Elton (1936)

Journal of Animal Ecology, v 5: 188-192

REVIEWS

THE FEBRUARY ISSUE OF THE *JOURNAL OF ECOLOGY* (VOL. 24, NO. 1, FEBRUARY, 1936)

THIS number contains 12 original papers, notices of recent literature, an account of the Annual Meeting at Reading, the revised Constitution and Rules of the Society and the list of members. P. W. Richards published the first part of his observations on rainforest in Sarawak, on the lines of the earlier papers by T. A. Davis and himself on the Guiana rainforest. These careful analyses of the detailed structure of rainforest in widely separated regions of the tropics are of fundamental value. J. G. Myers writes of his reconnaissance journeys on the interior plateau of Guiana, an area little known botanically and whose vegetation has hitherto been undescribed.

Parts of two extended studies of East Anglian areas are H. Godwin's account of the establishment and development of Fen Scrub at Wicken Fen, and A. S. Watt's general consideration of the Climate, Soil and Vegetation of Breckland. Minor British studies are G. Philip's description of an enalid community (Zosteretum) in the Humber estuary, and Messrs Heddle and Ogg's account of irrigation or flushing experiments with spring water on a Scottish hill pasture, in which they record the raising of the *pH* value and the change to vegetation more palatable and nutritious to stock. W. Watson gives a useful account of the bryophytes and lichens of beechwoods, the late S. K. Mukerji contributes the first three sections of his extended study of the autecology of *Mercurialis perennis*, and Katherine Warington writes of the effect of temperature on the germination of weed seeds.

Of more theoretical papers there is A. R. Clapham's on statistical methods in the study of the distribution of individuals in vegetation, illustrated by an interesting analysis of "over-dispersion" in grassland; F. E. Clements's valuable account of the concept of "the climax" and its applications; and a short summary of "biotic community" terminology on the lines of Clements and Shelford, by J. R. Carpenter.

Reviews deal with the November issue of the *Journal of Animal Ecology*, and books and papers on wholesale erosion in America resulting from the misuse of land, on Swiss fens, on the Italian International Phytogeographical Excursion of 1934, on the heat economy of plants, etc.

A. G. TANSLEY.

A NEW INVADER

Nicolaus Peters and **Albert Panning.** *Die Chinesische Wollhandkrabbe* (Eriocheir *sinensis H. Milne-Edwards*) *in Deutschland.* Zoologischer Anzeiger, Supplement to Vol. 104, pp. 1–180. Leipzig, 1933. With Appendix by W. Schnakenbeck.

THE Chinese mitten crab, already widespread in Europe, has reached the Thames. In 1935 one was caught alive in a water-screen at Chelsea. There may be others, and it may not be long before the occupation of British river systems by this new pest is in full swing. The crab gets its name from the very hairy appearance of the front claws.

The Ministry of Agriculture and Fisheries have already issued a warning leaflet (Fisheries Notice, No. 22), since various experts, and in particular Dr W. T. Calman of the British Museum of Natural History, had foreseen that this crab would inevitably spread here from Europe. Pycraft discusses the matter in an interesting popular article in *The Illustrated London News* for Dec. 14th, 1935, to which the general reader may be referred. For ecologists the important German monograph reviewed here comes at an opportune moment.

Its authors did their work at the Zoologisches Staatsinstitut, and the Zoologisches Museum in Hamburg, where important enquiries into the spread of the Chinese crab have also been done by Schnakenbeck.

The account begins in the traditional fashion with a long and detailed description by Panning, covering 55 pages, of the systematics, world distribution and structure of the crab. It is obviously of great value to have the synonymy of the species, and the distribution in Asia of allied forms, carefully traced. The structural details have one important use in checking any changes that may occur in the new countries of occupation. Ecologists will, however, find their main interest in the rest of the monograph in which Peters reviews the ecology, and economic significance of the crab.

The following are the main facts at present known about the mitten crab:

Original distribution. North China, down at least to Shanghai. Another species, *E. japonicus*, inhabits Japan and South China. It is not known if the ranges of these two overlap. They may only be geographical races occupying different climatic habitats. It is suggested that if the crabs spread farther south in Europe they may show structural changes in the warmer climate.

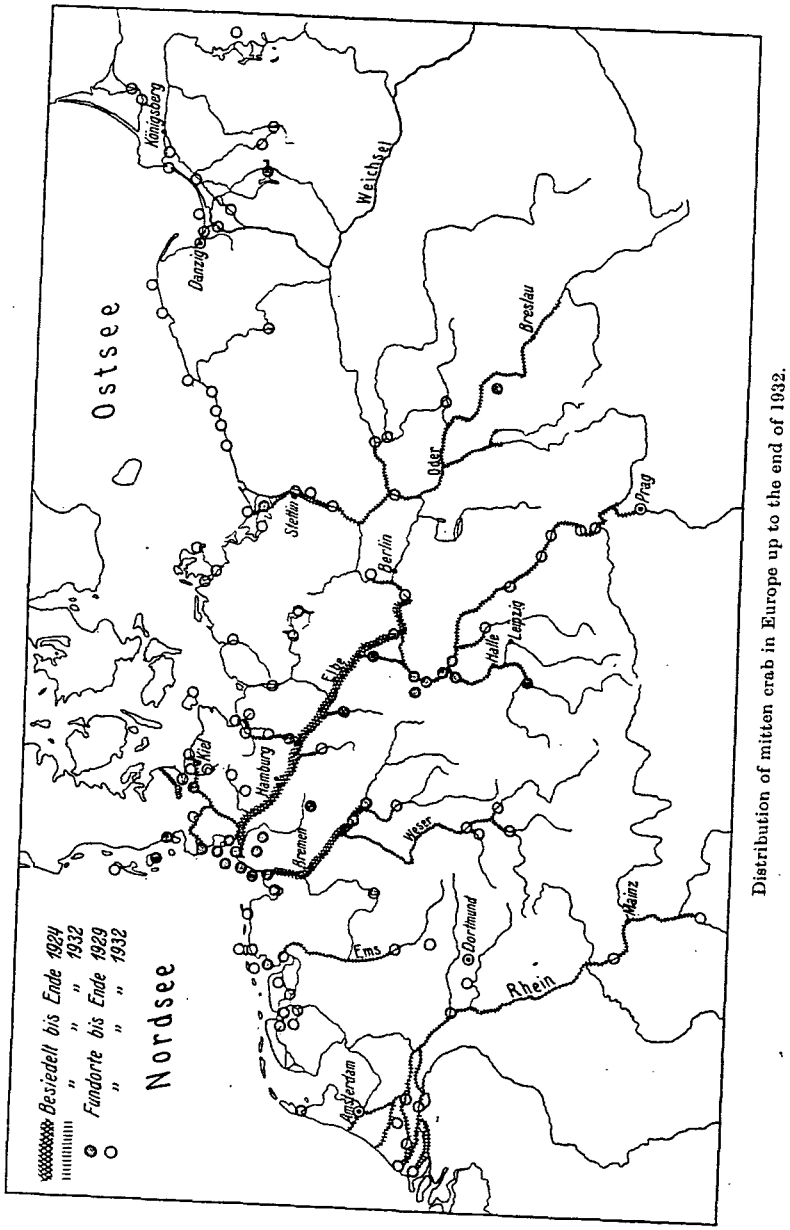
Sexes. Differ in the shape of the carapace and abdomen. Mature crabs weigh upwards of 50 gm.

Dispersal. Not definitely known how it got from China to Germany, but almost certainly either in marine growths on the bottoms of ships or in the sea water ballast tanks. Other cases are cited: two species of Indo-Pacific crabs have reached the Adriatic; various crabs have been found among marine growths on ships; another Chinese crab (*Pilumnoides perlatus*) has turned up on the Scilly Islands. The most important direct evidence is that in December 1932 a Hamburg-American steamer was found to have two large mitten crabs in the sea water ballast tanks: owing to the small size of the grill covering the seawater intakes these crabs must have got in when they were small and were almost certainly picked up in Hamburg Harbour. But it seems to us that the general use of small mesh grills makes it highly improbable that the crabs could get out of such ballast-tanks when they had been in them a few weeks and begun to grow up. *Arrival in Europe.* First found in a tributary of the Weser in September 1912. The history of the subsequent spread was mainly worked out by Schnakenbeck from Hamburg. During the War mitten crabs appeared in the Elbe. *Present distribution.* Nearly the whole of North Germany and Holland (see map), also in Belgium and along the Baltic coast beyond Konigsberg. It now occurs hundreds of miles from the sea and has penetrated up the Elbe as far as Czecho-Slovakia, at Prague. It occurs in the Oder beyond Breslau, in the Rhine beyond Mainz and in the Ems. It is also found in the Weser and Wechsel.

Habitat. The bottoms and banks of fresh waters and estuaries. This is the normal habitat which is left only when the crabs migrate to the lower estuaries and sea to breed. They live both in standing and running water. They occasionally come up on land and frequently live in intertidal regions. They can stand quite oily water, but the authors do not say much about the effects of other pollution. *Physiology.* Can withstand high variations in salinity, and can live out of water for about a week. *Hibernation.* In winter, when the old sexually ripe crabs migrate to the coast, the small and medium sized ones remain inland, mostly moving down into the deeper water.

Food. Omnivorous, but details not fully known. Includes netted and dead fish, Crustacea, insects (especially larvae of *Chironomus*), molluscs, worms, and each other. They avoid frogs and newts. They eat water plants such as *Potamogeton*, *Elodea*, duckweed (*Lemna*) and filamentous Algae. They have a taste for soft animals such as snails and bivalves. There is no case known of mitten crabs catching and eating live fish, but they may possibly go for spawn. *Habits.* Feed mainly at night, but are also active during the day; in winter they are active, and the gut is often full of food. The mitten crab can go without food for at least a month.

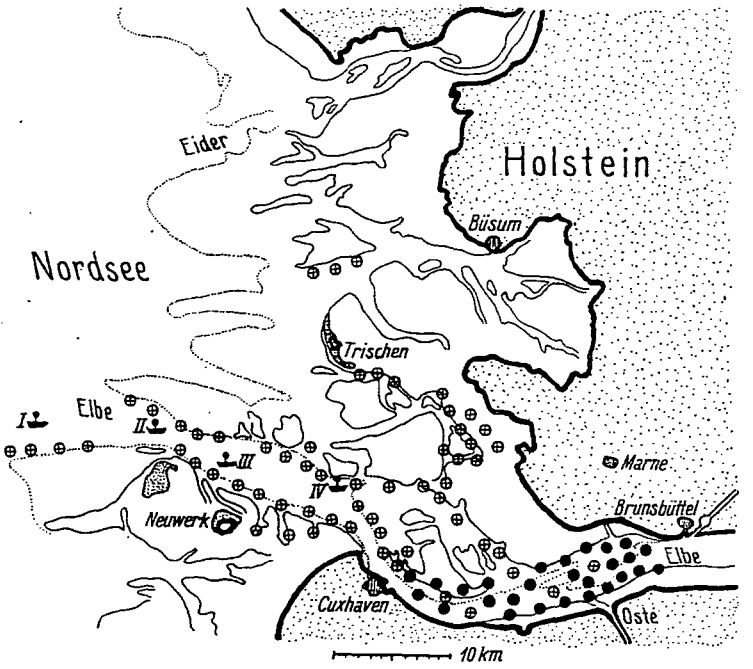
Burrows. The fishermen of the Lower Elbe, engaged in eel trapping at night, discovered that what had appeared to be rat runs were made by mitten crabs. In the right kind of soil, there may be as many as 30 burrows in a square metre. These are most conspicuous



Distribution of mitten crab in Europe up to the end of 1932.

in intertidal stretches. They are usually about 4–5 cm. wide and 40–60 cm. long. They cause serious damage to the banks.

Migration and breeding. Essentially a marine animal which returns to the sea to breed, like the eel. The direction of migration is not necessarily controlled by the flow of water, although this speeds it up, since crabs living in stagnant water also perform the migration. The planktonic *Zoaea* larvae have not yet been detected in nature. The *Megalopa* larvae migrate inland by swimming. The movements of the later stages are better known. They are most strongly marked in spring and have helped to spread the crab 440 miles up the Elbe and over 800 miles up the Yang Tse Kiang. The downward movement, which is among



The spawning area of the mitten crab at the mouth of the Elbe.

animals over 40 mm. long, takes place in autumn and winter and mostly in mid-stream. The sex ratios indicate that the males move much farther up-stream than the females and that the latter tend to stay in the estuaries, and lower parts of the river.

Both in nature and in captivity breeding takes place only in brackish and sea water. Pairing activity may occur in fresh water, but the eggs are not laid. They breed over a longish period from about November to July, when both sexes swarm in thousands in the brackish water estuaries. Females go farther out to sea, with the eggs carried on the hairs of the pleopods from which they hatch as larvae (see map, above). One female crab produces from several hundred thousand to a million eggs at one laying. The crabs stay for some time at sea or in the estuaries, and often get completely covered with marine growths.

Growth and length of life. They grow only during the warm months, mainly June–

September. Sexual maturity is probably reached between the fourth and sixth years when the length is over 45 mm. Statistics suggest that few survive to breed after their fifth year, although occasionally big crabs occur which may be as much as ten years old.

Damage. Erosion of banks has already been mentioned. They are also a pest to fisheries: eating the bait off lines (especially eel lines), destroying nets, taking up valuable space in the nets, eating netted fish, bruising the fish when the nets are pulled in and reducing potential fish food. Two fishermen in the Lower Elbe had their nets so full of mitten crabs that they could not lift them out of the water: there was probably half a ton of crabs.

Control. Quite impossible at present and perhaps always. There are natural enemies, among which brown rats may be important. Fish eat mitten crabs, e.g. the eel, burbot, cod, trout, perch and pike. No natural epidemics have yet been observed, while experimental diseases might be dangerous to crayfish and fish. The only possibility seems to be for fishermen to catch the breeding females. Mitten crabs are still spreading, and apparently increasing in some of their older centres of occupation.

Value. Although edible to man and animals and chemically valuable, little use has been made of them. They are rather too small for human consumption, but pigs certainly like them. They also make good bait for eels.

Schnakenbeck contributes an Appendix on crab larvae. There is a large bibliography with 168 references, and the monograph is fully illustrated by text-figures and photographs. I am greatly indebted to the Akademische Verlagsgesellschaft, Leipzig, for permission to reproduce in this review two of the excellent maps.

One misses any serious attempt to assess the density of crab populations at different times and places: this is of particular importance, since the present estimates of abundance and of increase and decrease are based only on the impressions of observers from what they see and catch. The history of this sudden spread is impressive and will no doubt be repeated again and again by other species in the future. It teaches us that (as in the case of the cord grass, *Spartina townsendii*) there are many ecological niches still to be filled by well-equipped invaders.

The mitten crab will no doubt join the growing band of invaders to this country, which already includes the grey squirrel, muskrat, French partridge, little owl, willow grouse, rainbow trout, black bass, Continental crayfish, American slipper-limpet, and several oyster-tingles; not to mention a host of insects, among which the most distinguished recent visitor is the Colorado potato beetle. There seems no reason to suppose that this list will not continue to grow, even though the folly of deliberate introductions is prevented.

In the present instance, we are fortunate in having such a competent study of the mitten crab's ecology ready to hand before the invasion has got under way. So far as one can see, the only factor likely to limit its establishment in the British Isles would be a zone of chemical pollution in the estuaries. Whether this will ever be deliberately planned depends upon the extent to which fresh-water fishermen are able to influence Government action.

CHARLES ELTON.

THE ECOLOGY OF MARINE COASTS AND ESTUARIES

(1) **V. E. Shelford, A. O. Weese, Lucile A. Rice, D. I. Rasmussen, Archie MacLean, Nettie M. Wismer,** and **John H. Swanson.** *Some marine biotic communities of the Pacific coast of North America.* Ecological Monographs, 5: 250–354, 1935. 20 tables, 14 figures and maps.

(2) **G. E. MacGinitie.** *Ecological aspects of a California marine estuary.* American Midland Naturalist, 16: 629–765, 1935. 3 maps, 21 figures.

(3) **W. B. Alexander, B. A. Southgate** and **R. Bassindale.** *Survey of the River Tees. Part II: The Estuary—Chemical and biological.* Department of Scientific and Industrial Research, Water Pollution Research, Technical Paper No. 5. xiv+171 pp., 117 tables, 65 figures, 2 maps. (H.M. Stationery Office, London, 1935. Price 9*s.* 0*d.* net, postage extra.)

(1) The principal marine climax communities in the area of the former Puget Sound Biological Station (now Univ. of Washington Oceanographic Laboratories) near Vancouver Island which are associated with the bottom are bivalve-annelid communities (the *Pandora-Yoldia* and *Macoma-Paphia* biomes) and gastropod-barnacle communities (the *Strongylocentrotus-Argobuccinum* and *Balanus-Littorina* biomes). The studies were made during the years 1926–30 and are essentially an expansion and continuation of those begun by Shelford and Tower in 1922.[1] A description of each of the biomes is presented in varying detail with discussions on their component fasciations and associations. In certain instances reference is made to ecological studies done in the laboratory with characteristic animals in the communities, and in all emphasis is laid upon the abundance of the different forms at the various collecting stations.

Two of the communities are characteristically subtidal: the *Strongylocentrotus-Argobuccinum* biome, which is associated with relatively swift moving water, high salinity, high light penetration, and little plankton; and the *Pandora-Yoldia* biome with relatively slower moving water, lower salinity, slow fine silt deposition, and much bottom detritus. These two communities are apparently restricted to the North Pacific, although communities similar to the former (composed, however, of different species) exist at Vineyard Sound and to the latter at Buzzard's Bay (both Southern Massachusetts) and near Denmark.

The *Macoma-Paphia* biome is essentially subtidal, although it may be exposed in its upper reaches at low tide; its most characteristic form is the edible clam. While resembling a general type found throughout the Northern Hemisphere at least, it cannot be said to compare precisely with any other community thus far described. The *Balanus-Littorina* biome is a true "tidal" (i.e. intertidal) community and is largely determined by water movement; it is characterised by barnacles epizootic upon mussels. Examples of the community were studied in this region (Rice) and in southern California near La Jolla (Rasmussen). This general type of community was considered as being characteristic of many shores in both the Atlantic and Pacific in the Northern Hemisphere.

The investigation dealt chiefly with bottom communities; but throughout the whole the influence of the above pelagic communities and their constituents are emphasised. Also, there are studies dealing with succession in the ecotone between the *Strongylocentrotus-Argobuccinum* and *Pandora-Yoldia* biomes in relation to the physiographic processes taking place there, in the early and late stages toward land, in which *Salicornia* plays an important part (Weese, MacLean, Markus). In a detailed study of a series of stations at the edge of "Brown Island" (Swanson and Wismer) it was shown that the maximum number of animals occurred in subtidal areas.

"The writers are convinced that organisms, or more especially community groupings of organisms, are the best indicators of hydrographic conditions and that the success or failure, presence or absence, scarcity or abundance of these living things is correlated with determinable physical and chemical conditions. To yield best results, the study of (environmental) conditions and of communities must go hand in hand, but also the nature of the study of conditions must constantly be moulded by a study of the correlation of the responses of organisms with the knowledge of conditions already gained."

This paper is an important contribution both to the knowledge of marine communities of the region studied and to the understanding of community composition, structure, development, and local distribution of dominance: all important principles of ecology making the paper doubly valuable. Although not so stated this monograph is a summary

[1] 1925, Pub. Puget Sd. Biol. Sta. 5: 33–73.