

Trawl – Total Effort & Catch Estimation



Sampling Priorities

1. **Collect information on fishing effort**
2. Randomly sample for catch composition
3. Record gear characteristics
4. Collect length-frequency data on target and non-target catch

Objectives

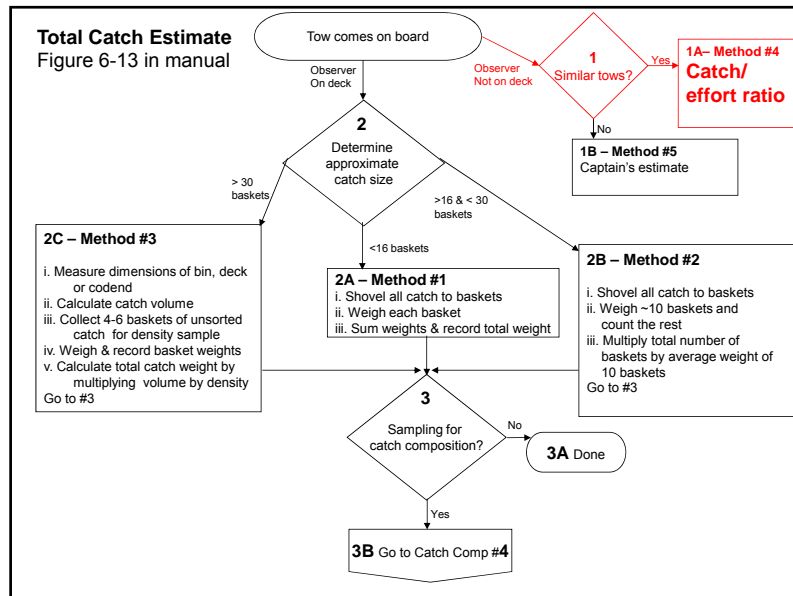
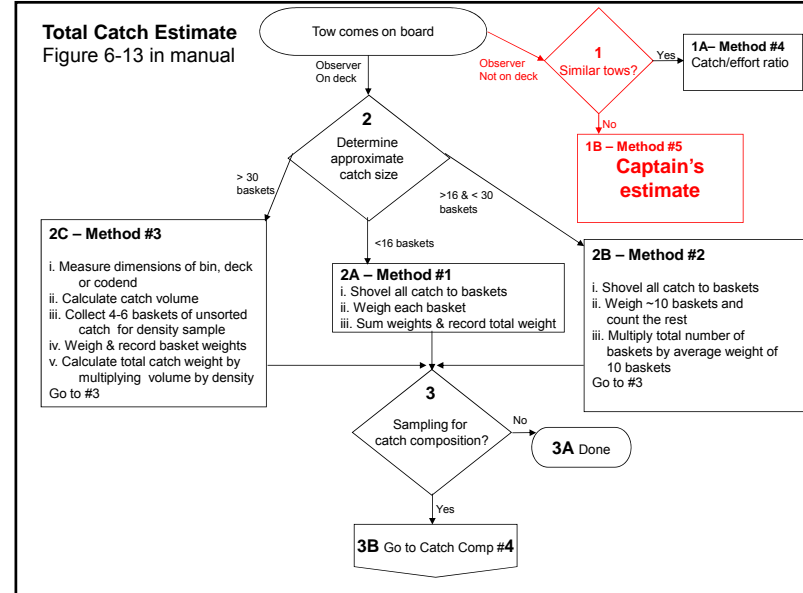
- Describe two methods to estimate total catch
- Determine when each method should be utilized
- Demonstrate ability to complete the Trawl Effort / Catch form

Total Catch Estimation

- Make an estimate for every haul
- Choice of method depends on
 - haul size
 - observer presence when haul comes aboard
- Unsorted or sorted first
- 5 methods

Total Catch Estimation - Methods

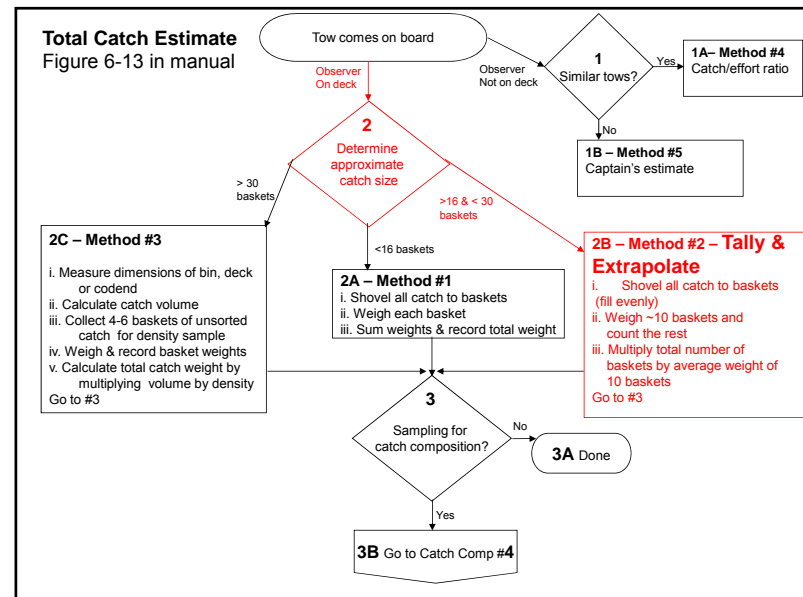
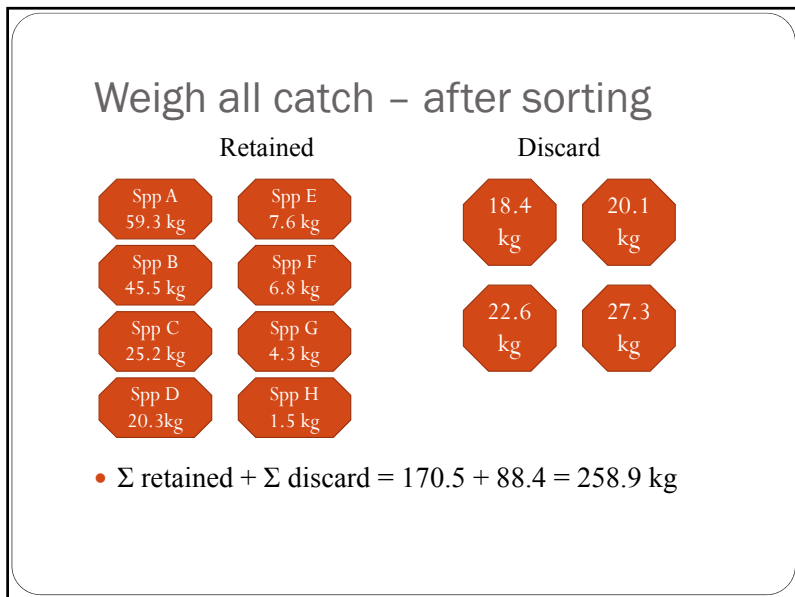
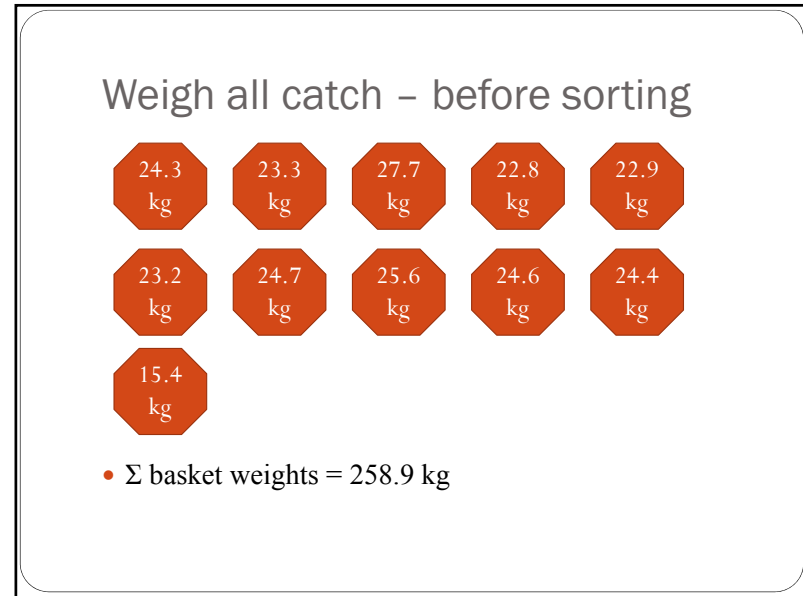
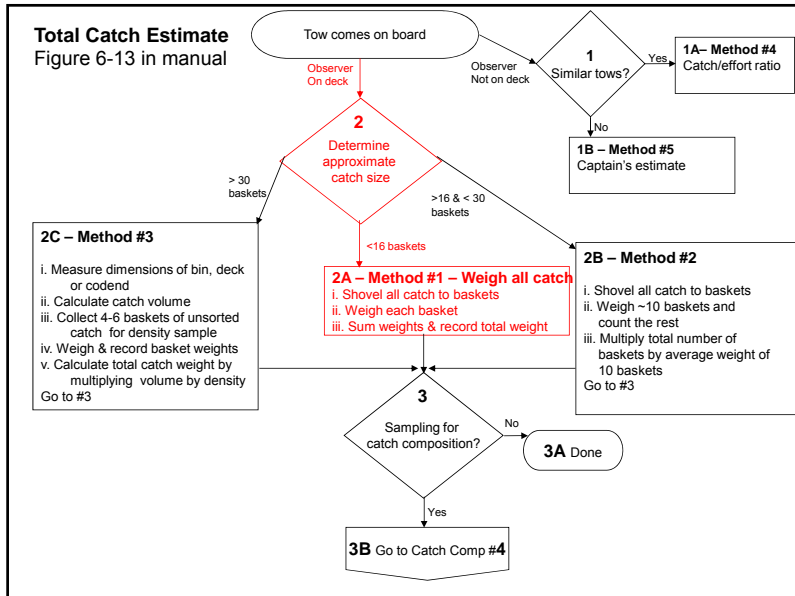
1. Weigh entire catch (small, ~400 kg,) before or after sorting;
2. Weigh subsample, tally total baskets and extrapolate to total catch using average basket weight (moderate, ~400-750kg);
3. Volumetric estimate: Bin or codend (large);
4. Catch/effort ratio
5. Captain/vessel estimate – least desirable
10. Unable to estimate Section 6.6.1 of Observer Manual



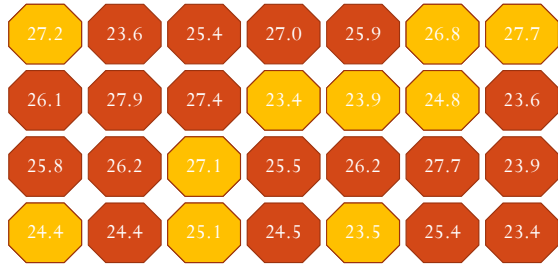
Catch/effort ratio

Haul	Total Catch (mt)	Start	End	Duration (min)
17	0.87	22:47	02:20	273
18	1.11	02:59	06:38	219
19	0.55	07:10	12:18	308
20	X	12:51	16:49	238

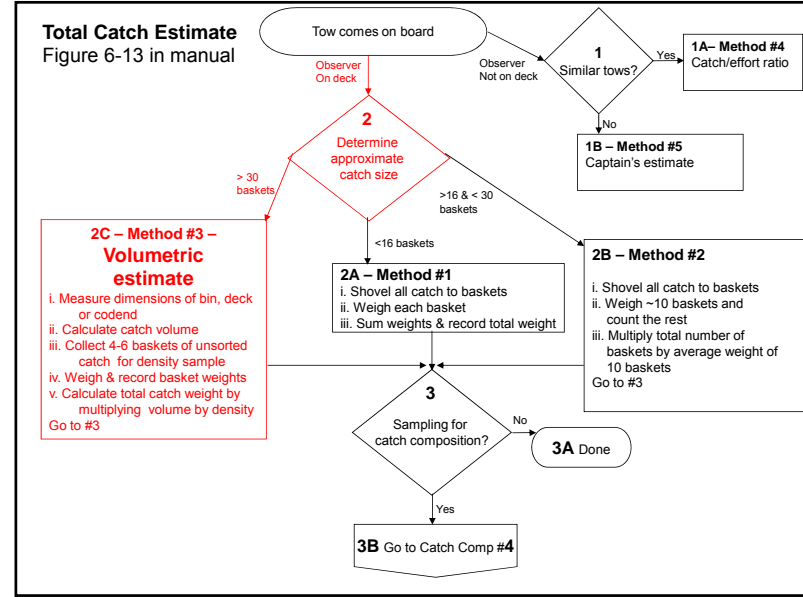
- $(\sum \text{Total weight of similar hauls} / \sum \text{Haul duration of similar hauls}) * \text{Haul duration of unknown haul} = \text{Estimated weight of unknown haul (X)}$
- $X = (2.53 \text{ mt} / 800 \text{ minutes}) * 238 \text{ minutes} = 0.752675 \text{ mt}$ or 0.75mt



Weigh subset of catch – before sorting



- Fill evenly – randomly select 10
- Σ basket weights (orange) / # baskets weighed = 253.8 / 10
- Total count * average = 28 * 25.38 = 710.64 kg
- Actual = 713.7 kg



Volumetric estimate - bin

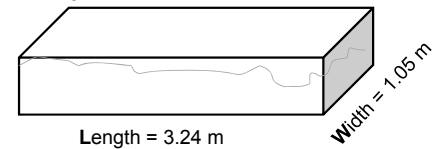
- Measurable areas on deck or holding bins
- Primary measurements: length, width & height
- Problems/issues:
 - Too much water
 - Accessibility
- Steps
 - Determine appropriate shape
 - Measure
 - Calculate volume
 - Multiply volume by density



<http://www.searish.org/t2b/subject.asp?p=325>

Volumetric estimate - bin

Heights = 0.56 m, 0.43, 0.48, 0.3, 0.35, 0.27
Average H= 2.49 / 6 = 0.415 m



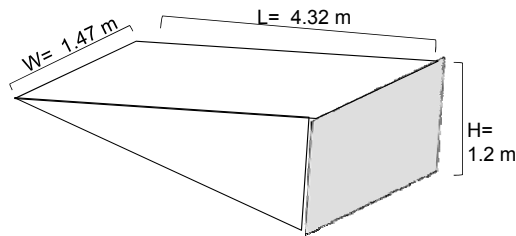
Volume (rectangular bin) = L * W * H_{average}
V = 3.24m * 1.05m * 0.415 m = 1.41183 m³

Estimated weight = V * density

= 1.41183 m³ * 0.912554 mt/m³ = 1.28837111382 mt

Estimated weight = 1.29 mt

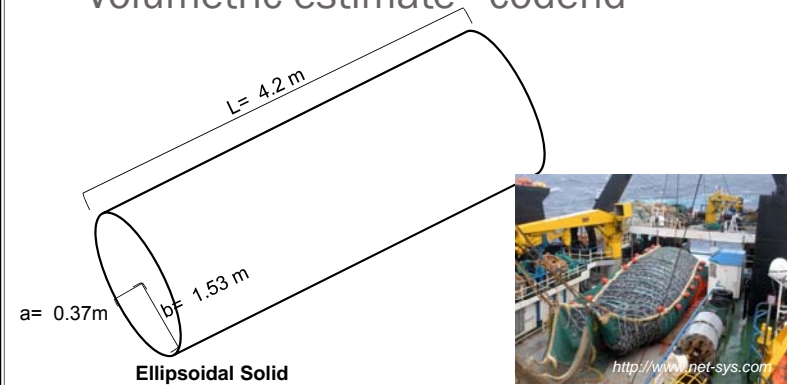
Volumetric estimate - bin



$$\text{Wedge Volume} = \frac{1}{2} (H * L * W)$$

$$V = \frac{1}{2} (1.2 * 4.32 * 1.47) = 3.81024 \text{ m}^3$$

Volumetric estimate - codend



Ellipsoidal Solid

$$V = \pi * \text{short radius} * \text{long radius} * \text{length}$$

$$V = \pi * a * b * L$$

$$V = 3.14 * .37 \text{ m} * 1.53 \text{ m} * 4.2 \text{ m}$$

$$V = 7.469513 \text{ m}^3$$

Codend measurements

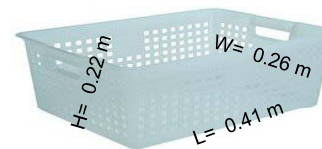
- Be aware of moving nets in trawl alley
- Measure dimensions using actual measurements and/or reference points (e.g. premeasuring trawl alley width, length can save time)
- Measure large codends in sections



<http://www.photolib.noaa.gov>

Density

- Density = Weight (mt) / volume (m³) = Σ basket weights / Σ basket volumes



Basket weights (all filled to bottom of handle): 24.3 kg, 20.7 kg, 21 kg, 22.9 kg, 22.7 kg, 23 kg
Total basket wt = 134.6 kg or 0.1346 mt

Basket volume = L * W * H

$$V = 0.41 * 0.26 * 0.22$$

$$V = 0.023452 \text{ m}^3$$

Density (ρ) = mass (mt) / V (m³)

$$\rho = .1346 \text{ mt} / (0.023452 \text{ m}^3 * 6)$$

$$\rho = .1346 \text{ mt} / (0.140712 \text{ m}^3)$$

$$\rho = 0.95656376 \text{ mt/m}^3$$

Total Weight Calculations

- Total weight estimate = volume * density
- Observer logbook (covered this morning)
 - Diagrams – if possible, make measurements of trawl alley and/or bins before leaving port
 - Space for haul by haul calculations
 - Record all original measurements and formulas used

Issues – removal of catch prior to sorting

- Dangerous or other ‘protected species’ may be removed prior to sorting.
- Inorganic debris & plant material
- Large fish

Record number, species, estimated weight and include the weight in the total catch estimate
Record on spp comp form if appropriate

Retained catch estimate

- Sometimes you will be unable to access discards
- Retained based on # cartons retained * average carton weight

Species	# cartons retained	Carton weight	Estimated retained weight per species
Cassava fish	3	25 kg	75 kg
Shrimp	12	20 kg	240 kg
Grouper	1	25 kg	25 kg
TOTAL			340 kg or 0.34 mt

Trawl Effort / Total Catch form

Document no: _____ Vessel code: _____ Trip ID: _____

Haul	Total net	Gear Perf	Sample?	Target	Substrate	Day	Month	Year	Time (GMT)	Lat-Deg	Lat-Min	Lat-NS	Long-Deg	Long-Min	Long-EW	Beam, bottom (m)	Depth, surface (m)	V/O	Speed (knots)	Retained Catch (mt)	Total Catch Est. (mt)	Method
						Start																
						End																
						Start																
						End																
						Start																
						End																
						Start																
						End																
						Start																
						End																

END

Gear performance codes:

1. No problem
2. Door- and warp-related problems
3. Net not fishing (bogged, obstructed, bag untied, tom, etc)
4. Net lost
5. Other

Target:
S – Shrimp, F – Fish
Substrate:
M – Mud S – Sand
R – Rocky C – Corals
CM – Corals & mud
CMS – Corals, mud & sand

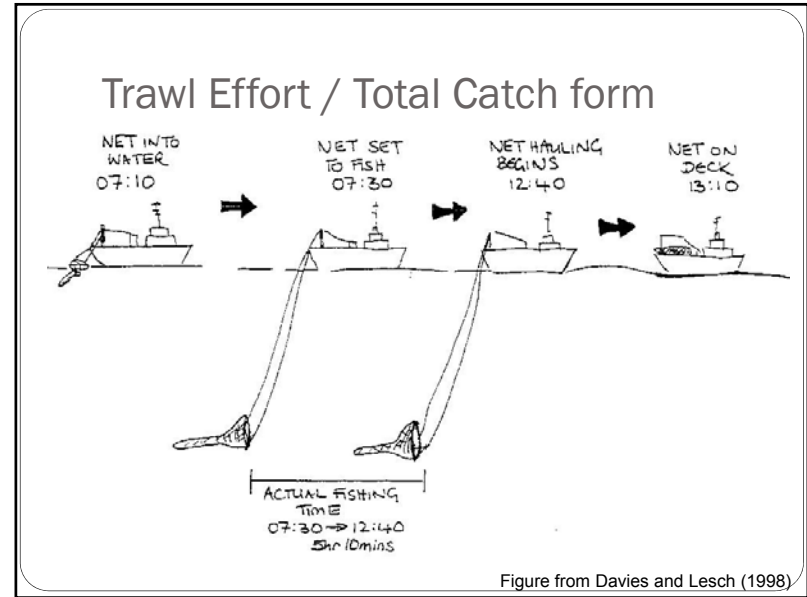
Total Catch method:

1. Weigh entire catch
2. Weigh subsample & extrapolate to total count (basket, carton)
3. Volumetric estimate: Bin or codend
4. Catch / effort ratio
5. Captain / Vessel estimate
9. Other
10. Unable to obtain Total Catch estimate

Trawl Effort / Total Catch form

Trawl Effort / Total Catch Page ___ of ___

Observer code		Vessel code		Trip ID		Date/Time							Position							Gear		Target	
Haul	Total mths	Gear Perf	Sampled?	Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg	Long-Min	Long-E/W	Depth, bottom (m)	Depth, towing (m)	V / O	Speed (knots)	Retained catch (mt)	Total Catch Est. (mt)	Method			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			



Trawl Effort / Total Catch form

Trawl Effort / Total Catch Page ___ of ___

Observer code		Vessel code		Trip ID		Date/Time							Position							Gear		Target	
Haul	Total mths	Gear Perf	Sampled?	Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg	Long-Min	Long-E/W	Depth, bottom (m)	Depth, towing (m)	V / O	Speed (knots)	Retained catch (mt)	Total Catch Est. (mt)	Method			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			
				Start																			
				End																			

Gear performance codes:

- No problem
- Door- and warp-related problems
- Net not fishing (bogged, obstructed, bag untied, torn, etc)
- Net lost
- Other

Target:

S - Shrimp F - Fish

Substrate:

M - Mud S - Sand

R - Rocky C - Corals

CM - Corals & mud

CMS - Corals, mud & sand

Total Catch method:

- Weigh entire catch
- Weigh subsample & extrapolate to total count (basket, carton)
- Volumetric estimate: Bin or codend
- Catch / effort ratio
- Captain / Vessel estimate
- Other
- Unable to obtain Total Catch estimate

- ### Activity
- Working alone but you can discuss among yourselves
 - 15 minutes then the rest is homework
 - Turn in when class starts tomorrow
 - Review answers after graded

Summary

- What are the 2 types of volumetric catch estimates? When should a volumetric estimate be used?
- When should you weigh a subsample of the catch and extrapolate to the total basket count?
- How do you estimate catch if you were asleep during a haulback?
- True or false – Make an entry on the trawl effort and total catch form for sampled hauls only.

References

- Davies, S., and H. Lesch. 1998. The Commercial Sampling Programme, Grade One Observer Manual, Version 2.1 - CSP/03. Ministry of Fisheries and Marine Resources, Commercial Sampling Programme, Observer Section, Walvis Bay, Namibia.
- Pauly, D. 1984. Some simple methods for the assessment of tropical fish stocks. FAO Fish. Tech. Paper 234, FAO, Rome.

January 16, 2012

Activity –Trawl Effort / Total Catch form

Name:

Complete the blank Trawl Effort / Total catch form and attached logbook pages using the following information.

You board the Observer code: FS345, Vessel code: LIB9997, Trip #7

Your vessel is fishing with a single Crimond Nova Demersal trawl net deployed from the back of the boat and targeting bottom fish..

You board the boat at noon in Freetown (N8° 29.75 W013° 27.4) on May 16, 2011.

The first tow started on May 16 at 2245 and finished the next day at 0215. There were some issues with the warp and the net hit hard on a very rocky bottom. The net was ripped and had to be repaired. You recorded the start and end position as N7° 46.35' W14° 8.75' and N7° 44.74' W14° 5.78', respectively. Start depth was 150 m and end depth was 100m. The weather was a little choppy (sea state ~4). Towing speed was consistently 2.3 knots and you use the captain's estimate of 1.00 mt.

The weather started to come down for the second haul and the net was mended with no further problems. The second tow was also on rocky bottom. You decided to take advantage of the down time to get some sleep. The captain woke you 30 minutes before the retrieval started which was at 0957. He wrote down the following 'start' information for you: time=0730; N7° 45'21" W14° 9'20"; bottom depth 120m, speed=2.3 knots. Because the vessel is new and the first tow was a mess, you decide not to sample this one and work on species ID and watch which species/size ranges are retained. You'll make a sampling plan after watching a real tow. However, because you're awake, you do record the end position at N7° 43.81' W14° 6.50' and end depth at 115 m. You eventually use hauls 3-5 for a catch/effort ratio estimate for total catch.

The 3rd haul which you decide to sample was on sandier bottom and started at 1023. The initial bottom depth was 150m and ended at about 225m. You also recorded the positions at N7° 43.04' W14° 6.66' and N7° 45.17' W14° 10.15'. The retrieval began at 1450. Sea state remains at ~3 and tow speed slowed a bit to 2.2 knots. This haul was moderate in size. You estimate you could fill 25-30 baskets. You decide to get the crew to shovel everything into baskets and weight 10. The weights are: 26.3 kg, 23.2 kg, 24.6 kg, 24.1 kg, 23.6 kg, 25.8 kg, 24.9 kg, 23.8 kg, 24.1 kg, 23.3 kg. The actual basket count was 32.

You were still on deck when the 4th haul went into the water so the captain recorded some information for you. time=1525; N7° 46'51" W14° 11'17"; bottom depth 172m, speed=2.3 knots, sea state 3, sandy bottom. The method of weighing / counting baskets of unsorted catch created a lot of extra work for the crew. You decide that this time, you'll let the crew sort first. Then you'll weigh all the retained and subsample the basket weights for discard. This haul ends at 1902 at 195m depth. You record the position: N7° 51.23 W14° 13.74. The total retained weight was 347.3 kg and there were a total of 14 discard baskets with an average weight of 25.3 kg/basket.

Trawl – Total Effort & Catch Estimation

January 16, 2012

Haul 5 was also on sandy bottom. It's after dark but you're committed to sampling the next 2 tows. The start & end times are 2117 and 0041 (on May 18). Start position was N7° 51.54' W14° 13.56' and initial depth was 161 m. You also record the end information as: N7° 54.50' W14° 14.78' and 198 m depth. The weather has come down even more to sea state 2 and tow speed is the usual 2.3. The catch was small so you weighed it all before sorting. Basket weights were: 24.3 kg, 22.2 kg, 24.6 kg, 25.1 kg, 25.6 kg, 24.8 kg, 23.9 kg, 22.8 kg, 24.1 kg, 22.3 kg, 25.2 kg, 25.4 kg, 25.7 kg, 23.5 kg.

Haul 6 was on fairly muddy bottom and it was clear this was a very different tow when it came up. The codend was full of mud and invertebrates mixed with a few fish. You decide a codend estimate is the best way to go. You record the start information as 0130, N7° 55.40' W14° 15.12' and 216 m and end info as 0716, N8° 03.09' W14° 15.22' and 224 m. Using the basket dimensions in the manual (Section 6.6), your density weight samples were: 25.6, 24.8, 26.8, 25.5 KG.

There was no more fishing on May 18. You're transiting back to port. The May 19 position around 1300 was N8° 4.93' W14° 16.0'

Trawl – Total Effort & Catch Estimation

January 16, 2012

Haul #: 1 Total catch WT:	Total Weight Calculation
Density /Other Calculation	
Haul #: 2 Total catch WT:	Total Weight Calculation
Density /Other Calculation	
Haul #: 3 Total catch WT:	Total Weight Calculation
Density /Other Calculation	

Trawl – Total Effort & Catch Estimation

January 16, 2012

Haul #:4 Total catch WT:	Total Weight Calculation
Density /Other Calculation	
Haul #:5 Total catch WT:	Total Weight Calculation
Density /Other Calculation	
Haul #:6 Total catch WT:	Total Weight Calculation
Density /Other Calculation	

Observer code	Vessel code	Trip ID
---------------	-------------	---------

Haul	Total nets	Gear Perf	Sampled?	Target	Substrate	Date/Time				Position					Depth, bottom (m)	Depth, fishing (m)	V / O	Speed (knots)	Retained catch (mt)	Total Catch Est. (mt)	Method
						Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg	Long-Min							
						Start					.			.							
						End					.			.							
						Start					.			.							
						End					.			.							
						Start					.			.							
						End					.			.							
						Start					.			.							
						End					.			.							
						Start					.			.							
						End					.			.							
						Start					.			.							
						End					.			.							
						Start					.			.							
						End					.			.							
						Start					.			.							
						End					.			.							

<p>Gear performance codes:</p> <ol style="list-style-type: none"> 1. No problem 2. Door- and warp-related problems 3. Net not fishing (bogged, obstructed, bag untied, torn, etc) 4. Net lost 5. Other 	<p>Target: S – Shrimp F – Fish Substrate: M – Mud S – Sand R – Rocky C – Corals CM – Corals & mud CMS – Corals, mud & sand</p>	<p>Total Catch method:</p> <ol style="list-style-type: none"> 1. Weigh entire catch 2. Weigh subsample & extrapolate to total count (basket, cartoon) 3. Volumetric estimate: Bin or codend 4. Catch / effort ratio 5. Captain / Vessel estimate 9. Other 10. Unable to obtain Total Catch estimate
--	---	---

Haul	Total nets	Gear Perf	Sampled?	Target	Substrate	Date/Time			Position					Long-E/W	Depth, bottom (m)	Depth, fishing (m)	V / O	Speed (knots)	Retained catch (mt)	Total Catch Est. (mt)	Method	
						Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg									Long-Min
						Start					.			.								
						End					.			.								
						Start					.			.								
						End					.			.								
						Start					.			.								
						End					.			.								
						Start					.			.								
						End					.			.								
						Start					.			.								
						End					.			.								
						Start					.			.								
						End					.			.								
						Start					.			.								
						End					.			.								
						Start					.			.								
						End					.			.								