Supplementary Information

Coral reef fish populations can persist without immigration

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Expanded methods

(c continued) Demographic parameters *Mortality measurement (biannual).* Probability of identity, as well as probability of identity between siblings, were still small when removing the two loci with the highest exclusion probability (1.9 x 10-9 and 9.1 x 10-9, respectively). Individual matches that fell in this category were accepted if other available data such as size, site, and anemone number corresponded to expectations between years (same size or increment, same or close anemone).

Reproductive success to self-recruitment, reproductive success to local connectivity, and immigration measurements (biannual). We used an introduced error rate (to account for genotyping errors) of 0.0001 to simulate the distribution of LOD scores for true and false parents. Based on these simulations, and because the presence of full/half-sibs is a potential source error, we excluded

all single-parent assignment with LOD score < 6 and accepted parent-pair with LOD scores > 11. We also excluded all offspring/parent-pair couple if the parents were not in the same or a nearby anemone.

(f continued) Sensitivity analysis

We independently varied each parameter by 30% and plotted the resulting trajectory of population size through time. Firstly, the mortality rates (which have an negative effect on the population dynamics) were reduced by 30% whereas parameters of carrying-capacity and self-recruitment (which have positive effect on the population dynamics) were increased by 30%. Then, the mortality rates were increased by 30% and the carrying-capacity and self-recruitment were decreased by 30% in order to test the modification of each parameter in both directions. The population abundance trajectories for each of these cases were compared to the trajectory computed with the rates estimated from the parentage analysis.

Expanded results

(a continued) Population demography

Mortality measurements (biannual). We excluded two cases of survival assignments (i.e. similar genotypes with 3 mismatches on 44 alleles from fins-clipped in two consecutive periods) because fins came from females which were sampled in different subpopulations separated by more than 350m. We retained five survival assignments of fins coming from individuals that were not sampled in the same anemone than the previous period of sampling. Among these five cases, 4 individuals were non-breeders, the fish sizes were increased between the consecutive years of sampling, the subpopulation were the same and the anemone hosts where individuals were found for the second time were close to the anemone at the first capture (distance < 100m).

Recruitment measurements (biannual). Within the 578 new-recruits assigned to parents, we retained only 2 cases of ‘extra-pair’ and 15 cases were excluded because (1) the distance between the

anemone of mother and anemone of father was in average higher than 220m and (2) the number of mismatch was superior to 2 loci (Table S5).

(b continued) Modeling population dynamics

Reproductive success to self-recruitment was the most influential parameter for the persistence of subpopulation A and E (Fig. S6A, Subpopulations A and E, green curve). Subpopulations A and E are always persistent (Fig S6B), irrespective of whether mortality rates, reproductive success to self-recruitment and carrying capacity are modified 30%. For subpopulations B and G the carrying-capacity for juveniles was the most influential parameter for their persistence (Fig. S6A, subpopulations B and G red curve). The subpopulation B was not persistent in the case where the carrying-capacity was decreased by 30% (Fig S6B). Subpopulation G became persistent when mortality rates where decreased by 30% or when the carrying capacity was increased by 30% (Fig S6A).

Table S1. Number of new-recruits and subadults (i.e. juveniles), males and female per subpopulations according to the year of sampling. We have taken into account only anemone that were present for the 5 periods of sampling. In 2005, subadults were not counted or fin-clipped (indicated by "?" in the table).

	2005				**2007**				**2009**				**2011**				**2013**			
	NR	**SA**	**M**	**F**	**NR**	**SA**	**M**	**F**	**NR**	**SA**	**M**	**F**	**NR**	**SA**	**M**	**F**	**NR**	**SA**	**M**	**F**
A	68	?	57	57	69	75	56	57	104	30	55	56	69	39	55	57	68	45	56	57
B	38	?	21	21	13	31	21	21	18	27	21	21	28	15	21	21	18	27	21	21
C	27	?	18	19	10	22	19	19	13	13	16	17	6	14	17	17	11	17	17	17
D	29	?	20	20	10	28	20	20	20	20	20	20	12	22	20	20	15	18	20	20
E	64	?	56	56	32	87	56	56	66	47	55	55	46	52	56	56	48	47	55	55
F	2	?	6	7	8	5	7	7	7	2	7	7	6	1	5	7	6	1	6	7
G	21	?	29	29	19	34	30	30	31	16	28	29	32	14	29	29	33	14	28	28

Table S2. List of 22 microsatellites used.

Primer Name	Dye	Access Genbank	References
70	6-FAM	KM106225.1	Bonin et al. 2015[1]
CF11	PET	KM106238.1	
CF27	PET	KM106228.1	
CF3	PET	KM106226.1	
CF9	NED	KM106227.1	
perc06	VIC	KM106216.1	
perc07	PET	KM106217.1	
perc14	PET	KM106218.1	
perc16	NED	KM106219.1	
perc17	NED	KM106220.1	
perc21	6-FAM	KM106221.1	
perc38	VIC	KM106222.1	
perc41	6-FAM	KM106223.1	
perc42	PET	KM106224.1	
CF12	VIC	EF375494.1	Buston et al. 2007[2]
CF29	6-FAM	EF375496.1	
CF36	6-FAM	KM106229.1	
CF39	VIC	EF375497.1	
CF42	VIC	EF375498.1	
44	6-FAM	AY523937	Quenouille et al. 2004[3]
79	NED	AY523933.1	
120	VIC	AY523935.1	

[1] Bonin MC, *et al.* (2015) Characterisation and cross-amplification of microsatellite markers in four species of anemonefish (*Pomacentridae*, *Amphiprion spp.*). *Mar. Biodivers.* DOI 10.1007/S12526-015-0336-6.

[2] Buston PM, Bogdanowicz SM, Wong A, & Harrison RG (2007) Are clownfish groups composed of close relatives? An analysis of microsatellite DNA variation in *Amphiprion percula*. *Mol. Ecol.* 16(17):3671-3678.

[3] Quenouille B, Bouchenak-Khelladi Y, Hervet C, & Planes S (2004) Eleven microsatellite loci for the saddleback clownfish *Amphiprion polymnus*. *Mol. Ecol. Notes* 4(2):291-293.

Table S3. Per capita biannual mortality rates of juveniles (J), and adult males (M) and females (F) for 2009-2011 and 2011-2013.

	Subpopulations						
Parameters	A	B	C	D	E	F	G
	2009-2011						
d_J^i	0.233	0.407	0.385	0.500	0.128	0.000	0.688
d_M^i	0.218	0.143	0.375	0.550	0.218	0.571	0.536
d_F^i	0.268	0.143	0.353	0.350	0.255	0.429	0.586
	2011-2013						
d_J^i	0.359	0.133	0.154	0.455	0.231	1.000	0.286
d_M^i	0.527	0.048	0.412	0.250	0.179	0.000	0.345
d_F^i	0.526	0.238	0.412	0.350	0.232	0.286	0.517

Table S4. Measurements of average biannual reproductive success to self-recruitment (grey cells) and reproductive success to local connectivity observed during the five periods of sampling (2005, '07, '09, '11 and 13). Last column shows the average biannual number of immigrants (θ^i, not assigned to any of the subpopulations of Kimbe Island) observed during the five periods of sampling. *n* corresponds to the maximal number of breeding-pair per subpopulations.

Destination	A *n*=57	B *n*=21	C *n*=19	D *n*=20	E *n*=56	F *n*=7	G *n*=30	θ^i
A	0.449	0.267	0.084	0.070	0.150	0.114	0.073	28.6
B	0.077	0.057	0.032	0.010	0.043	0.057	0.067	12.0
C	0.039	0.048	0.074	0.020	0.011	0.000	0.053	6.2
D	0.032	0.019	0.032	0.060	0.018	0.029	0.060	10.6
E	0.144	0.114	0.074	0.110	0.207	0.229	0.067	23.0
F	0.010	0.009	0.010	0.020	0.014	0.086	0.013	2.6
G	0.063	0.029	0.053	0.050	0.061	0.000	0.093	14.4

Table S5. List of 'extra-pair' mating retained and excluded according to location of parental anemones, year of sampling of parents, LOD SCORE, and number (NB) of mismatches between loci. The offspring name contains the year of sampling, subpopulations and our anemone number.

Offspring name	Parent 1 location	Parent 2 location	Sampling year of parent 1	Sampling year of parent 2	Distance parents anemones (m)	LOD SCORE	NB Mismatches	Exclusion
07A333NR1	A8	A269	2007-2009	2007	133.8	48.24	0	NO
11G277NR1	C174	C176	2009	2009	13.23	31,7	2	NO
07G542NR1	D50	E243	2005-2007-2009-2011-2013	2005-2007-2009	551.82	47,16	4	YES
09A10NR2	A212	A334	2009-2007-2009-2011-2013	2005-2007-2009-2011	150.67	41,12	2	YES
09A327NR1	b523	A263	2009-2011	2007-2009	217.19	40,55	5	YES
09E228NR1	A212	E554	2003-2005-200-2009-2011	2005-2009	466.35	38,72	3	YES
11A320NR2	F575	E138	2011-2013	2007-2009-2011-2013	285	27,18	5	YES
11A218NR1	A268	F535	2011-2013	2005-2007-2009-2011-2013	370.87	23,62	4	YES
11A266NR1	A265	C164	2005-2007-2009-2011-2013	2009-2011-2013	540	21,2	3	YES
11A319NR1	E129	E138	2009-2011-2013	2007-2009-2011-2013	25.82	25,91	5	YES
11A320NR2	E138	F575	2007-2009-2011-2013	2011-2013	285	27,18	5	YES
11A335NR2	A269	E292	2009-2011-2013	2011-2013	268.34	34,67	4	YES
09E281NR1	B523	A261	2009-2011	2007-2009-2011-2013	275.32	42,05	3	YES
09G513NR1	E239	E525	2007-2009-2011	2005-2007-2009-2011-2013	184.08	41,48	4	YES
09G553NR1	B317	A306	2009	2005-2007-2009-2011	354.37	32,03	4	YES
05E294NR2	C73	A331	2005-2007-2011	2005	467.76	48,12	4	YES
11E124NR2	E146	E223	2007-2009-2011-2013	2005-2007-2009-2011-2013	88.33	23.41	3	YES

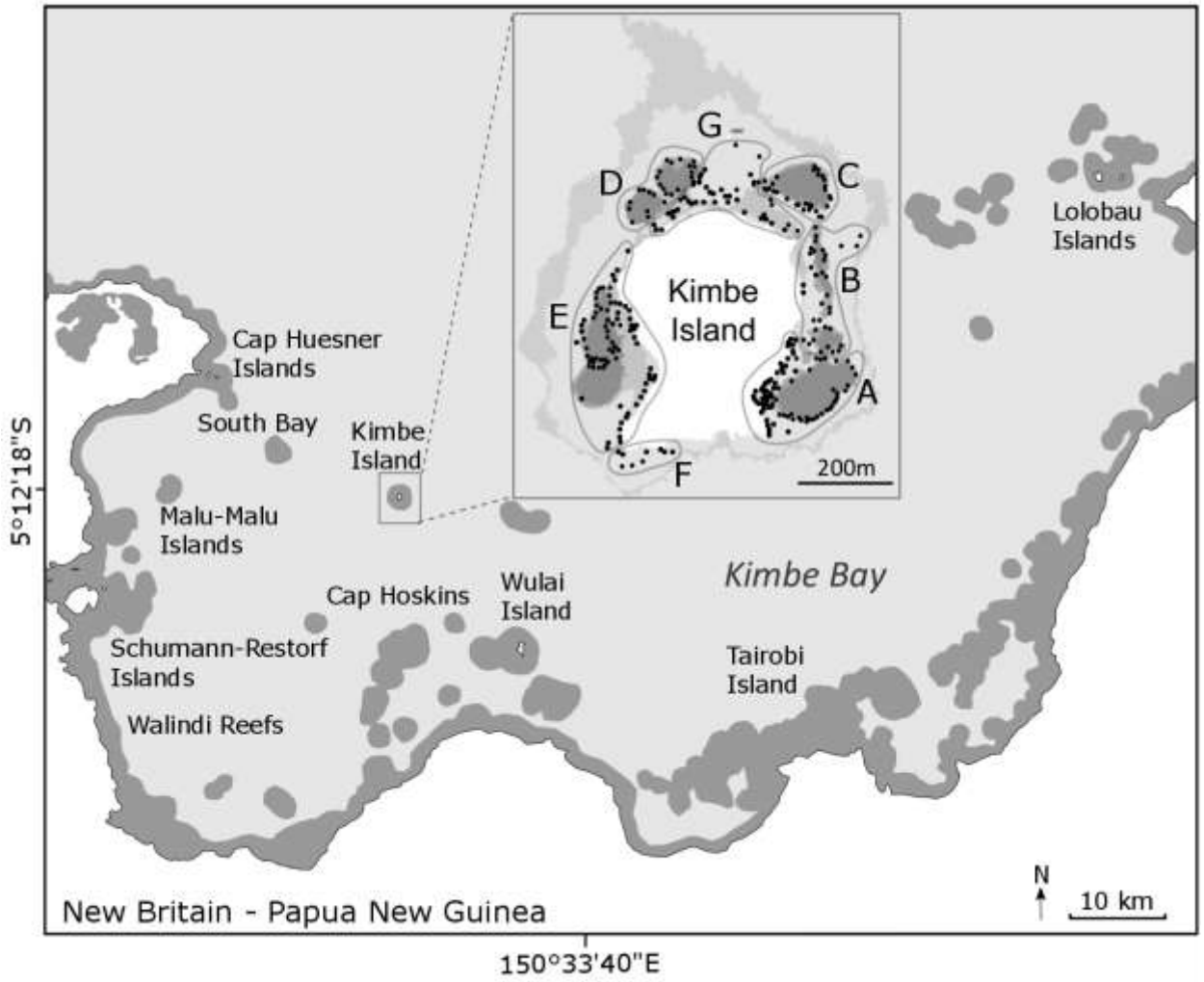

Fig. S1. Map showing the location of Kimbe Island in New Britain, Papua New Guinea and of the reefs and clownfish sub-populations within Kimbe Bay. The location of anemones within the inset Kimbe Bay map are shown as black dots and the boundaries of each of the seven sub-populations are shown with light grey polygons.

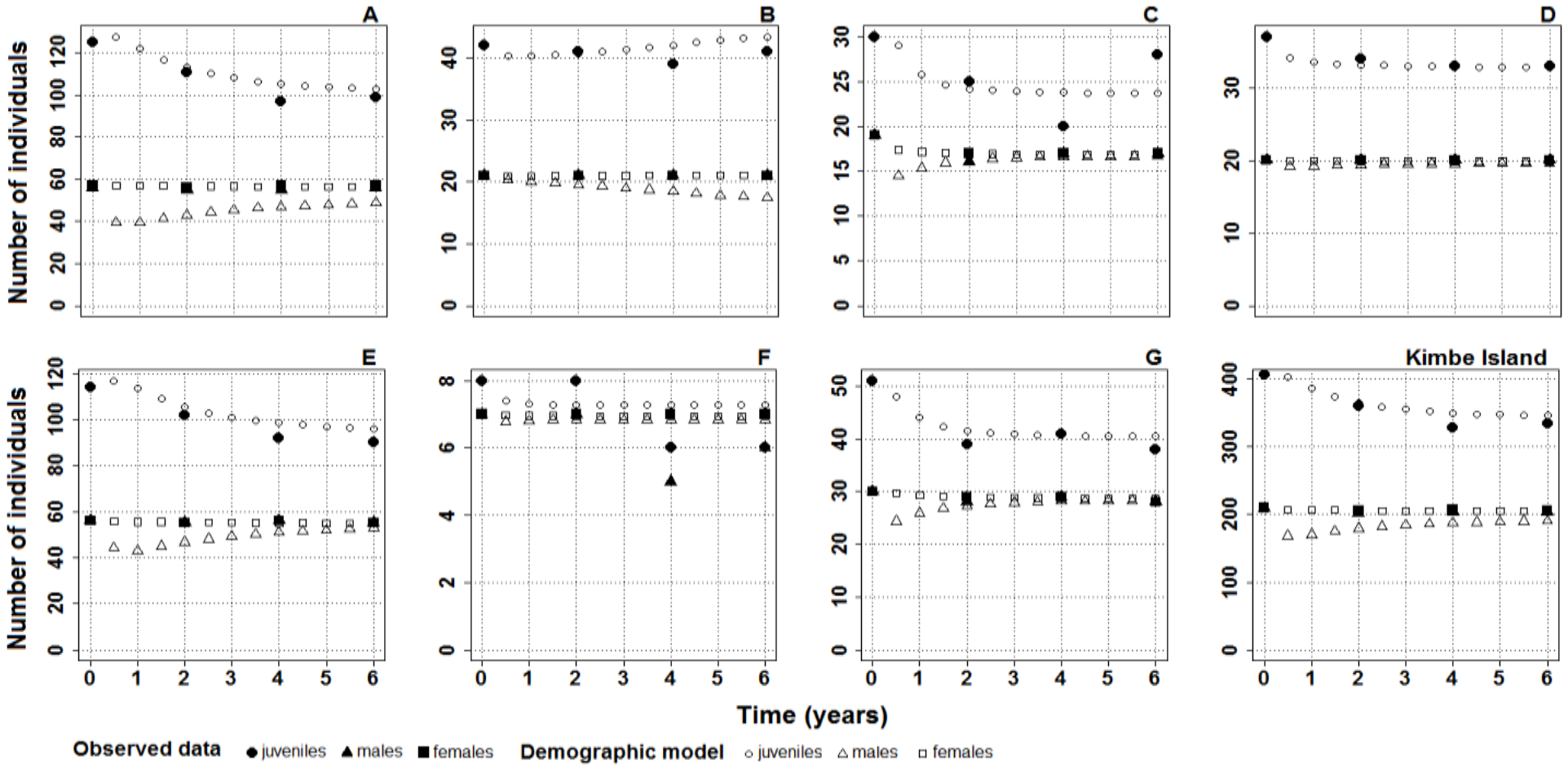

Fig. S2. Values observed in the natural population versus values predicted by the demographic model using the method of least-squares for each of the life stages of each subpopulation and for Kimbe Island. The model was initialized with data of total captures (each life stage) during 2007 (set as time[year] =0) so the subsequent years (1-6 on the x-axis) refer to 2008-2013. The resolution of the model is equal to a month and the results are displayed bi-annually.

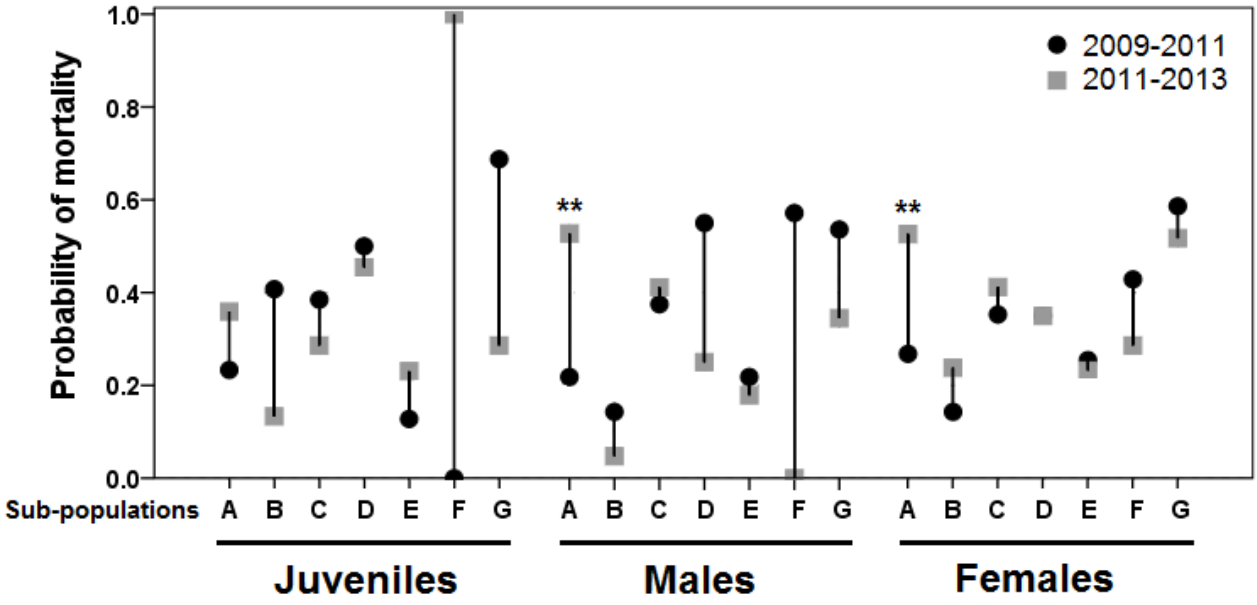

Fig. S3. Mortality rates of juveniles and adult males and females among the 7 subpopulations (A to G) during the two periods 2009-2011 and 2011-2013 (see Table S1 for data values). ** indicates a difference that is statistically significant ($p<0.05$; $p=0.002$ for males and 0.007 for females) according to a Fisher Test (all others are not significant; $p>0.05$). Average mortality rates for the two 2-year periods are used in the demography model (see Table 1).

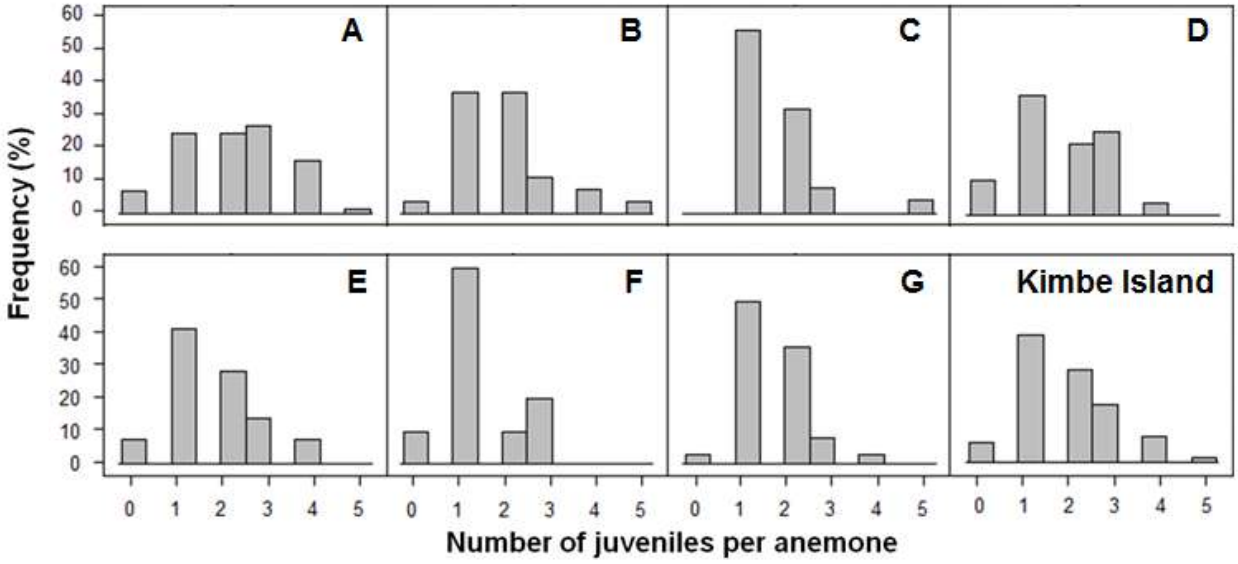

Fig. S4. Distribution of the maximum average number of juveniles per anemone between 2007 and 2013 in each subpopulation (i.e., lagoon) of Kimbe Island.

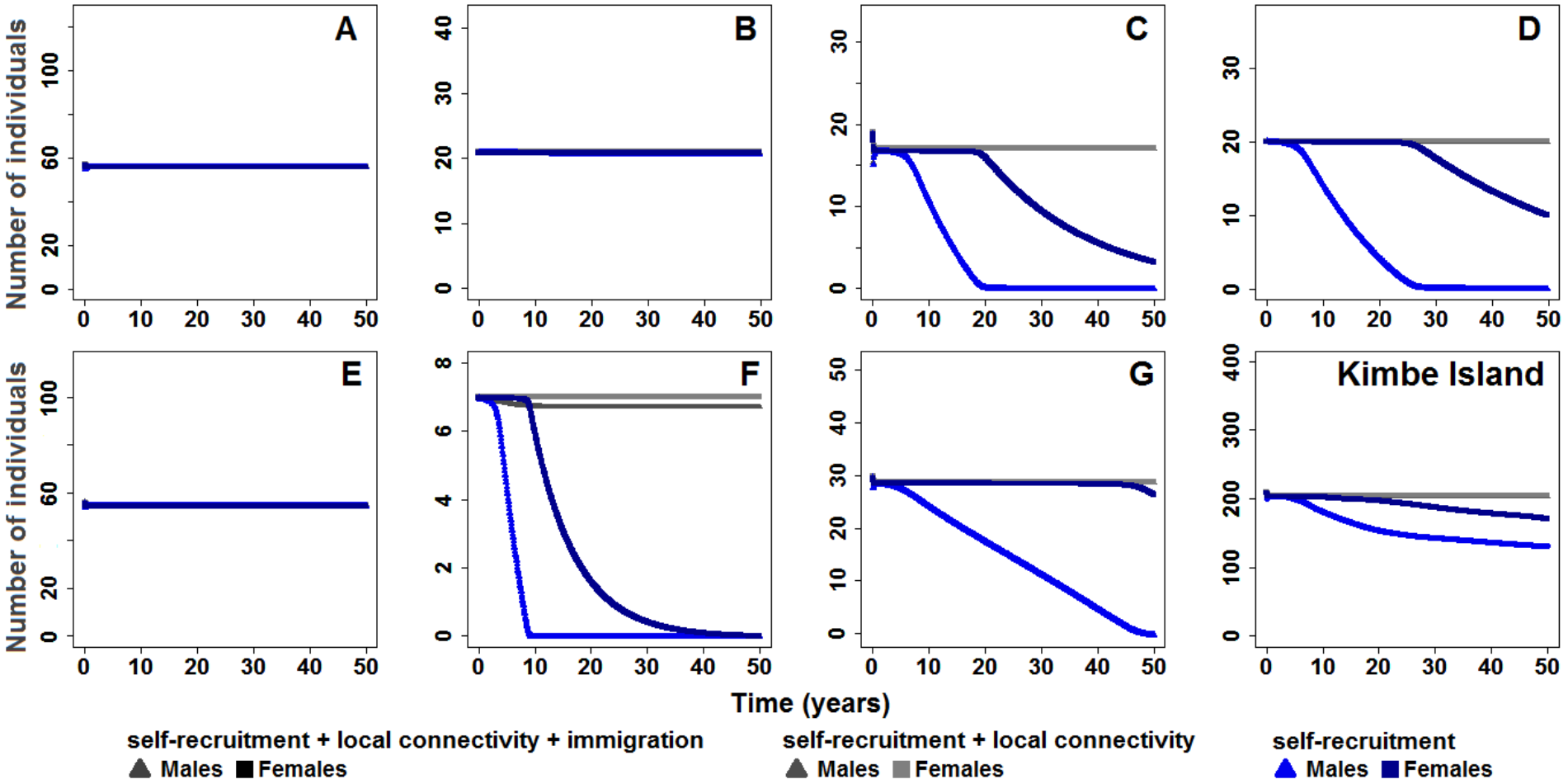

Fig. S5. Demographic model projections of numbers of male and female *Amphiprion percula* within each of the subpopulations (A to G) and within Kimbe Island (sub-populations A-G combined) for three different recruitment and immigration scenarios. The model was initialized with data of total juvenile captures during 2007 (set as time[year] =0); the model temporal resolution is one month and the results are plotted here bi-annually for 50 years. Self-recruitment and local connectivity refer to reproductive success to self-recruitment and reproductive success to local connectivity, respectively in the demographic model.

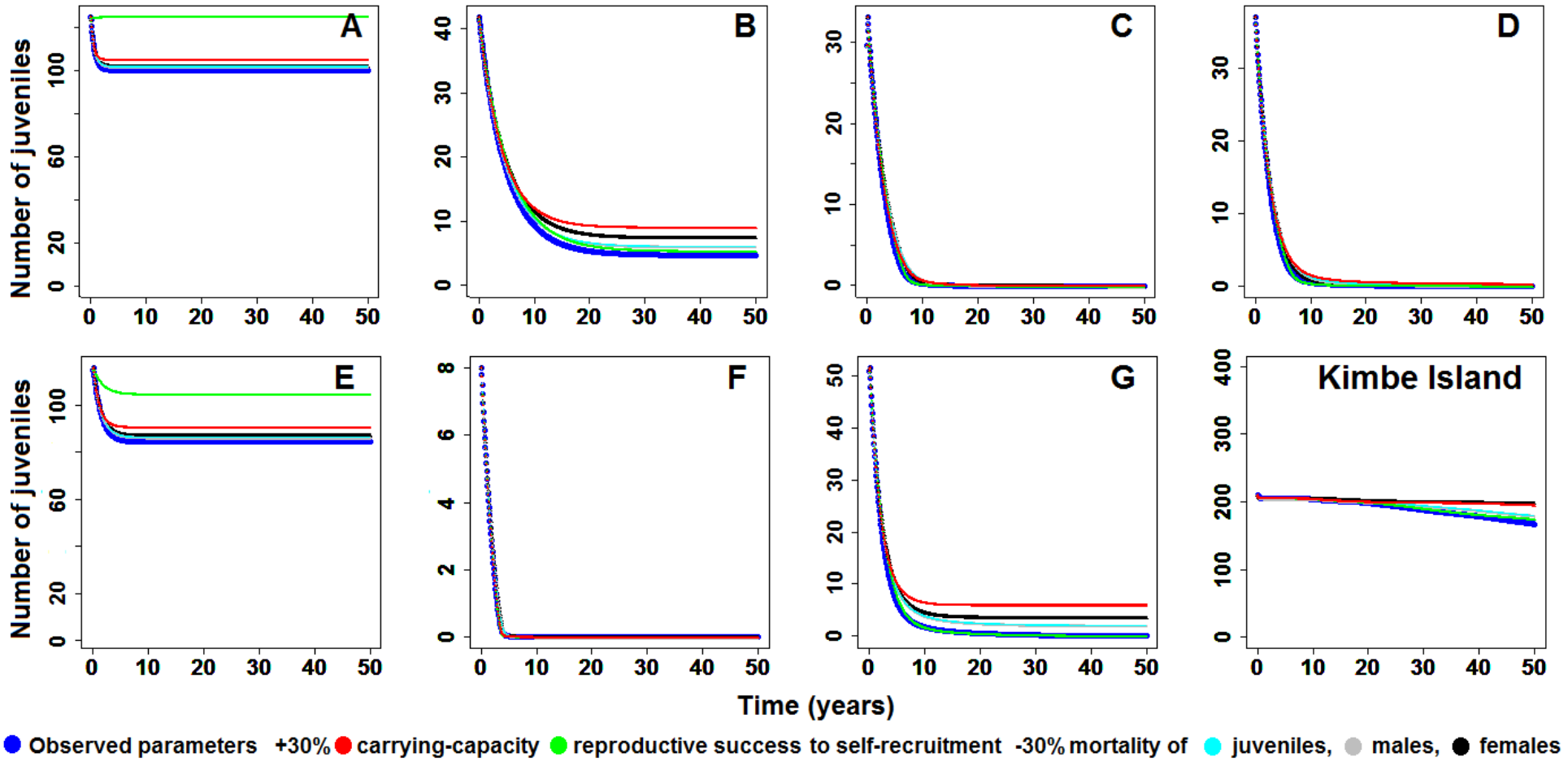

Fig. S6A. Simulated curves for the sensitivity analysis of the demographic model with inputs based only on self-recruitment (scenario in blue in Figure 3) with increases of 30% for carrying-capacity and self-recruitment and decreases of 30% for the mortality at each life stage.

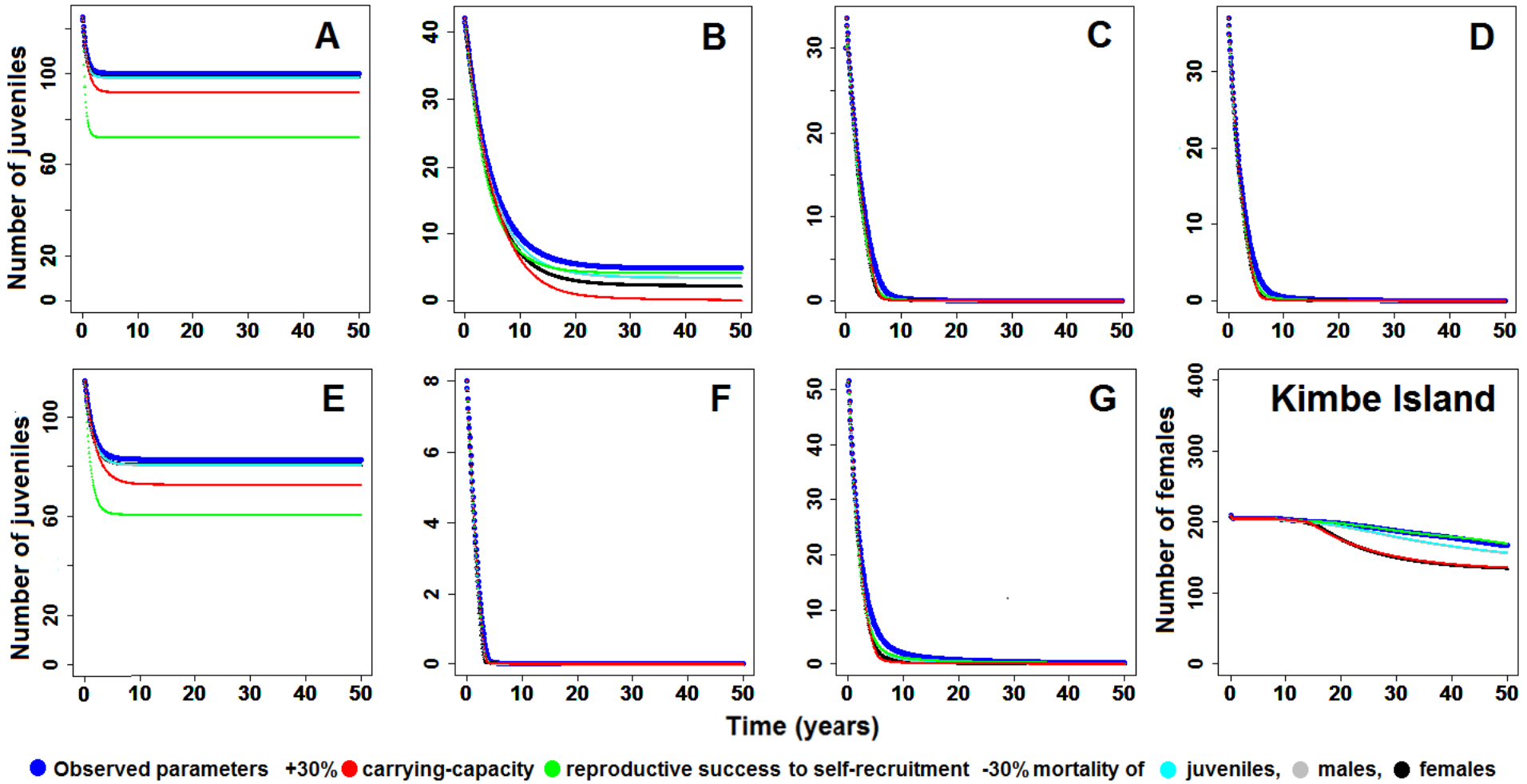

Fig. S6B. Simulated curves for the sensitivity analysis of the demographic model with inputs based only on self-recruitment (scenario in blue in Figure 3) with decreases of 30% for carrying-capacity and self-recruitment and increases of 30% for the mortality at each life stage.