Chapter 4
CATCH-PER-TRIP ANALYSIS

When performing catch-per-trip analyses within a state/mode/wave stratum, reweighting of data is not necessary since intercept sampling is random within each stratum and an assumption can be made that the true effort distributions are represented. However, if catch-per-trip analyses are performed among state/mode/wave strata, data must be reweighted prior to pooling among strata. Reweighting of state/mode/wave data on the basis of total estimated trips is necessary for any trip-based variables, including fishing hours, fishing target, gear type, and interview time.

Reweighting of data is necessary due to the non-random distribution of intercepts among strata. Distribution of sampling among state/mode/wave strata is not representative of true fishing effort due to the following factors: 1) heavier sampling of fishing effort in the boat modes; 2) variations in sampling levels among states due to state add-ons to the MRFSS; 3) variations in sampling levels among waves; and 4) variable success rates in achieving sampling targets. Variability in the level of sampling among states and particularly among modes of fishing is demonstrated through a comparison of the distribution of intercepted trips by state and fishing mode from Wave 4 of the 1992 MRFSS intercept survey (Figure 9) with the distribution of total estimated trips (Figure 10). A much higher proportion of trips are intercepted in the boat modes and sampling levels are higher in stats that add-on to the MRFSS. Weighting of catch-per-trip data by the total estimated fishing effort will adjust for the effects of non-random sampling across strata.

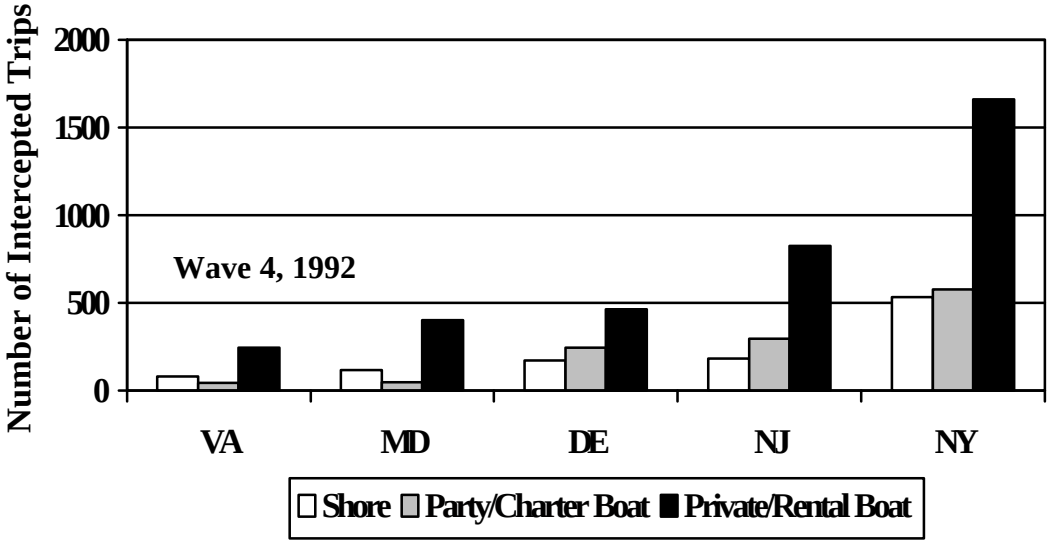

Figure 9. Distribution of intercepted trips by state and mode of fishing from Wave 4 of the 1992 MRFSS intercept survey.

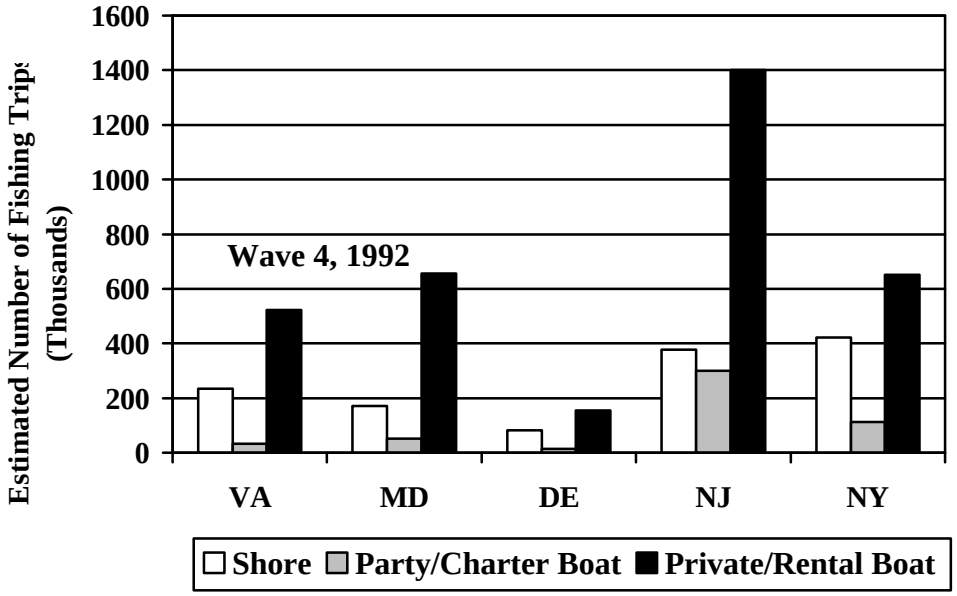

Figure 10. Distribution of total estimated trips by state and mode of fishing from Wave 4 of the 1992 MRFSS intercept survey.

To estimate the number of trips in a given catch class for pooled state/mode/wave strata, the number of trips in the given catch class in each state/mode/wave stratum is weighted by the total number of estimated trips in that state/mode/wave stratum following the equation:

$$t_{C=X} = \sum_{i,j,k} \frac{t_{C=X\,(ijk)}}{\sum_{C} t_{ijk}} x\, t_{ijk}$$

where:
- i = state
- j = mode
- k = wave
- C = catch class
- X = number of fish in catch
- $\tau_{C=X}$ = total estimated number of trips with C=X over all pooled state/mode/wave stratum

τ_{ijk} = estimated number of trips in a given state/mode/wave stratum

$t_{C=X\ ijk}$ = number of intercepted trips with C=X in a given state/mode/wave stratum

Σt_{ijk} = total number of intercepted trips in a given state/mode/wave stratum (all catch classes included)

Computational Steps:

Pooling among states for catch-per-trip analyses is demonstrated using hypothetical MRFSS data for Wave 4, private/rental boat mode for the states of New York and New Jersey. The number of intercepted trips with a catch of one fish (C=1) in the private/rental boat mode Wave 4 for each state ($t_{C=1\ ijk}$), the total number of intercepted trips pooled over all catch classes for the given state/mode/wave stratum (Σt_{ijk}), and the estimated total number of trips for each state/mode/wave stratum (τ_{ijk}, or NUMRTRIP as calculated in Section II.A.1.) are shown in Table 4.

Table 4. Hypothetical MRFSS data for New York and New Jersey in Wave 4 for the private/rental boat mode, including data on the number of intercepted trips with a catch of one fish in the state/mode/wave stratum, the total number of intercepted trips in the state/mode/wave stratum over all pooled catch classes, and the estimated total number of fishing trips for the state/mode/wave stratum.

State	Mode	Wave = 4	Intercepted Trips With C = 1	Total Intercepts (pooled catch classes)	Total Trip Estimate
NY	PR	Jul/Aug	60	1500	500,000
NJ	PR	Jul/Aug	50	500	700,000

The incorrect procedure for estimating the total number of trips that caught one fish is to pool New York and New Jersey data without weighting by stratum as follows:

$$t_{C=1} = \frac{(t_{C=1\,NY,PR,4} + t_{C=1\,NJ,PR,4}) \, x \, (t_{NY,PR,4} + t_{NJ,PR,4})}{(t_{NY,PR,4} + t_{NJ,PR,4})}$$

$$t_{C=1} = \frac{(60 + 50) \, x \, (500{,}000 + 700{,}000)}{(1500 + 500)} = 66{,}000$$

The correct procedure for estimating the total number of trips that caught one fish for pooled New York and New Jersey data weights the intercepted trips for each stratum by the total estimated trips for that stratum as follows:

$$t_{C=1} = \frac{(t_{C=1\,NY,PR,4} \, x \, t_{C=1\,NY,PR,4})}{t_{NY,PR,4}} + \frac{(t_{C=1\,NJ,PR,4} \, x \, t_{NJ,PR,4})}{t_{NJ,PR,4}}$$

$$t_{C=1} = \frac{(60 \, x \, 500{,}000)}{1500} + \frac{(50 \, x \, 700{,}000)}{500} = 90{,}000 \text{ trips that caught 1 fish of the given species}$$

The difference in the unweighted and weighted estimation procedures is demonstrated for pooling among states and modes of fishing for black sea bass and weakfish using Wave 4, 1992 MRFSS data. The mean number of black sea bass caught varies minimally with the two estimation procedures, with an unweighted mean of 5.71 fish per trip and a weighted mean of 5.47 fish per trip (Figure 11). The two estimation procedures produces a much greater difference in mean number of weakfish caught, with an unweighted mean of 2.94 fish per trip and a weighted mean of 4.26 fish per trip (Figure 12).

A similar weighting procedure must be performed when pooling catch-per-trip data among waves and modes of fishing within a state due to variable MRFSS sampling levels among waves and modes of fishing. Variability in the level of sampling among waves and modes of fishing is demonstrated through a comparison of the distribution of intercepted trips by wave and fishing mode

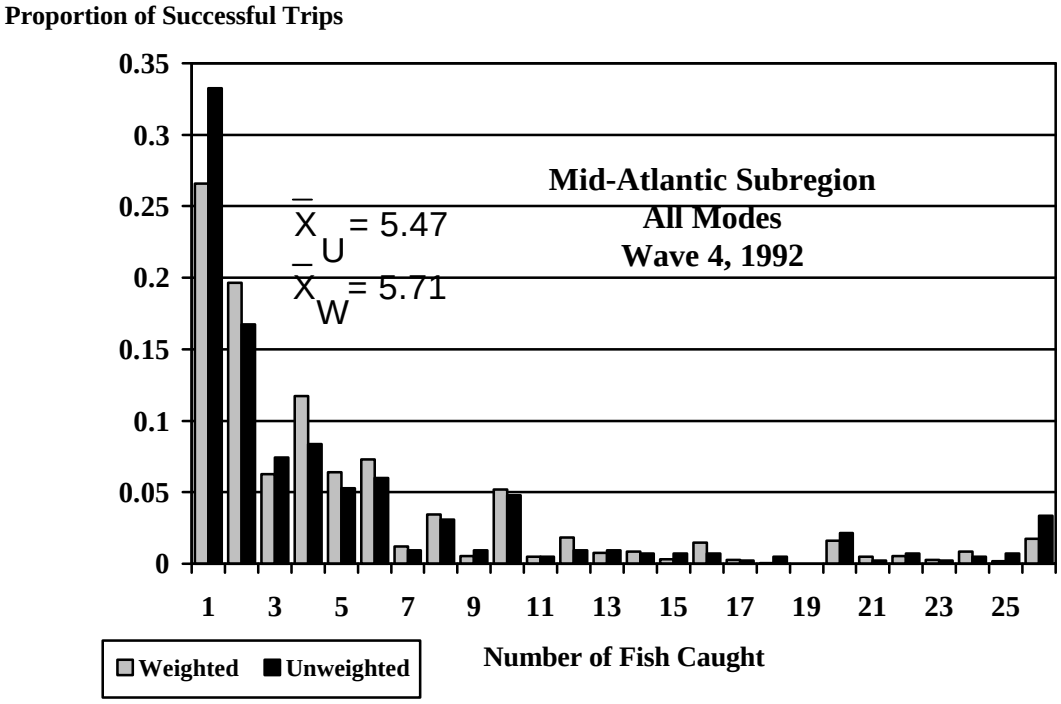

Figure 11. Distribution of successful trips catching black sea bass in the mid-Atlantic region during Wave 4 of the 1992 MRFSS survey. Proportions were estimated using an unweighted and weighted catch-per-trip analysis. Data are pooled across states and modes of fishing. (u = unweighted, w = weighted)

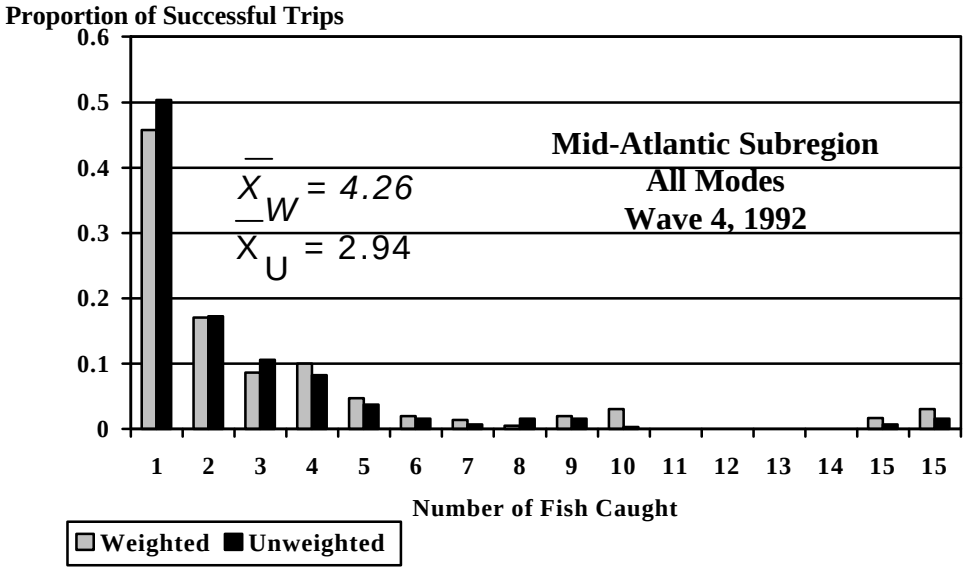

Figure 12. Distribution of successful trips catching weakfish in the mid-Atlantic region during Wave 4 of the 1992 MRFSS. Proportions were estimated using an unweighted and weighted catch-per-trip analysis for pooling among states and modes of fishing. (u = unweighted, w = weighted)

for New Jersey during the 1992 MRFSS intercept survey (Figure 13) with the distribution of total estimated trips (Figure 14). Without proper weighting, the potential exists for estimating a higher number of trips in a particular mode or wave due only to the increased level of sampling. Catch-per-trip analyses using the unweighted estimation procedure and pooling among both waves and modes of fishing provide an estimate of the mean number of bluefish per trip of 4.77, while the weighted estimation procedure provides a mean value of 3.97 bluefish per trip (Figure 15).

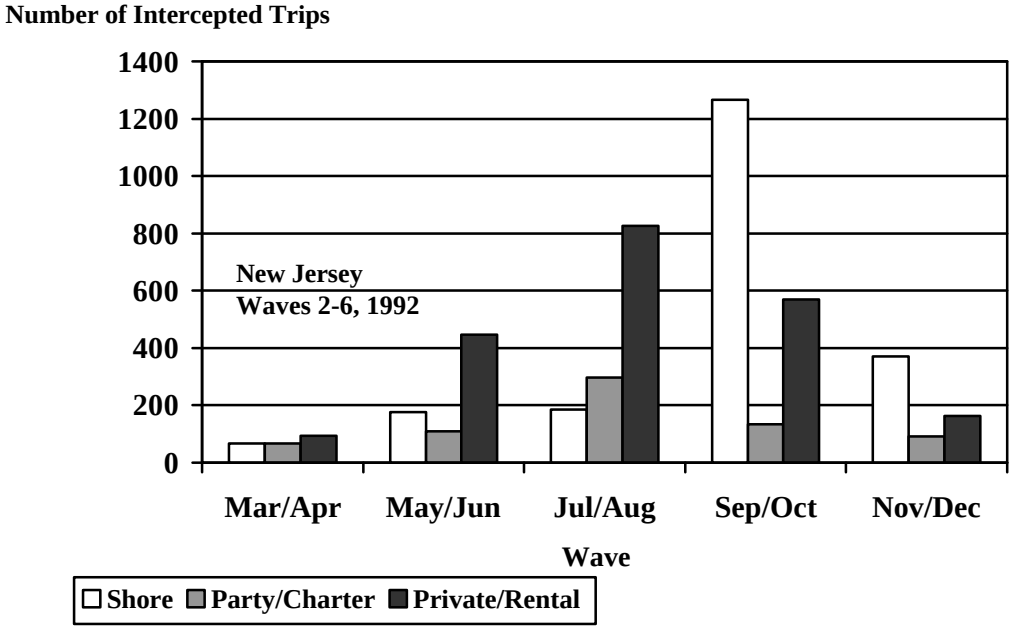

Figure 13. Distribution of intercepted trips by wave and mode of fishing for New Jersey during the 1992 MRFSS intercept survey.

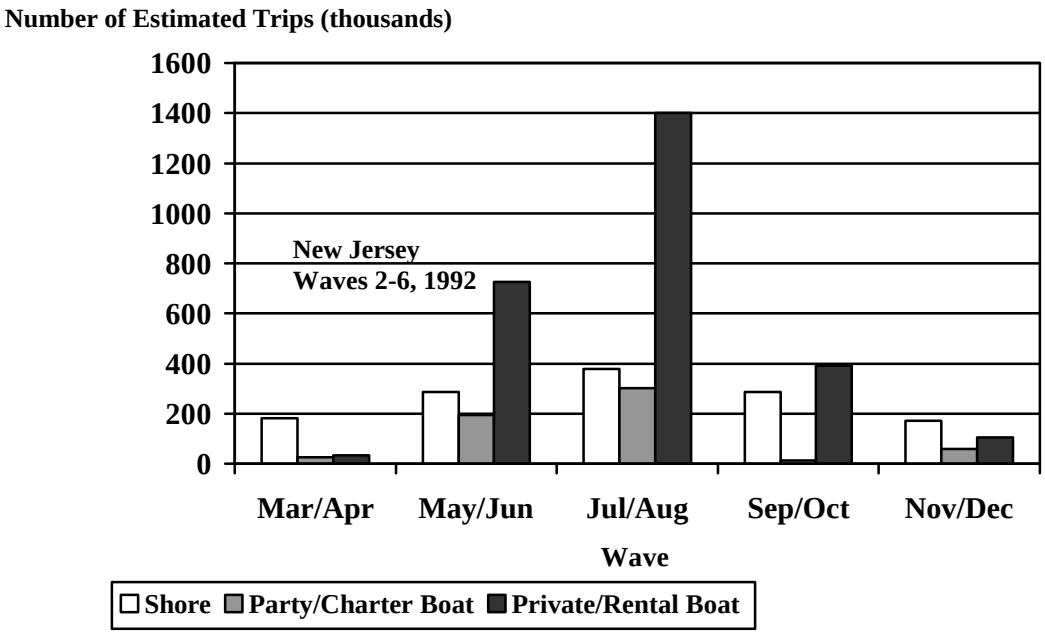

Figure 14. Distribution of total estimated trips by wave and mode of fishing for new Jersey during the 1992 MRFSS intercept survey.

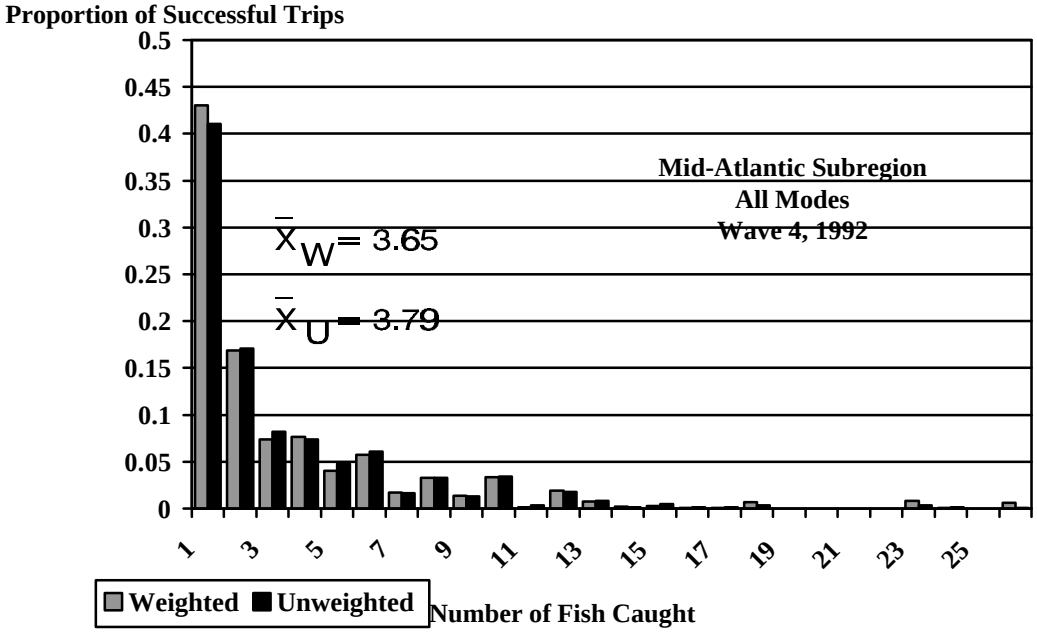

Figure 15. Distribution of successful trips catching bluefish in New Jersey during Wave 4 of the 1992 MRFSS survey. Proportions were estimated using both unweighted and weighted catch-per-trip analysis. Data are pooled among waves and modes of fishing.

The specific steps in catch-per-trip analyses using the MRFSS SAS datasets are as follows:

1. Calculate the total number of fish of a given species unavailable for inspection (Type B1 and B2 Catch) for each separate interview (ID_CODE) for a given state/mode/wave stratum.

    a. From the Type 2 records, select the records with the given species code (SP_CODE) and disposition (DISPO).
    b. From the Type 2 records, sum the variable NUM_FISH by ID_CODE and label this variable SUM_FISH.

2. Calculate the total number of fish of a given species available for inspection (Type A Catch) for each separate interview (ID_CODE) for a given state/mode/wave stratum.

    a. From the Type 3 records, select the records with the given species code (SP_CODE).
    b. Keep only the first record for each ID_CODE.
    c. Keep the variable FSHINSP (# of Type A fish inspected).

3. Merge the data from steps 1 and 2 with the Type 1 records.

    a. Merge the Type 2 records with the variable SUM_FISH with the Type 1 records by ID_CODE.
    b. Merge the subsetted Type 3 records with the Type 1 records by ID_CODE.

4. Calculate the total number of fish caught (Type A + B1 + B2 Catch) for each separate interview (ID_CODE) for the given state/mode/wave stratum.

    a. Add SUM_FISH and FSHINSP by ID_CODE.

5. Keep only the records with one contributor (CNTRBTRS = 1).

6. Calculate catch frequencies by state/mode/wave stratum.

7. Calculate total intercepts by state/mode/wave stratum.
8. Merge the catch frequency data with the total intercept data by state/mode/wave stratum.

9. Calculate relative frequencies by state/mode/wave stratum.

10. From the SAS trip estimation files select the records with the given state/mode/wave stratum and keep the variable NUMRTRIP (total estimated number of trips for that stratum).

11. Merge the trip data (NUMRTRIP) with the relative catch frequency data by state/mode/wave stratum.

12. Calculate the estimated number of trips by catch class for each state/mode/wave stratum by multiplying each relative catch frequency times NUMRTRIP.