Illustrating Fish Eggs and Larvae

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Scientific illustrations of fish eggs and larvae are an indispensible component of any descriptive work, providing a visual reference of form and structure which is not possible to express by written descriptions and measurements alone. Illustrations facilitate identification by emphasizing distinctive but often subtle morphological characters and allow for comparison of features at different developmental stages and with morphologically similar taxa. These qualities make illustrations the preferred and most frequently used aid for taxonomic identification of fish eggs and larvae.

The broad range of morphological diversity found among larval fishes requires flexibility in technique and style to produce effective illustrations, but the criteria of accuracy, clarity, and consistency of style should be met. The basic concept behind illustrating a fish larva involves accurately representing a three-dimensional, somewhat transparent organism on a two-dimen-

sional sheet while emphasizing characters which are most useful in identifying the actual larva from the drawing. Such characters include the fins, pigmentation patterns, and details of the head such as the jaws, spines and eyes. Internal structures such as myomeres, the gut, cleithrum, and posterior end of the notochord may also be emphasized but without masking important external characters. Details of other internal structures as well as shading or stippling for contrast are best excluded or deemphasized to maintain clarity. Pigmentation is important in identification of most larvae and should be depicted clearly. External melanophores can be drawn with a fine-tipped pen as realistically as possible. Internal pigmentation can be effectively represented by using light stippling with a smaller sized penpoint. Care must be taken to avoid confusion of internal structures with pigmentation.

Specimens selected for illustration should ideally be those of the best condition available and representative of the particular developmental stage in both pigmentation pattern and morphology. The number of specimens to be illustrated is determined by the nature and objective of the publication, the amount of material available in various size groups, and the degree of morphological and pigmentation change undergone by the particular species during ontogeny. Specimens from described series should be archived in a museum collection for proper care and future reference after completion of the illustrations, and catalog numbers should be published.

The detailed drawing begins with an accurate body outline showing the proper body proportions and position of fins and critical pigment spots. This is most easily achieved by drawing in light or blue pencil from a camera lucida-equipped microscope. Other methods include drawing from a projection of a slide transparency of the specimen or tracing a photograph. By convention the lateral view of the larva is drawn, with the head to the left. The exception to this is made with right-eyed pleuronectiforms. In some instances a dorsal or ventral view is also necessary to clarify a pigment pattern or laterally projecting morphological structures. If sketching through a camera lucida, it is helpful to use a magnification which allows the entire specimen to be in the field of vision as long as important details remain visible. Any resulting distortions at the periphery of the field can be compensated for by differentially focusing the microscope on the particular region involved while carefully pencilling along the image, then reconstructing a smooth line where disjointed lines meet. Problems involving specimens that are too large or too small can often be overcome by using lens adapters or eyepieces of lower or higher magnification. Large specimens may require being drawn in sections which are later pieced together. This original sketch should be made large enough to clearly indicate fine details such as the full complement of fin rays, but not excessively so with the result of producing lines which bleed in the final reduction for publication. Related to this is the use of appropriate sizes of pen points which produce lines fine enough to draw minute details yet not be lost in reproduction. Therefore, in determining the original size of each drawing, thought should be given to the desired reduction ratio as well as the number of illustrations comprising each plate. An opaque projector is most useful for obtaining a specific size for the final drawing from the initial sketch, but photocopy reductions also work well. With this final pencilled sketch, the illustrator can work with the larva under a microscope as a reference to complete details of the drawing before attempting to ink it. A light table can be helpful when tracing or inking over a rough pencilled sketch. The illustrator should always have a set of meristics of the specimen being drawn and an understanding o the important characters to be emphasized. A thorough inspection for accuracy is essential to insure agreement between illustrations and descriptive text, especially concerning pigmentation and meristic elements with size and stage of development. Ideally exact counts and measurements can be obtained directly from the illustration, allowing easy identification of the larva.

Illustrations are often designed for comparison of features at different stages of development or for comparison of similar features which occur among different taxa. Special care should be taken to represent similar features in a consistent style from illustration to illustration. For example, a partially ossified fin ray element, an ossified fin ray, and a fin spine may each be depicted in a consistent but slightly different manner so that the illustration not only shows the number and position of fin elements but also the type of element and its relative stage of development.

Literature dealing with larval fishes contains a broad array of illustrative styles, techniques, and quality. Many of these are of limited use since they fail to meet the criteria discussed above. Photographs frequently yield unsatisfactory results due to difficulties in focusing on small, transparent organisms so that all body parts appear equally sharp, and they preclude emphasizing inconspicuous but important features for identification. Color illustrations in a variety of media, although potentially valuable, particularly for xanthophores, are limited due to prohibitive publication costs, poor reproducibility, and the absence of a long-lasting color preservative. Half-tone illustrations (see Ahlstrom, 1965) are effective but difficult to reproduce. These latter two techniques may become more practical with advances in photocopy technology. The preferred technique in widespread use consists of pen and ink drawings done in black india ink. Various styles of illustrations of diverse groups of larvae are represented in Moser (1981) and in this volume which serves as a useful overview. Poul Winther, George Mattson, and other artists (Ahlstrom and Ball, 1954; Ahlstrom and Counts, 1955; Bertelsen and Marshall, 1956; Ege, 1953, 1957, and 1958; Grey, 1955b; Moser, Ahlstrom and Sandknop, 1977; Moser and Ahlstrom, 1970; Tåning, 1961; Richardson and Washington, 1980) have been instrumental in establishing a fine style of pen and ink drawings which we emulate and have found most effective in its applicability to larval fish identification. We maintain a degree of flexibility in technique and style which varies with the taxonomic group under consideration but falls within the general framework discussed above.

Illustrating a fish egg poses a more difficult problem than illustrating a fish larva and will be limited to a brief discussion. Encapsulation by the chorion necessitates representing the three-dimensional quality of the egg in the drawing while showing important morphological and pigmentation characters of internal structures (Ahlstrom and Moser, 1980; Matarese and Sandknop, this volume) with as much clarity as possible. Difficulties arise due to the superimposing of these characters from a two-dimensional perspective, particularly when the chorion is ornamented, when an oil globule(s) is present, and when the developing embryo is fully coiled.

In spite of the more complex structural representation required, the same criteria of accuracy, clarity and consistency of style apply to egg illustrations. The relative proportions of the egg size to the size of the embryo, oil globule(s), and width of perivitelline space, the number of myomeres, and length of gut

need to be accurately drawn. An effective balance between showing important characters for identification and three-dimensional realism of the egg is required to maintain clarity. Several illustrations of the egg at different stages of development and from different perspectives are helpful in demonstrating key characters such as embryonic pigmentation, myomeres, and position of the oil globule(s) in the yolksac. Adherence to a consistent illustrative style is primarily critical for a developmental series of eggs. As with fish larvae, pen and ink drawings provide the most practical technique for illustrating fish eggs, but the specific style of illustrating and details shown depend upon the character of the egg and its stage of development. Many kinds of illustrative styles and techniques are found in the literature (see Ahlstrom and Moser, 1980 and references cited therein) and examination of these is most helpful in effectively illustrating a particular type of fish egg.

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