Suriname FISMIS: Implementing sample-based surveys to obtain catch estimates using Calipseo v.2

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Suriname's marine fisheries are divided into an industrial and an artisanal fleet segment. Data collection for the industrial fleet is done using a census approach, where companies send full landing data to the Fisheries Department. A sample-based methodology is implemented for the much larger artisanal fleet, using data enumerators in the field that collected data from a subset of the total landings. In 2020-2021, the sample-based methodology was revised by the Suriname Fisheries department and FAO (James Geehan, Yann Laurent). The aim of the current document is to describe and discuss how the recommendations by Geehan (2021) can be implemented in the Calipseo platform to obtain reliable catch estimates for the artisanal fishery.

A. General approach for the sample-based methodology:

- The artisanal fleet is divided in **sampling strata**. A stratum is defined by a combination of vessel, gear and area characteristics. An example stratum could be: '*BV fykenet fishery in the Suriname River estuary'*. The main criterium to delineate strata is that data from a subset of all the landings of the vessels in that stratum (i.e. landing samples), can reliably be raised to obtain a total catch estimate for that stratum for a given time period. Is it clear that if the stratum is too heterogeneous in vessel or gear type, a limited number of landing samples will not result in a reliable estimation of total catches. In essence, the new methodology is thus a **stratum-based approach**, rather than a site-based approach. Raising of catches is from landing samples is done at the stratum level.

- For each sampling stratum, the total catches will be calculated for each calendar month, according to the following general equation:

  Average CPUE (in kg/day) X total effort (in days) = total catch (in kg) (1)

- Equation (1) will be applied for each landed species separately. The total catch is then the sum of the total catch of all species that are caught by a given sampling stratum.

- **Average CPUE (in kg/day)** for a given species in a given stratum will be calculated monthly from landing samples. The minimum amount of samples needed will depend on the number of active vessels in that stratum and the available manpower to collect the samples. The samples should be randomly distributed within the stratum.

- **Total effort (in days)** will be obtained in two different ways:

  ➔ For some (smaller) strata an **effort census** will be conducted, i.e. collection of total effort for each calendar month. This will be done by data enumerators in the field, who collect 'effort samples' from all vessels at the landing site. This is simply done by asking the captain how many days they spent fishing when the catch from a trip is landed. From the vessels that are selected for landing sampling (to obtain CPUE estimates), fishing effort will be obtained as well. The effort samples will be entered in Calipseo using an **'effort form'**. This could essentially be the same as a landing form, without entering the catch information. I do suggest to adding the departure and return time in the form, because some vessels might just spent a few hours fishing. It would also be good to have a field to enter the 'trip number' of that particular vessel, to keep track of the amount of trips the vessel has done that year.

➔ For larger strata, it will be impossible to do a monthly effort census. Here, the total monthly effort will be estimated using a Boat Activity Coefficient (BAC) as follows:

Number of vessels in stratum X BAC (in days/vessel) = total effort (days) (2)

The BAC coefficient itself will be obtained by asking the vessel captains how many days they have been fishing over a certain period in the past: the number of days fished over the last, say, 14 days. The time period might differ between strata, therefore, Calipseo should allow for flexibility in entering these 'BAC-samples'. The entry form could just mention the vessel, date, and then field allowing for the entry of "X days fished over the last Y days".

BAC samples should be randomly spread over the sampling stratum and could also be collected by telephone. In that way, bias is avoided when part of the fleet is down (e.g. low season) and the BAC would be erroneously calculated based a small number of active vessels in the stratum, sampled by the data enumerators in the field.

For each stratum, the BAC can then be calculated on a monthly basis, based on the BAC-samples. In doing this calculation, it should be taken into account that a BAC-sample collected in month *t* might represent activity in month *t – 1.* E.g. when asked about effort in the last 14 days, on the 2nd day of the month, this information should primarily be used to calculate the BAC from the previous month.

B. Needs for implementation of the methodology using Calipseo v.2

B.1 Data entry (user interface)

- Registry of sampling strata
- Option to select effort estimation method for each sampling stratum (effort census or BAC)
- Option to assign vessels to certain sampling stratum
- Landing form to submit landing samples (already in place)
- Effort form to submit effort samples. The form should have the following fields:
    - Vessel name*
    - Vessel registry number: used to assign effort sample to certain sampling stratum*
    - Departure day and time*
    - Arrival day and time*
    - Trip number (not mandatory)
- BAC form to submit 'BAC samples'. The form should have the following fields:
    - Vessel name*
    - Vessel registry number: used to assign effort sample to certain sampling stratum*
    - Field allowing for the entry of "*X* days fished over the last *Y* days", with X and Y being free number fields.

B.2 Calculations to be done in the system

For *each sampling stratum and per calendar month*, total catch should be estimated using the following approach.

1. **Average CPUE** (in kg LWE/day) is calculated for each species using the landing samples from that month taken within the stratum
2. **Total effort** (in days) is calculated using either effort census or a BAC.
    - **Effort census:** total effort is calculated as the sum of all fishing days reported in the landing samples and effort samples

- **BAC:** this approach requires two steps
  (1) Calculation of a BAC using BAC samples from that month taken within the stratum. Samples are recalculated to a monthly basis, e.g.: a BAC sample reports 10 days fished over the last 15 days. This translates to a boat activity of 20 days/vessel on a monthly basis, assuming a 30-day month. The BAC at stratum level will be the average of all recalculated BAC samples.
  (2) The BAC (in days/vessel) is multiplied by the number of vessel within the stratum (which, in turn, is obtained from assigning each (artisanal) vessel in the registry to a sampling stratum).

3. **Total catch** (in kg LWE) **for each species** is calculated as *CPUE (in kg LWE/day) X total effort (in days)*
4. Finally, the **total catch** (in kg LWE) is calculated as the sum of the catches of the separate species