Appendix D. Evaluation of bias and precision of parameters estimated with time-dependent temporary emigration models.

To generalize our results on the performance of the TE model we analyzed a typical data set with high survival (S = 0.7), high on-site recapture probability (p = 0.8) and clearly non-random temporary emigration (ψ^{OU} = 0.5, ψ^{UO} = 0.2) with all time-dependent models that are intrinsically identifiable. Data analysis with a more general model than the data-generating model is a valid approach for studying the performance of the more general model (Burnham et al. 1987), provided that the data-generating model is nested within the more general model and identifiable. This was true in our case. The bias in all parameters and models and was near zero (Table 1). Coefficients of variation (CV) of parameters tended to be more or less the same when either none, only one parameter type, or only survival and on-site recapture was time-dependent. When transitions and on-site recapture were all time-dependent, CVs of these parameters were about doubled. We concluded that time-dependent models (provided they were identifiable) also performed well.

TABLE 1. Approximate absolute bias and CV of the parameter estimates under different models. The expected capture histories were produced under model $\{S_{.}, \psi_{.}^{OU}, \psi_{.}^{UO}, p_{.}\}$ using the parameter values S = 0.7, ψ^{OU} = 0.5, ψ^{UO} = 0.2, p = 0.8 with 8 capture occasions and 500 new releases at each occasion. When parameters were time-dependent, the bias and the CV (in %) were averaged. Parameters that were not separately estimable (see appendix 3) were not included for calculating these averages.

	S		ψ^{OU}		ψ^{UO}		p	
Model	Bias	CV	Bias	CV	Bias	CV	Bias	CV
$S_{.}, \psi_{.}^{OU}, \psi_{.}^{UO}, p_{.}$	-0.0000003	4.48	-0.0000001	14.64	0.0000003	20.17	0.0000003	17.58
$S_{t}, \psi_{.}^{OU}, \psi_{.}^{UO}, p_{.}$	0.0000007	6.47	-0.0000030	14.77	-0.0000008	20.27	-0.0000050	17.69
$S_{.}, \psi_{t}^{OU}, \psi_{t}^{UO}, p_{.}$	-0.0000020	4.76	0.0000050	16.05	0.0000020	26.37	0.0000100	17.97
$S_{.}, \psi_{.}^{OU}, \psi_{.}^{UO}, p_{t}$	0.0000002	4.51	-0.0000001	14.69	-0.0000003	20.20	-0.0000002	18.30
$S_{t}, \psi_{.}^{OU}, \psi_{.}^{UO}, p_{t}$	0.0000010	7.48	-0.0000040	14.90	-0.0000010	20.31	-0.0000070	18.81
$S_{.}, \psi_{t}^{OU}, \psi_{t}^{UO}, p_{t}$	0.0000010	5.00	-0.0000020	31.27	-0.0000030	46.61	-0.0000050	32.41

Literature cited

Burnham, K. P., D. R. Anderson, G. C. White, C. Brownie, and K. P. Pollock. 1987. Design and analysis methods for fish survival experiments based on release-recapture. American Fisheries Society Monograph **5**. Bethesda, Maryland, USA.