can be determined by cutting the area of the outcrop from a map, and comparing the weight of the paper containing this area with the weight of the paper containing a known area, cut from the same map.

RONALD L. IVES

UNIVERSITY OF COLORADO

A METHOD OF PREPARING SKELETONS OF SMALL VERTEBRATES

ALONG the entire Pacific Coast of the United States there occurs a marine isopod, *Cirolana harfordi,* which is an excellent agent for cleaning small vertebrate skeletons. I have used it a great deal in making osteological preparations, principally of fishes, and several colleagues to whom I have demonstrated the method have displayed great interest, while some have used it with considerable success.

The advantages of the method are that the finished skeleton is not disassociated, that it is cleaned within a day or two, and that no special malodorous place is required in the laboratory for storage during the process.

A fish to be skeletonized should first be skinned and eviscerated. The isopods will not attack the skin and it is practically impossible to remove it after skeletonization without tearing apart some of the smaller bones. In the case of large specimens, a little rough fleshing should be done. The specimen is then placed in a glass jar with a metal cap, such as the ones in which mayonnaise is commonly sold. The metal cap should be pierced by several 1/8 or 3/16th inch holes. These holes serve for entrance of the isopods which are small enough to leave even minute epipleurals intact and attached, while they exclude crabs which would tear the skeleton apart. The jar is placed securely under some large rock between tide marks and other stones heaped around it to keep it in place and to break up the force of waves which might damage the specimen. Twenty-four or 48 hours later the isopods have usually completed their task. The skeleton should then be gently washed in fresh water and hung up in the sun to dry. After drying, a drop of water placed on the promixal end of any bone which happens to be in an unnatural position softens the ligament and allows the bone to be rearranged.

A certain number of delicate specimens are bound to come apart in one or two places, but these may readily be patched or may serve very well as study material. A good percentage of skeletons turns out to be perfect museum material. A little practice enables any one to judge quite well the abilities of the isopods, and to balance accurately the size of the holes in the top of the jar, the amount of manual fleshing to be done, if any, and the length of time required in order to get the best results.

It should be mentioned that *Cirolana harfordi* will not attack animals which have been preserved in alcohol or formalin. Fresh material is required. The isopods also display a distaste for organisms in which putrefying bacteria have gained a good foothold. As a result 48 hours is usually their limit of activity on one specimen. In case their task is too great to be completed in this time the specimen must be thoroughly washed in order to remove all putrefying flesh, whereupon they can be induced to continue their work.

Keeping a supply of isopods in an aquarium in order to perform the work has been found to be unsatisfactory. While they eat the flesh very rapidly, they soon become satiated, and the number of individuals required to complete even a small skeleton is enormous. With the specimen placed in the ocean itself there is evidently a continuous parade of hungry workers into the jar and well-fed individuals out, resulting in the acme of efficiency.

In addition to fishes, I have made skeletons of toads, birds and small mammals. In these animals surplus pieces of ligaments should be clipped away while the skeleton is still wet. Drying the specimens in the sun for a few days generally gives them a satisfactory whiteness, but chemical bleaching agents may be used if desired.

While *Cirolana harfordi* is available to relatively few zoologists, it may well be that related forms along the Atlantic and Gulf coasts will prove equally efficient, while the fresh-water amphipods may possibly serve inland workers in the same manner.

ROLF L. BOLIN

HOPKINS MARINE STATION
PACIFIC GROVE, CALIF.

BOOKS RECEIVED

BURKILL, I. H. *A Dictionary of the Economic Products of the Malay Peninsula.* Vol. I (A–H) Pp. xi + 1220. Vol. II (I–Z) Pp. 1182. Crown Agents for the Colonies, London. 30 shillings.

CRAWLEY, S. L. *Study Outline for General Psychology.* Pp. ix + 223. Prentice-Hall. $1.50.

DOLLARD, JOHN. *Criteria for the Life History.* Pp. iv + 288. Yale University Press. $2.50.

FORTUNE, R. F. *Manus Religion.* Vol. III, 1935, of the Memoirs of the American Philosophical Society. Pp. ix + 391. 10 plates. The Society.

HAUSMANN, ERICH and EDGAR P. SLACK. *Physics.* Pp. viii + 776. 471 figures. Van Nostrand. $4.00.

LÉEMANN, A. C. *Le Pansoma et la Géométrie de l'Énergie.* Pp. viii + 257. Georg & Co., Genève. Fr. suisses 15.—.

MCKINLEY, EARL B. *A Geography of Disease.* Pp. xxv + 495. George Washington University Press.

MEYER, BERNARD S. and DONALD B. ANDERSON. *Laboratory Plant Physiology.* Pp. vi + 107. Edwards Brothers. $1.75.

WOLF, B. *Animalium Cavernarum Catalogus.* Pars 5: Band II, S.-129–176; Band III, S.-305–384. Pars 6: Band II, S.-177–224; Band III, S.-385–464. W. Junk, Gravenhage.