The following supplement accompanies the article

Trends and variability in demographic indicators of a recovering population of green sea turtles *Chelonia mydas*

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Supplement.

Table S1. Estimates of straight carapace length (SCL) for newly tagged and veteran nesters at East Island, French Frigate Shoals, 1981 – 2010, derived from the top ranked linear mixed model.

Year	Estimated New Tag	New Tag SE	New Tag Lower 95% CI	New Tag Upper 95% CI	Estimated Veteran Nester	Veteran SE	Veteran Lower 95% CI	Veteran Upper 95% CI
1981	90.9253	0.1895	90.25572	91.59488	91.4488	0.1895	90.85864	92.03896
1982	90.8475	0.189	90.25832	91.43668	91.371	0.189	90.78182	91.96018
1983	90.6113	0.2837	89.83651	91.38609	91.1348	0.2837	90.36001	91.90959
1984	90.74532	0.1734	90.18672	91.30392	91.26882	0.1734	90.71022	91.82742
1985	90.75639	0.242	90.06333	91.44945	91.27989	0.242	90.58683	91.97295
1986	89.6385	0.337	88.75924	90.51776	90.162	0.337	89.28274	91.04126
1987	89.4076	0.3317	88.53873	90.27647	89.9311	0.3317	89.06223	90.79997
1988	89.3011	0.1492	88.78993	89.81227	89.8246	0.1492	89.31343	90.33577
1989	90.0224	0.1392	89.53083	90.51397	90.5459	0.1392	90.05433	91.03747
1990	89.9465	0.1551	89.42377	90.46923	90.47	0.1551	89.94727	90.99273
1991	89.3731	0.1613	88.83822	89.90798	89.8966	0.1613	89.36172	90.43148
1992	90.4865	0.1236	90.02551	90.94749	91.01	0.1236	90.54901	91.47099
1993	90.1847	0.1406	89.69039	90.67901	90.7082	0.1406	90.21389	91.20251
1994	90.6786	0.1536	90.15881	91.19839	91.2021	0.1536	90.68231	91.72189
1995	90.6514	0.1292	90.17943	91.12337	91.1749	0.1292	90.70293	91.64687
1996	90.2013	0.1217	89.74403	90.65857	90.7248	0.1217	90.26753	91.18207
1997	90.4168	0.1146	89.97345	90.86015	90.9403	0.1146	90.49695	91.38365
1998	91.0679	0.1827	90.49107	91.64473	91.5914	0.1827	91.01457	92.16823
1999	90.1615	0.1339	89.68032	90.64268	90.685	0.1339	90.20382	91.16618
2000	89.9799	0.1214	89.52322	90.43658	90.5034	0.1214	90.04672	90.96008
2001	90.3448	0.1183	89.8942	90.7954	90.8683	0.1183	90.4177	91.3189
2002	90.5251	0.1122	90.08645	90.96375	91.0486	0.1122	90.60995	91.48725
2003	91.2229	0.1296	90.75015	91.69565	91.7464	0.1296	91.27365	92.21915

Year	Estimated New Tag	New Tag SE	New Tag Lower 95% CI	New Tag Upper 95% CI	Estimated Veteran Nester	Veteran SE	Veteran Lower 95% CI	Veteran Upper 95% CI
2004	89.963	0.108	89.53258	90.39342	90.4865	0.108	90.05608	90.91692
2005	90.0706	0.1174	89.62176	90.51944	90.5941	0.1174	90.14526	91.04294
2006	90.2549	0.1154	89.80998	90.69982	90.7784	0.1154	90.33348	91.22332
2007	90.74062	0.115	90.29648	91.18476	91.26412	0.115	90.81998	91.70826
2008	91.2036	0.1127	90.76397	91.64323	91.7271	0.1127	91.28747	92.16673
2009	91.0038	0.1269	90.53634	91.47126	91.5273	0.1269	91.05984	91.99476
2010	90.7972	0.1116	90.57846	91.01594	91.3207	0.1116	91.10196	91.53944

Estimating Clutch Frequency using MSORD Models

In addition to the other demographic indicators estimated in this study, clutch frequency, or the number of nests laid in a season, is an important demographic indicator used in population models. Clutch frequency is used to estimate nester abundance from the total number of nests when only nests are monitored, egg production and cohort strength (Bjorndal et al. 2010). Clutch frequency could be influenced by age structure of females or environmental conditions (Miller 1997).

In intensively monitored sea turtle populations, clutch frequency can be measured directly through re-sights of females within a nesting season, but the estimate will almost always be biased low due to missed nesting events. The MSORD model also calculates a derived parameter, residence time, the average number of secondary survey periods that an individual spent in the study area during a primary period. This parameter could give an indication of clutch frequency. Residence time was modeled as a function of the time since arrival to the nesting beach (e.g., the probability a female lays a clutch is dependent on the number of clutches already laid), and as our data set only contains breeding females on the nesting beach, allowed for derivation of clutch frequency from the model output (Kendall 2013).

Clutch frequency from MSORD displayed wide temporal fluctuations (Fig. S1). The top-ranked model included temporal effects on φ and p_{ent}, the parameters used to derive clutch frequency. The estimates of clutch frequency ranged from 1.05 (0.0368 – 1.1325 95% CI) to 4.96 (-30.7 – 40.6 95% CI). However, we found a strong relationship between the estimated clutch frequency and the number of secondary sampling periods (Fig. S2). A low number of secondary sampling periods biased the estimates of clutch frequency low. If the number of secondary survey periods is restricted to ≥ 5, then the estimate of clutch frequency ranged from 1.39 (1.18 – 1.60 95% CI) to 4.96 (-30.7 – 40.6 95% CI). In all, these estimates are still greater than previously published and show a wide range of variability across years (Table 1). Based on these results, it is important to carefully consider the length of the survey season when setting up a survey with the goal of estimating clutch frequency.

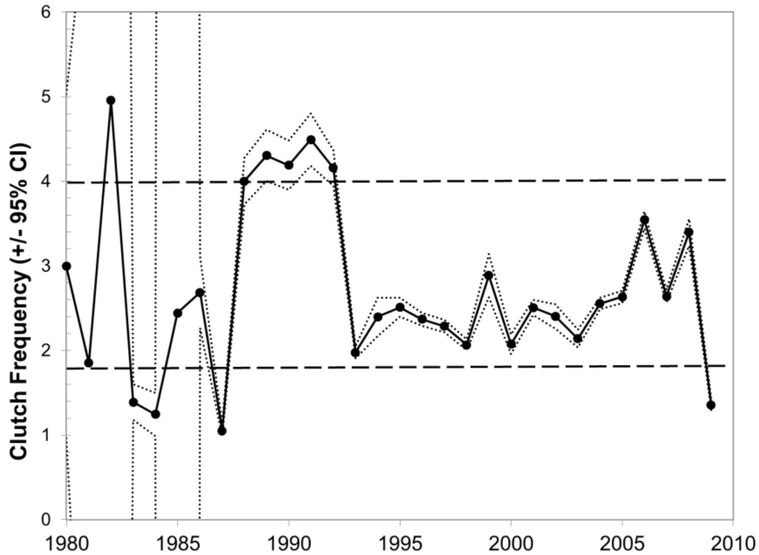

Figure S1. Annual estimates of clutch frequency (nests/year) with 95% confidence intervals based on multistate open robust design models (MSORD) from 1980-2009. Dashed lines refer to published estimates of clutch frequency.

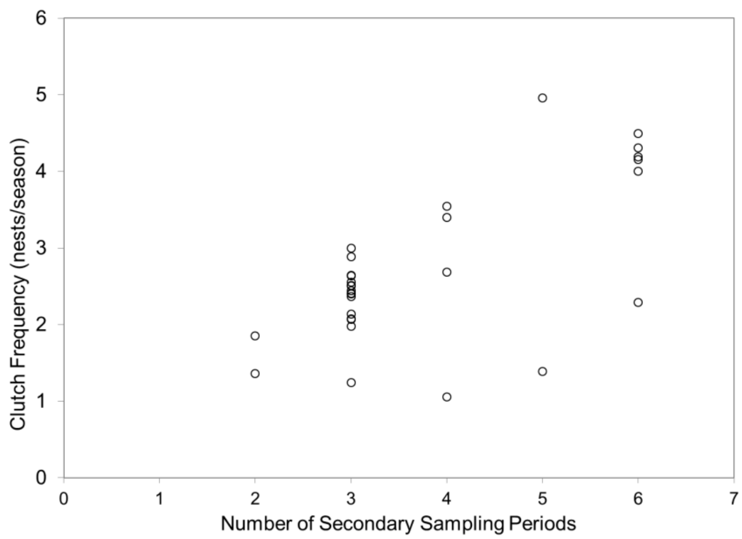

Figure S2. Estimates of clutch frequency as a function of the number of secondary survey periods.

LITERATURE CITED

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