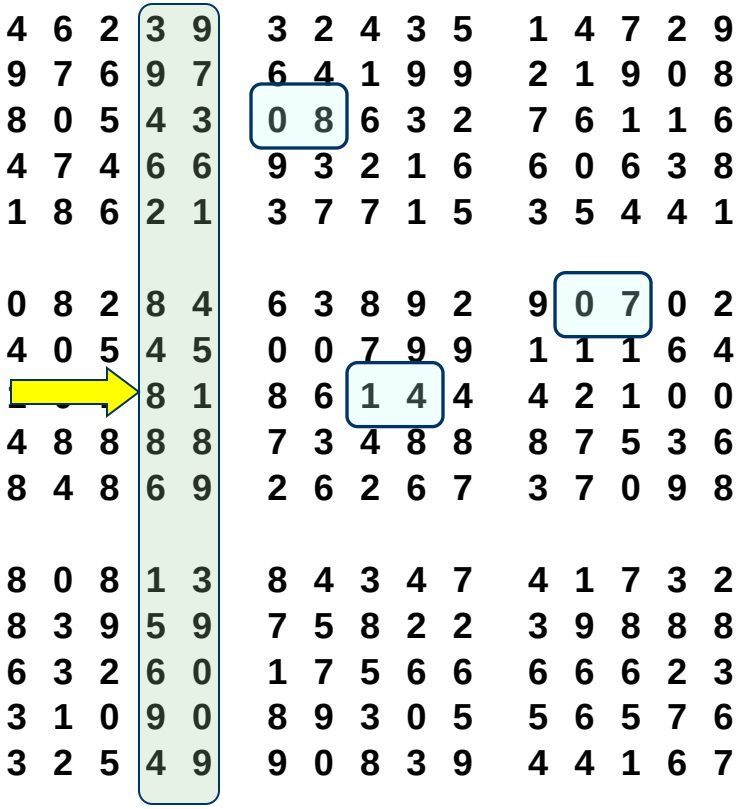
Random Systematic Sampling

- Knowledge of total sampling units ideal

5. Determine how many units you want to sample
6. Divide total units by # units you want to sample (n)
7. Select a random number between 1 and result of above (n)
8. Sample every n^{th} unit thereafter

Random number table (RNT)

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



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

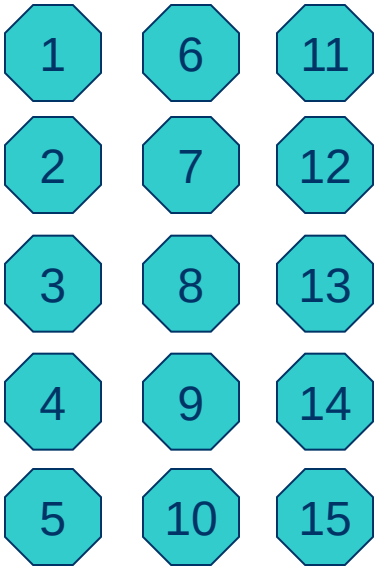
Random systematic sample - example

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

Random sample – example 2

- 15 units
- Target sample rate 40%
  - How many units? **6**
- Select 6 random numbers between 1 and 15

79062	57544	70968	51896
76638	93140	02723	57828
02812	33059	77784	68022
75245	85491	35724	30579
52656	10301	55446	88845
96563	47970	95573	61119
42787	97057	01718	73847
88936	00110	45422	93538
38347	21879	90124	28666
96354	15727	81811	56291



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
- Create a sampling plan based on the sample rate and type being handed out
- Circle the quadrants you sample
- 20 minutes
- Answer the questions on handout (homework)

Summary

- What is random sampling
- Why is random sampling important?
- List three levels (strata) where sampling occurs
- Where is the random sample table located?
- Demonstration - random number table (select 4 numbers between 1 and 20)

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

Summary

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