7. A case study

A regional workshop was held in November 1998 in Tunisia with the purpose of presenting and discussing methodological and operational aspects in the design and implementation of sample-based catch/effort assessment surveys. The discussions focused on sampling and estimation involving mean daily catch and fishing effort, these two variables being the basis for estimating total catch. A case study was worked out concerning an artisanal fishery of 165 non-motorized gillnetters, operating from the ports of Bizerte and Ghar el Melh on a one-trip-per-day basis. Objective of the case study was to evaluate alternative sampling schemes for estimating two important catch/effort parameters:

(a) The Boat Activity Coefficient (BAC) expressing the probability that any boat would be active (i.e. fishing) on any day;
(b) The mean overall CPUE expressing the average catch per day of any boat (including all species).

In order to verify the applicability of the presented theory on safe sample size, use was made of census data relating to daily catches and boat activities.

7.1 Estimation of Boat Activity Coefficient (BAC)

A dataset of boat activities was made available showing recordings for all 165 boats during a reference period of 31 calendar days. Boat activities consisted of values of 1 and 0, 1 if a boat was active during a day or 0 if the boat was not active. Thus, the population of boat activities consisted of $\mathbf{N}$ = 31 x 165 =5 115 elements with values 0 or 1. The population mean (found to be 0.691) indicates the average activity level of a boat (BAC); that is the probability that any boat would be expected to be active on any day.

7.2 Estimation of CPUE through landings

A second dataset was also made available showing 3 555 recordings of daily catch for all 165 boats during the same reference period of 31 calendar days. Total catch was found to be 17 704 kg corresponding to a total effort of 3 555 fishing days, thus resulting in a population CPUE of 4.98 kg per boat per day. The maximum daily catch found in the dataset was 9.93 kg and the minimum zero; thus the population range of the daily catches is 9.93 kg.

7.3 Emulating "safe" sampling operations

7.3.1 Boat activities

In order to evaluate the operational requirements for future sampling operations and with the objective of deriving estimates of mean daily catch and mean boat activity, it was suggested that sampling from both datasets should target at a minimum sampling accuracy level of 95 percent.

Using Table B.1 it was found that for the concave population of 5 115 elements of boat activities a sample size of about $n=358$ would be needed in order to achieve the desired minimum accuracy level of 0.95.

In actual surveys this sample is composed of:

(a) The total number of boats of the sampling sites, as reported by a frame survey, multiplied by the number of sampling days. For instance if sites A and B are sampling sites and they contain 10 and 20 boats respectively, then the sample size over 8 days of sampling operations will be $n=(10 + 20) \times 8 = 240$.
(b) If only sub-sets of the total number of boats are examined for state of activity (case of large ports), then the sum of all these numbers over the sampling period will provide the sample size.

7.3.2 Sample landings and sample CPUE

Using Table B.2 for the flat or convex population of daily landings, it was found that a sample size n=125 landings would guarantee the same minimum accuracy of 95 percent.

Sample CPUE is formulated by adding up all landings sampled and dividing by the associated fishing effort.

7.3.3 Remarks

In determining safe sample size the following points were considered:

(a) The population of boat activities was determined as the total number of boats (=165) multiplied by the number of calendar days in April (=30).
(b) The exact total number of landings cannot be predicted in a real situation. Consequently the size of the population of daily catches (although known to be 3 555) was set at the theoretical maximum N=5 115, assuming that all 165 boats made landings on every day;
(c) No other information regarding population means and ranges was used and sample sizes were determined only on the basis of population size and desired level for minimum accuracy. Census data were used for verification purposes only.

Table 7.1 illustrates ten trial sampling operations applied to both datasets, each trial using the appropriate sample size determined above. For each trial operation the table shows the resulting mean daily catch and mean boat activity and resulting accuracy levels, as well as the estimated total effort and total catch. It is worth noticing that most of the resulting catch estimates compare well with the known total catch figure of 17 704 kg.

Table 7.1. Trial sampling and resulting estimates using census data of landings and boat activities (FAO Regional Workshop, Tunisia, 1998).

Trial	Sample CPUE (2)	Sampling accuracy	Sample BAC (4)	Sampling accuracy	Estim. effort (6)	Estim. catch (2)x(6)
1	5.123	0.985	0.685	0.994	3503	17945
2	5.128	0.985	0.702	0.989	3590	18409
3	4.905	0.993	0.674	0.983	3447	16907
4	4.769	0.979	0.721	0.970	3687	17583
5	4.867	0.989	0.680	0.989	3478	16927
6	4.962	0.999	0.710	0.981	3631	18017
7	4.848	0.987	0.649	0.958	3319	16090
8	5.182	0.979	0.669	0.978	3421	17727
9	5.068	0.991	0.699	0.992	3575	18118
10	4.978	1.000	0.685	0.994	3503	17437

SUMMARY

In this section readers were presented with a case study dealing with census data on landings and boat activities. The following points have been emphasized.

(a) Setting-up population sizes for boat activities.
(b) Considering the population size of boat activities as a theoretical maximum for determining the population size of landings.
(c) Using Tables B.1 and B.2 from Annex B in order to determine safe sample sizes achieving desired accuracy levels.
(d) Verifying that trial samples taken as per theory result in estimates that have a sampling accuracy that is higher or at least equal to the level selected.