ECASA - Model description template

1	Name of model	*Reporter/Institute (email address)*
1.a	***Shellfish production model***	Aline Gangnery / Ifremer email: Aline.Gangnery@ifremer.fr
1.b	*date this form was completed or updated*	5 September 2007

2	Short DESCRIPTION of model	
2.a	*Main state variables:*	Shellfish abundance as a function of their individual mass.
2.b	*Scale to which applicable:*	Shellfish population.
2.c	*General description.* *NB: if the model is complicated, or has easily distinguishable components (such as a physical and a biological sub-models) that can be, or have been, used separately, it may be easier to complete one form for each of the main components.*	This model was specifically developed to assess temporal variations in the standing stock and marketable production of oysters cultivated in the Thau lagoon. It is based on the coupling between an Individual Based Model and a DEB model (see also DEB template). The population is divided into cohorts and its dynamics is reproduced by simulating the growth trajectories of numerous individuals. Shellfish growth is simulated with the DEB model. Population dynamics also includes harvest and mortality rates. Standing stock is then obtained by summing up individual mass and the size distribution of individuals. Marketable production is estimated as the cumulative harvest of cohorts. Inter-individual variability of growth between individuals was also taken into account in the population model: variation between each cohort was simulated with a random parameter X_k (*i.e.* saturation coefficient, which is a parameter of the DEB model).
2.d	*Key semi-universal parameters and example values (which should apply at least regionally or for at least one type of water body); summarize any restrictions or reservations about these parameters*	Some of the parameters of the DEB model can be eventually considered as semi-universal in the way they are close for related species. The population model has no key semi-universal parameters.
2.e	*Main forcing data needed - initial values of state variables; boundary conditions; inputs; imposed environmental conditions; generalized loss terms. State whether single values or time-series needed.*	* Times series of water temperature and food concentration (*e.g.* chlorophyll a or particulate organic matter) are needed to simulate shellfish growth. A dataset of shellfish growth data is preferable to calibrate the individual growth model. * Observed mass distributions of the standing stock are required to make simulations with real initial conditions.

		* Knowledge of rearing strategies (seeding or recruitment / harvesting) used by farmers as well as an estimate of the mortality rate are also required.
2.f	*Restrictions to use of model*	There is no specific restriction but special attention should be given when determining the seeding interval to which the number of cohorts is related.

3	**possibly relevant INDICATORS and example EcoQOs**	
3.a	***D**river*	
3.b	***P**ressure*	
3.c	***S**tate*	
3.d	***I**mpact*	
3.e	***R**esponse*	Modification of shellfish standing stock and marketable production in response to environmental changes (*e.g*. eutrophication, warming of water).

4	**STATUS of model** *NB: refers to scientific theory and equation set; distinguish from implementation*	
4.a	*Origin(ator) of model concept and initial formulation:*	Conceptual background of IBM and DEB models can be found in DeAngelis and Gross (1992) and Kooijman (2000), respectively.
4.b	*Present status of model, including scientific basis of claimed robustness and key matters still needing study:*	The model is not validated because of a lack knowledge concerning the numbers of shellfish seeded in the system per unit of time.
4.c	*Present use:*	Assessment of shellfish marketable production and its sensitivity to environmental conditions.
4.d	*Potential use and development in ECASA :*	Estimating potential impact of environmental modifications on aquaculture (shellfish populations).

5	**IMPLEMENTATION of model**	
5.a	*State of implementation :* *(This refers to realization of model theory in numerical algorithms, spreadsheets, computer programs, etc. to provide solutions of the model equations when supplied with appropriate forcing data.*	Equations and parameters are listed in Bacher and Gangnery (2006). Model algorithms are programmed in Matlab 7.0.1.
5.b	*State of documentation (which describes how to use an implementation as well as giving model theory)*	Equations, parameters and theoretical background can be found in Bacher and Gangnery (2006).
5.c	*Intellectual property concerns - if none stated here,*	IFREMER is the owner of the code coupling DEB and IBM. Any use requires the written consent of

	model and implementation will be deemed to freely available on request	IFREMER.

6.	**TESTING of model**	
6.a	*Summary of conditions and measurements needed:* *Refer back to 2.e if necessary. Highlight observations needed for model testing.*	Measurements needed concern: environmental data (water temperature, available food), shellfish growth data, distributions of the shellfish standing stock, estimate of the shellfish mortality rate, knowledge of rearing strategies.
6.b	*Criteria for model rejection*	No specific rejection criteria were set.

7	**OTHER models**	
7.a	*Used explicitly or implicitly with this model*	See DEB template.
7.b	*Similar models (which might serve roughly the same purpose in relation to mariculture)*	No similar model to our knowledge.

8. REFERENCES cited *show in bold the most important paper describing the model*

Bacher, C., Gangnery, A. 2006. Use of dynamic energy budget and individual based models to simulate the dynamics of cultivated oyster population. J. Sea Res. 56, 140-155.

DeAngelis, D.L., Gross, L.J. 1992. Individual-based models and approaches in ecology: populations, communities and ecosystem. Chapman & Hall, New York.

Kooijman, S.A.L.M., 2000. Dynamic energy and mass budgets in biological systems, Cambridge University Press, Cambridge.