

The use of topographic numeric imaging tools and computerized video tracking systems to study the reproductive behavior in fish: towards a "field-lab" integrative approach

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In many fields centered on behavioral research, numeric imaging techniques now allow the conceptualization of tools and systems whose descriptive precision, quantification abilities open original and very promising prospects. By the computing power offered by these new techniques, ethologists have the possibility to quantify and take into account a large number of variables which usually cannot be measured by usual methods of direct observation. This parameterization then allows attempts of modeling and simulation of behavioral patterns of animals according to the environmental situations to which they are exposed. There are two principal options in numerical imagery. First, the digitization of analog images, a process allowing the detection and the recognition of characteristic objects compared to a image of reference without object. Second, the creation of digital images from databases, for instance topographic measurements.

In a first field approach (conducted while scuba diving), we exploited this second option, using computer tools (Surfer[®] 6 and GIS-Idrisi[®] 2 for Windows 95) to model the reproductive microhabitat in the nesting Mediterranean labrid fish *Symphodus ocellatus*. The software produces 3-D surface maps of sites. With this topographic numeric imaging, we can analyze the evolution of the spatial distribution of algae nests built by territorial males during the reproductive season. A high density of *Symphodus ocellatus* is found on a rocky substrate within 50 m of the shore. This area of 1247 m² (43 x 29 m) was chosen as study site. We measured depths (z) every meter along parallel transects (x, y co-ordinates) between -10 m and the surface with a diving computer (precision: 10 cm). These data allowed us to create detailed 3-D numerical images of the zone. The second step was to count and to locate nests daily and report them on the maps. The results show that the maximum nest density is found between 6 and 8 m depth and that this density varies in the horizontal plan according to the light exposition of substrate for nesting. A nest/day curve shows a rapid increase of nests number in the beginning of the season (May) and a slow decrease at the end of June (last nests).

If this method provided a good estimation of space and time utilization modes for territorial males' nesting behavior, the other pole of numerical imagery will allow to test in laboratory (aquariums) the parameters influencing the reproductive behavior in territorial fishes. With the future acquisition of [EthoVision Color-Pro](#), a computerized video tracking system (detection by color tracking of markers attached to animals) we will quantify for each fish locomotor activity (distance traveled, swimming speed), number of visits and amount of time spent in a defined zone of the aquarium (territory) and social interactions (approach, avoidance) according to intensity of light, photo-period, water temperature, stream, structure and nature of substrate, density of congeners, etc.

Coupling the numeric imaging techniques (field and lab), we hope to build a statistical model to better understand the relations between fish and its reproductive microhabitat.

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