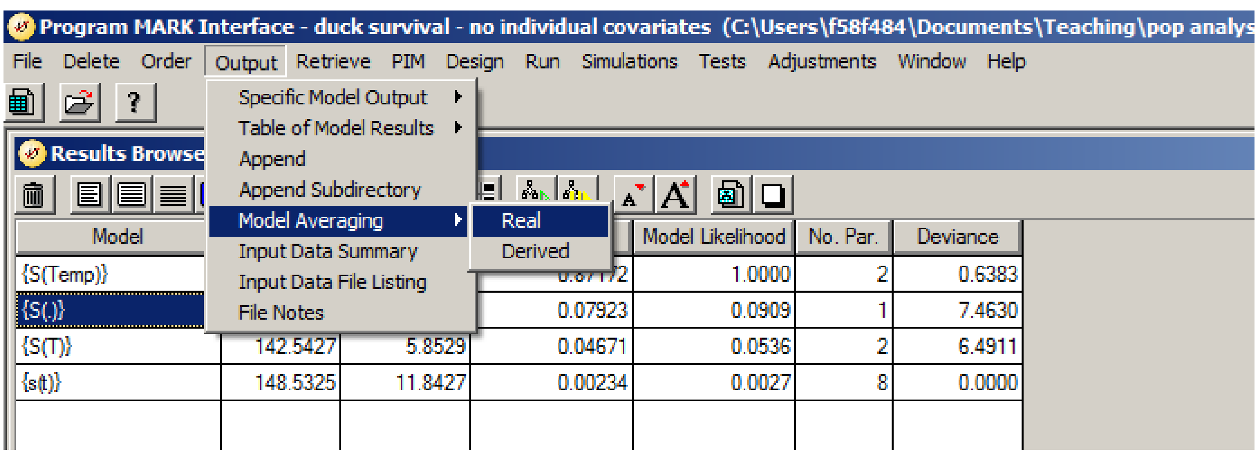
Model Averaging

Quoting from Cooch & White (Chapter 4), "… 'model selection should be considered as the process of making inference from a set of models, not just a search for a single best model'. As such, whenever possible, use model averaging. Not only does this account for model selection uncertainty regarding estimated parameters and weight of evidence for each approximating model …"

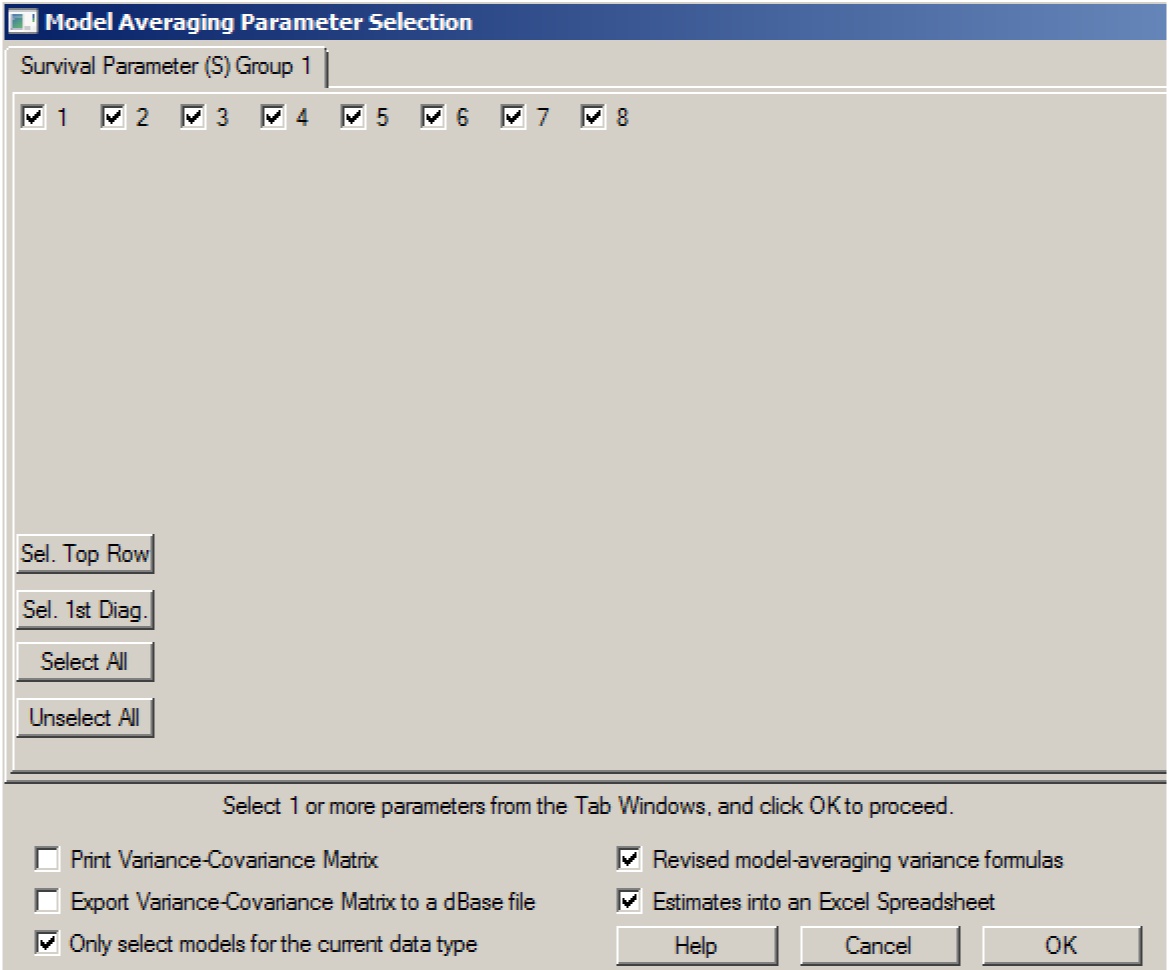
For now, we'll focus on the estimates of weekly survival for black ducks from 4 competing models from Lab 1. Each model provides slightly different estimates of weekly survival. And, each model receives a different amount of support from the data.

Model	AICc	Delta AICc	AICc Weight	Model Likelihood	No. Par.	Deviance
{S(Temp)}	136.6898	0.0000	0.87172	1.0000	2	0.6383
{S(.)}	141.4861	4.7963	0.07923	0.0909	1	7.4630
{S(T)}	142.5427	5.8529	0.04671	0.0536	2	6.4911
{s(t)}	148.5325	11.8427	0.00234	0.0027	8	0.0000

Program MARK has good tools for model-averaging. For the real parameters (i.e., weekly survival estimates [rather than the beta's or the log-odds of S]), we can easily get model-averaged estimates back for this week's problem. (*It will get more complicated when individual covariates are in play; more on that later*.)



Set the model-averaging parameter selection window up as below and click ‘OK’.



The Excel sheet provides the model-averaged estimates, which are as shown below.

	A	B	C	D	E
1	Parameter	Estimate	SE	LCI	UCI
2	Survival Parameter (S)	0.969698	0.018008	0.905898	0.990687
3	Survival Parameter (S)	0.954539	0.016022	0.910576	0.977425
4	Survival Parameter (S)	0.943684	0.015169	0.905456	0.967017
5	Survival Parameter (S)	0.867199	0.048356	0.741434	0.936991
6	Survival Parameter (S)	0.912869	0.021126	0.861594	0.946331
7	Survival Parameter (S)	0.891892	0.031402	0.813345	0.93983
8	Survival Parameter (S)	0.961316	0.020635	0.893336	0.986619
9	Survival Parameter (S)	0.952571	0.020704	0.89107	0.980124
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But, we want to look at the mechanics of how the model-averaged point estimates were obtained from the model-selection table and the model-specific weekly estimates.

Estimates for week 1

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                      duck survival - no individual covariates
                      Estimates only for data type Known Fate

                     Survival Parameter (S) Group 1 Parameter 1
Model                                    Weight   Estimate       Standard Error
---------------------------------------- -------  -------------- --------------
{S(Temp)}                                0.87172  0.9740110      0.0130349
{S(.)}                                   0.07923  0.9330986      0.0148259
{S(T)}                                   0.04671  0.9508169      0.0199414
{s(t)}                                   0.00234  0.9791667      0.0206152
---------------------------------------- -------  -------------- --------------
Weighted Average                                  0.9696982      0.0135171
Unconditional SE                                                 0.0180084
95% CI for Wgt. Ave. Est. (logit trans.) is 0.9058982 to 0.9906872
Percent of Variation Attributable to Model Variation is 43.66%
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The table provided by Program MARK orders the estimates by model weight (which correspond with what's in the model-selection table). The weights for all models sum to 1.0. Thus, we can simply (1) multiply each model's survival estimate by the corresponding AICc weight for the model and (2) sum the resulting values across all models. That is,

$$\text{avg}(\hat{\theta}) = \hat{\bar{\theta}} = \sum_{i=1}^{R} w_i \hat{\theta}_i$$

For week 1, 0.9696982 = 0.872*0.974 + 0.079*0.933 + 0.047*0.951 + 0.002*0.979

This procedure is repeated for each of the weeks. With this procedure, you don't have to make arbitrary decisions about which models to consider; all are allowed to influence the model-averaged estimate in accordance with the amount of support they received.

The uncertainty in the model-averaged estimate is influenced by model-selection uncertainty, variation in the model-specific estimates, and the SEs associated with each model's estimate. If different well-supported models produce different estimates from one another, then the uncertainty on the model-averaged estimate will be larger than if all the well-supported models provide very similar estimates. You can find details about how the unconditional SE is obtained in Cooch & White (Chapter 4).