**Supplementary Material S3: Details on the Bayesian estimation procedure**

**Proportion of dFADs *α***

To estimate the uncertainty in the fraction of all FOBs of French, Spanish and other purse-seine fleets that are dFADs (as opposed to logs) in a specific 9x9 degree cell, we made the assumption that the process of observing GPS buoy-equipped dFADs (as opposed to logs) of each PS fleet approximately a binomial process with probabilities *α*fr, *α*sp and *α*oth respectively. The probability of observing dFADs of a given PS fleet *j* out of a total number of FOBs observed for that fleet is, therefore, proportional to the binomial distribution with probability *α*j (based on using Bayesian statistical inference assuming a uniform prior distribution for the proportions):

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|  |  |  |

This probability can be normalized (with respect to ) by integrating over all possible values of , yielding the final probability density and cumulative distribution functions:

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| --- | --- | --- |
|  |  |  |

Deployments of GPS buoys on dFADs and logs by French and Spanish purse seiners and randomly encountered Other-dFADs and Other-logs were counted in each 9x9 degree cell and for each period (2007-2009 or 2010-2013) using observer data.

**Proportion of FOBs of each fleet *p***

To estimate the uncertainty in the fraction of all FOBs that pertain to a given PS fleet *j* in a specific 9x9 degree cell (*p*j), we made the assumption that the process of observing French, Spanish and Other GPS buoy-equipped FOBs in a 9x9 zone is approximately a multinomial process with probability *p*fr, *p*sp and *p*oth, respectively (assuming the total number of FOBs is considerably larger than the fraction of them recorded by observers and that FOBs of different fleets are encountered randomly). The probability of observing FOBs of a given PS fleet *j* is given by the multinomial distribution:

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Where is the prior distribution for the proportions (noting that only two of the three proportions are independent) and the , and must satisfy the following conditions:

|  |  |  |
| --- | --- | --- |
|  |  |  |

The unnormalized log probability density for this distribution is:

|  |  |  |
| --- | --- | --- |
|  |  |  |

Randomly encountered GPS buoy-equipped FOBs pertaining to the French (, Spanish ( and Other PS fleets were counted in observer data. In each 9x9 degree cell centered on each 1x1 degree cell, and for each period 2007-2009 and 2010-2013, , and were used to estimate the distribution of the proportion of French (, Spanish ( and Other ( GPS buoys FOBs with the *metrop* function of R package mcmc, with the unnormalized log probability density defined in Eq. 5. The "reference distance approach" of Berger et al. (2015) was used to derive the non-informative multinomial prior distribution for the proportions, yielding a bivariate Dirichlet prior: . To improve mixing in the MCMC chains, 4 different MCMC chains of 2500 iterations each were built to obtain 10000 values of , and . For each of the 4 MCMC chains, *metrop* was run until we reached an acceptance rate of 0.25. Then, the number of batches of each iteration (i.e., the *blen* parameter to *metrop*) was adjusted to avoid autocorrelation along the MCMC chain.

**Total number of dFADs and GPS buoy-equipped FOBs**

Finally, daily or yearly estimates of French GPS buoys in 1x1 degree cells were combined with the 10 000 values of each proportion and in the appropriate 9x9 cells and for the appropriate period, 2007-2009 or 2010-2010, to obtain 10 000 values of the total number of GPS buoy-equipped FOBs and dFADs .

**Table S3.1:** *Mean estimate of the total number of GPS buoy-equipped dFADs in the Atlantic (solid line) and Indian (dashed line) oceans, per year (2007-2013) over the 10,000 iterations of the Bayesian procedure. Values of 2.5% and 97.5% quantiles of the estimated distribution of FAD and FOB are presented in square brackets.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Atlantic Ocean | | Indian Ocean | |
| *FAD* | *FOB* | *FAD* | *FOB* |
|  |  |  |  |  |
| 2007 | |  | | --- | | 2962 [2595;3630] | | 3296 [2899;3630] | 7727 [6961;9547] | 9325 [8360;9547] |
| 2008 | 3763 [3248;4716] | 4185 [3629;4716] | 9323 [8632;10492] | 11479 [10656;10492] |
| 2009 | 7339 [6344;9492] | 8131 [7070;9492] | 8220 [7739;8958] | 10222 [9658;8958] |
| 2010 | 8977 [8493;9821] | 9419 [8910;9821] | 19949 [17553;24857] | 21658 [19097;24857] |
| 2011 | 11600 [10549;13876] | 12214 [11120;13876] | 21025 [18426;26196] | 22858 [20094;26196] |
| 2012 | 15138 [14146;17123] | 15922 [14872;17123] | 28545 [25193;35203] | 30753 [27212;35203] |
| 2013 | 17763 [15465;22754] | 18449 [16097;22754] | 31978 [28450;38549] | 34659 [30892;38549] |

References

Berger, J. O., Bernardo, J. M., and Sun, D. 2015. Overall Objective Priors. Bayesian Analysis, 10: 189–221.