quantitative work lies in the fact that the factors all work together on the plant, and measurement taken of individual factors may not indicate the true effect of the same factor working with others. Livingston's suggestion of using the living plant as an index is aimed at overcoming this difficulty.

Along physiographic lines, Cowles's recent work on so-called lakes of the Mississippi valley has applied the principles of plant succession in a very practical way. The control of moving sand is best accomplished by application of ecological principles in the choice of plants for that extremely xerophytic habitat.

E. Place of Ecology in an Agricultural Course of Study.—Up to the present the method in agricultural texts and courses has been to teach a little plant morphology, a chapter on plant activities, and then nine tenths of the work on agricultural practise. In addition to that we would recommend the insertion of a section on ecological principles, covering the content of ecology as outlined above. This should be general and theoretical, yet so related to agricultural practise as to form a suitable foundation for an agricultural course. A knowledge of these principles is fundamental to any real grasp of the subject.

In conclusion, emphasis should be laid on the fact that this discussion does not aim to criticize present agricultural activities, but to emphasize what is now being done along scientific lines for the development of the general principles underlying the practise of agriculture, and the importance of its extension as far as possible. Secondly, to point out the opportunities in this growing branch of science and to urge the teaching of some brief but comprehensive study of the principles of ecology in all agricultural courses.

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FISH NAMES, ANCIENT AND MODERN, AND EARLY ILLUSTRATIONS OF FISHES

A favorite topic which has engaged the attention of naturalists in all ages has been the identification of the names bestowed on plants and animals by ancient authors, particularly those of classical antiquity.

Probably no living naturalist has made more profound study of this subject than Professor D'Arcy Wentworth Thompson, of Dundee. whose "Glossary of Greek Birds" (1895) and new translation of Aristotle's "History of Animals" (1910) are monuments of patient industry and vast erudition, both philological and zoological. So able a critic as the late Dr. T. N. Gill has recorded[1] in glowing terms his appreciation of the merits of Professor Thompson's researches.

Dr Gill's own labors in the same field have illumined many an obscure point in the interpretation of ancient Greek and Roman writers on natural history. We may recall here an article of his in the *American Naturalist* for 1873 (vol. 7, pp. 458–463) "On the Status of Aristotle in Systematic Zoology"; also his address before the American Association in 1896 on "Some Questions on Nomenclature." His scientific papers and reviews fairly teem with discussions of fish etymologies, and his article on the Glanis of Aristotle is a fine presentation of the results of scholarly research.[2]

Dr. D. S. Jordan also, to mention only one other contemporary ichthyologist, has performed, in association with H. A. Hoffmann, a valuable service in investigating vernacular names, ancient and modern, as applied to the fishes of the Greek peninsula and archipelago. A joint paper by Jordan and Hoffmann, embodying a catalogue of the fishes of Greece, was published in the *Proceedings of the American Philosophical Society* for 1892.

Among ichthyologists of the last century, Georges Cuvier was probably at more pains than any other author to determine what species of fish were referred to under the appel-

[1] Science, Vol. 33, 1911, pp. 730–738.

[2] Bull. George Washington Univ., Vol. 5, 1906.

lations of early writers. After him A. Koraes (or Coray), Johannes Müller, Louis Agassiz, Erhard, Lowe, and the various editors and translators of Aristotle (Strack, Barthélemy, J. G. Meyer, Ogle, Aubert and Wimmer) and other ancient writers also rendered notable services. Other commentaries of value relating to the Greek fauna and its nomenclature were made during the last century by President Felton and Professor Sophocles of Harvard, and by several native Greek students, such as Nicolaos Christo Apostolides, D. Bikélas and Ioannos Bouros. The last-named was a professor at Athens, and published an essay in Greek of which an abstract appeared in Oken's Isis for 1841. Apostolides is author of a catalogue of the fishes of Greece and also of a list of the freshwater fishes of Thessaly.

Johannes Müller, in his elaborate memoir[3] "Ueber den glatten Hai des Aristotelis," devotes a separate section to the attempts of 16th century ichthyologists to identify the species of shark (*Galeus lævis*) referred to by the "father of natural history."

In point of fact nearly all of the 16th to 18th century writers on fishes—Belon, Rondelet, Salviani, Gesner, Willoughby, Aldrovandi, Artedi, Linnæus, Bloch and Schneider, together with lesser lights, and not forgetting Charles Estienne[4]—filled their works with copious references to and annotations on the numerous observations on fishes that have come down from classical antiquity. Among these "fathers of modern ichthyology" Aldrovandi is credited by Sundevall, in his introduction to the "Thierarten des Aristoteles," with having "fast alles gesammelt, was die Alten über die Thiere gesagt haben." But with respect to Aristotelian writings alone we cannot do better than quote Professor Thompson's remark, that "to annotate, illustrate, and criticize Aristotle's knowledge of natural history is a task without end."

It will thus be seen that there has been a steady succession of commentators upon the etymology of ancient fish names from the beginning of the modern science of ichthyology down to the present day; nor are commentaries wanting upon early patristic and mediæval authors who have left memorials of the knowledge of the times respecting natural history topics. Thus, there was published a score of years ago, by Hosius, an annotated edition of Decius Magnus Ausonius, a Roman consul of the 4th century whose idyll on the Moselle contains recognizable descriptions of sixteen species of fish. Modern editions have been published[5] also of Konrad von Megenberg's "Buch der Natur," written about the middle of the 14th century, a work which in itself is but a free rendering in the German vernacular of "De Natura Rerum," by Thomas of Cantimpre (b. 1201, d. 1272). A similar service has been performed by H. Stadler for the "Historia Animalium" of Albertus Magnus (b. 1193, d. 1280). As an illustration of Konrad's style of description the following extract may be quoted from his chapter on Fishes. It relates to the Remora or Echeneis:

Echeneis haizt ain ech. Der visch ist halpfuezig, sam Jacobus und Isidorus sprechent, und ist sô kreftig, daz er ain schef stil helt, daz ez sich nindert wegt, ez slahen die wind in daz mer oder ez slahen die ünden, und wie sêr die wazzerflüzz diezzen, sô mag daz schef weder für sich noch hinder sich, reht als ob ez dâ gruntvest hab und dâ gewurzelt sei, niht dar umb, daz ez daz vischel wider ziehe, neur dar umb, daz daz vischel dar an hanget. Daz sprechent auch Ambrosius, Jacobus [*sic*] Aquinas, Aristotelis, Isidorus und der groz Basilius. Nu spricht Albertus . . . Plinius, Rabannus, Alex-

[3] *Abhandl. Akad. Wiss. Berlin,* 1840 (1842), pp. 187–258.

[4] Charles Estienne (Lat. Stephanus, b. 1504, d. 1564), a physician at Paris, was author of "La maison rustique," which passed through thirty editions. In 1537, and again in 1544 and 1546, he published a commentary on classical names of plants and animals entitled as follows: De Latinis et Græcis nominibus arborum, fruticum, herbarum, piscium et avium liber; ex Aristotele, Theophrasto, Dioscoride, Galeno, Nicandro, Athenæo, Oppiano, Æliano, Plinio, Hermolao Barbaro et Johanne Ruellio, cum gallica eorum nominum appellatione. Lutetiæ, 1544. 84 p. 8°.

[5] One by F. Pfeiffer in 1861, and another by H. Schulz in 1897.

ander, Solinus, Jeronymus, Augustinus, Adelinus, Haimo, Ambrosius, Maister Jorach.''[6]

Although Konrad von Megenberg's "Buch der Natur" has been properly recognized as the earliest natural history compendium in the German language, we must go back two centuries earlier before meeting the first German naturalist. This distinction belongs to the remarkable personage known as Saint Hildegard (in Latin Hildegarde de Pinguia, b. 1098, d. 1179), abbess of Bingen. Her original observations on natural history are contained in nine books called the "Physica," the first printed edition of which appeared in 1533, and the second in 1536. Book V. of this work, in 37 chapters, treats of fishes, and the descriptions of them are given in such terms that all of the species are identifiable.[7]

Concerning mediæval fish names it will be sufficient to refer to but two or three other publications, all by German philologists. One is an essay of 35 pages by Friedrich Schmidt, entitled "Die mittelenglische Version des Elucidarius des Honorius Augustodunensis," published in 1909. Another is J. J. Koehler's work of 87 pages devoted exclusively to old English fish names, published as Heft 21 of Anglistische Forschungen, Heidelberg, 1906. Lastly, mention should be made of Professor Karl Krumbacher's publication of "Das mittelgriechisches Fischbuch," a Byzantine work dating from about the twelfth century.

Returning to our own times, a long list might be given of articles dealing with the vernacular names of fishes in nearly all modern languages, including Chinese and Japanese. We will, however, content ourselves with citing but two useful works, the first of which contains a bibliography of 31 pages. These are, first, Émile Belloc, "Noms scientifiques et vulgaires des principaux poissons, etc.," Paris, 1899, 200 p. 8°. And second, P. P. C. Hoek, "Catalogue des poissons du Nord de l'Europe avec les noms vulgaires dont on se sert dans les langues de cette region" (Conseil Perm. Int. Explor. Mer, Pub. de Circonstance, no. 12, 1904).

EARLY PORTRAYALS OF FISHES

A special bibliography would be required to enumerate all of the articles that have been written on such subjects as prehistoric effigies of fishes, their representation in Egyptian monuments, ancient Greek vase paintings, Pompeian frescoes, the catacombs of Rome, and in the plastic and textile arts of pre-Columbian inhabitants of the western world. There is even a special group of articles dealing with the fish as a religious symbol in the early church, and with the fish motive in Christian art. But in the present note we wish to consider a more modern phase of fish portrayals.

Fishes and "sea-monsters" figured frequently in popular mediæval legends and bestiaries, and grotesque drawings of them were taken over into printed books from manuscript works which had been in circulation prior to the invention of printing. Among the various Herbals, or household recipe-books for medicines, which contained accounts of animals as well as plants and their uses in medicine, one that passed through numerous editions and translations was the "Hortus Sanitatis" of an author or compiler who styles himself Johannes von Cube. This soubriquet has been supposed by some to be a punning pseudonym for Dr. Johann Wonnecken, town physician of Frank-

[6] Concerning the last-named authority, ''Jorach'' or Jorath, little is known except that he was an eastern, perhaps Persian writer, whose work ''De Animalibus'' is quoted by the thirteenth century encyclopedists, Vincent de Beauvais, Albertus Magnus and Bartholomæus Anglicus. Bartholomew's encyclopedia, ''On the Properties of Things,'' was written originally in Latin some years prior to 1260, and was translated into English by John Trevisa in 1397. An epitome of it, under the title of ''Mediæval Lore,'' was published by Robert Steele in 1893.

[7] See in particular L. Geisenheyner, ''Ueber die Physica der heiligen Hildegard von Bingen, etc.'' *Sitzber. Naturh. Ver. Preussen, Rheinlande u. Westfalens,* 1911 (1912), *E,* pp. 49–72. Also E. Wasmann, Hildegard von Bingen als älteste deutsche Naturforscherin. *Biol. Centralbl.,* Vol. 33, 1913, pp. 278–288.

fort. The "Hortus," or "Ortus," was first issued at Metz about 1475, and other editions appeared at Strasburg about 1590 and later. The part entitled "Tractatus de piscibus" is divided into many short chapters, and has numerous woodcuts of fish and fishing, all of very singular character.

Those who are familiar with ancient angling literature will recall in this connection the earliest known book on fowling and fishing, written in Flemish and printed at Antwerp in 1492. It is usually referred to as the "Boecxken," or in German as "Buechlin" or "Fischbuchlin" (editions of 1552 and 1578), and contains woodcuts of angling scenes. As a treatise on fishing, this tract has priority in date over "The Book of St. Albans," ascribed to Dame Juliana Barnes, Bernes or Berners. The first edition of this work was printed by the school-master printer of St. Albans in 1486, but did not contain the "Treatyse of fysshynge wyth an angle" with its accompanying woodcut. The second edition, from the press of Wynkyn de Worde at Westminster in 1496, does contain it, however, and it appears also to have been published as a "lytyll plaunflet" in London about 1500. There are excellent modern facsimile editions of both the "Book of St. Albans" (M. G. Watkins, 1880) and the early Flemish tract known as "Boecxken" (Alfred Denison, 1872). A still earlier facsimile edition of Dame Barnes' book is that by Mr. Joseph Haslewood, in 1810; and in 1816 the same bibliographer brought out the second English edition of "The Dialogues of Creatures Moralysed." The edition was limited to 100 copies, and of these 56 were destroyed by fire. A Dutch version was printed in 1480, and a French in 1482, both of them containing illustrations of fish and fishing scenes.

Modern reproductions have also been published of the remarkably fine animal drawings in the "Album de Villard de Honnecourt" (Lassus, 1858), dating from the thirteenth century in France, and in "Das Tierbuch des Petrus Candidus, geschrieben 1460" (Killermann, 1914). It is to be hoped that before very long we may have at our disposal facsimile reprints of the wonderful animal figures, including fishes, which embellish four valuable codices preserved in the Landesbibliothek at Stuttgart. Two of these manuscripts happen to be translations of the "Liber de Natura Rerum," by Thomas of Cantimpré, who spent fifteen years in its preparation prior to 1240. Strangely enough, although translations of this work have been published (one of them by Konrad von Megenberg, noticed above), the original text has never been printed. Large portions of it were, however, incorporated by Vincent de Beauvais in his various works, especially his the "Speculum Naturale." Besides the Stuttgart codex of Thomas Cantipratensis, others are preserved in the libraries of Paris and Cracow. In Book VII., the author treats of freshwater and marine fishes.

For the benefit of those interested in the history of early prints and book illustrations we may refer finally to the recently published "List of works in the New York Public Library relating to prints and their production," compiled by F. Weitenkampf (1915), and also to Dr. Ludwig Choulant's articles on illustrated incunabula relating to natural history and medicine.

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SCIENTIFIC EVENTS

CALIFORNIA PETROLEUM

WITHIN a few days there will be issued the Report of the Committee on Petroleum of the California State Council of Defense. The members of the Committee on Petroleum are:

Max Thelen, president California Railroad Commission, chairman,

Eliot Blackwelder, professor of geology, University of Illinois,

David M. Folsom, professor of mining, Stanford University.

The committee was appointed by Governor Wm. D. Stephens on May 9, 1917, for the purpose of ascertaining and reporting to him the facts with reference to the production, distribution and utilization of California petroleum and its products. The report has been ap-