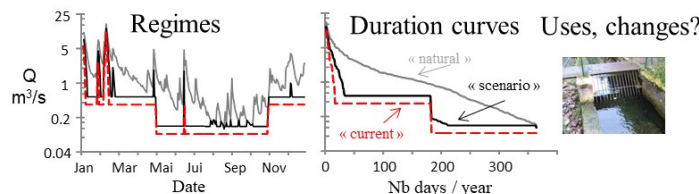# Basic concept

All hydraulic habitat models contribute to the definition of "e-flows" (environmental flows), seen as compromises between water uses and the ecological status of rivers. The use of habitat models fits into a global approach that takes into account the hydrological, environmental, biological and socio-economic context. The implementation and interpretation of habitat models is not immediate and requires expertise. The place of habitat models in the global approach is described for example in the following documents, whose reading is recommended for proper interpretation:

'*Lamouroux N., Hauer C., Stewardson M.J., Poff N.L. (2017) Physical habitat modeling and ecohydrological tools. In Horne A., Webb A., Stewardson M.J., Richter B., Acreman M. (Eds). Water for the Environment. Elsevier, Amsterdam. p. 265-285.* https://dx.doi.org/10.1016/B978-0-12-803907-6.00013-9'

'*Lamouroux N., Augeard B., Baran P., Capra H., Le Coarer Y., Girard V., Gouraud V., Navarro L., Prost O., Sagnes P., Sauquet E., Tissot L. (2018) Débits écologiques : la place des modèles d'habitat da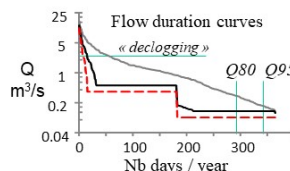ns une démarche intégrée. Hydroécologie Appliquée, 20, 1–26.* https://doi.org/10.1051/hydro/2016004'

Example of a consensual scenario-based approach, used in France for setting e-flows (from Lamouroux et al., 2018)

The general principle of hydraulic habitat models is to couple a hydraulic model that describes the hydraulic characteristics of microhabitats (flow velocity, water depth, etc.), with preference models for species and/or life stages and/or groups of species for these characteristics. Most often used at the scale of stream reaches, these habitat models make it possible to map habitat values ("Hab_Val" or "OSI", often standardized in the form of suitability scores varying between 0 and 1) that reflect the quality of the hydraulic habitat for the taxon considered. A variation of the reach-averaged habitat value or of a "weighted usable area" WUA (m2, "SPU" in French, product of the habitat value and the surface surface area) can then summarize the impact of a variation in flow on the quality of the hydraulic habitat.
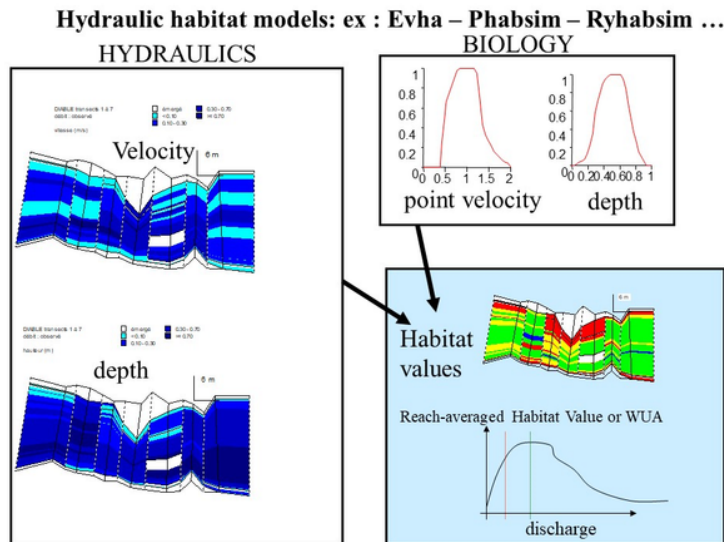
The principle of numerical, traditional habitat models : linking a hydrodynamic model with biological models of microhabitat selection

Most habitat models are numerical, as they are based on a numerical hydrodynamic model (nowadays often two-dimensional) which solves the mass and energy conservation equations within the reach. Numerical models require three-dimensional bed topography data and expert hydraulic calibration.