The Nature of Names

Japanese vernacular nomenclature in natural science

A Thesis
Submitted to the Faculty of Drexel University
by
Paul Callomon
in partial fulfillment of the requirements for the degree of
Master of Science

September 2016

Drexel
UNIVERSITY

Acknowledgments

In addition to research and interviews carried out specifically for it, this paper draws on my many years of engagement with Japanese malacology as an author, photographer and translator. The following people were all involved directly in its creation, but a great many others have influenced it. Of the latter, two merit special mention: the late Mr. Shun'ichi Higo of Isahaya, Nagasaki Prefecture and Mr. Yoshihiro Gotō of Yao, Osaka Prefecture.

In Japan

Mr. Mitsuo Chino, Kawasaki, Kangawa Prefecture; Mr. Kazufumi Ekawa, Arita, Wakayama Prefecture; Mr. Hirofumi Fujimoto, Marugame, Kagawa Prefecture; Dr. Harufumi Nishida, Chūo University, Tokyo; Mr. Masatoyo Okamoto, Chiba Prefecture; Dr. Takashi Okutani, Tokyo; Ms. Yoko Ōtani & Mr. Kenji Ōhara, Ashiya, Hyōgo Prefecture; Mr. Akira Tada & Ms. Tomoko Taki, Sanbonmatsu, Kagawa Prefecture.
(National Museum of Nature and Science) Dr. Kazunori Hasegawa; Dr. T. Kitayama; Dr. Hiroshi Saitō; Dr. G. Shinohara.

(Tokyo University) Dr. Takenori Sasaki; Ms. Akiko Shimizu; Dr. Rei Ueshima; Dr. Masaya Yago.

(Osaka Museum of Natural History) Mr. Kiyotaka Hato'oka; Dr. Shōji Hayashi; Ms. Ayako Hino; Dr. Sō Ishida; Mr. Itaru Kanazawa; Mr. Hisanori Kōtsuka; Mr. Nobuhira Kurozaki; Dr. K. Kogo; Mr. Kōzō Mizuno; Mr. Hisashi Ōishi; Mr. Daisuke Sakuma; Ms. Makino Tachibana; Mr. Kōichi Takenouchi; Dr. Kazumi Tanida; Mr. Hiroyoshi Taruno; Mr. Toshiya Yamazaki; Ms. Satomi Yonezawa; Mr. Teizō Zako.

(Kagawa University) Dr. Yukibumi Kaneko; Dr. Kazunori Matsumoto; Dr. Wataru Shinohara

(Tokushima Prefectural Museum) Dr. Haruna Matsuda; Dr. Ken'ichi Nakao; Mr. Yasuyuki Tsujino; Dr. Kazutaka Yamada

In the United States

(Drexel University) Dr. Lloyd Ackert; Dr. Kelly Joyce; Dr. Tiago Saraiva; Dr. Jonathan Seitz; (Smithsonian Institution) Dr. M. G. Harasewych; Ms. Daria Wingreen-Mason; Ms. Leslie K. Overstreet; (Library of Congress) Dr. Ei'ichi Itō (Princeton University) Dr. Federico Marcon (University of Pennsylvania) Dr. Molly Des Jardins

In the United Kingdom

(British Library) Mr. Hamish Todd; (Natural History Museum) Mr. Paul M. Cooper.

Thanks are also due to the staffs of the Wellcome Library, London, the Ewell Sale Stewart Library of the Academy of Natural Sciences, Philadelphia and the main library of the Museum National d'Histoire Naturelle in Paris.

Table of Contents

Abstract

The Nature of Names: Japanese vernacular nomenclature in natural science

Paul Callomon

Since prehistory Japanese people have named animals, plants and natural phenomena using their own language. Neither the advent of Chinese as a written language in the sixth century nor subsequently of modern Western science and its associated literature in the nineteenth substantially changed this practice.

Vernacular names remain the principal vehicle for natural knowledge within Japan, offering beginners a path to advanced scholarship that does not require the acquisition of a foreign language. They are not subject to formal laws such as those governing scientific nomenclature but instead to the rule of consensus. They nevertheless represent a parallel system based on more localized concepts that at species level is equally or more granular than scientific nomenclature, and their cultural grounding in the Japanese language means that they link to broader networks of local knowledge.

This paper explores the history of Japanese vernacular names in natural history and examines their scientific, epistemic and social functions. Their growth in number and sophistication following the scientific reforms of the Meiji period is linked to the establishment of a national education system that sought to teach Western science without adopting its parent languages.

Examples are given of historical and contemporary usage of Japanese names in natural history, and the ongoing debates over their use, function and regulation are reviewed.

Introduction

The Seashells of Sagami Bay.

In the autumn of 1971, marine scientists all over the world found a heavy package on their desks. In a shipping box specially created for it sat a presentation copy of The Seashells of Sagami Bay, a substantial book of 1,420 pages published by Maruzen at a suitably impressive price.[1] This comprehensive work represented many years' study of the shell collection belonging to the reigning Emperor Shōwa, housed mainly in his private laboratory in the grounds of the Imperial Palace in Tokyo. The book described many new species and genera and was illustrated with high-quality color plates.

The three authors had been carefully chosen for this privilege. At 85, Tokubei Kuroda[2] (1886-1987) was the seniormost figure in the field, having devoted himself since the age of fifteen to the study of mollusks and published more on the subject than any other Japanese scientist. His two co-authors had been recruited for their own prestige but also in acknowledgment of Kuroda's advanced age and their long association with him. Katsura Ōyama (1917-1995) was a well-respected paleontologist of aristocratic lineage and Tadashige Habe (1916-2001) was Kuroda's chief protégé and an accomplished modern systematist in his own right.[3]

The impressive bulk of The Seashells of Sagami Bay seems at first glance somewhat redundant, as half the text is in Japanese and the other half is an English translation. The former section is almost twice as long as the latter, however, and it is clear even to a non-Japanese reader that it contains far more information. A block of 121 plates sits in the middle, dividing the

[1] 13,000 yen; though various calculation methods produce different results, the average equivalent is roughly $650 in today's US currency.
[2] In keeping with general convention, names of people who became active in the Shōwa period (1926-89) and later are given in Western order. Earlier names are retained in the style of the time, with the family name first.
[3] He would become one of the few Japanese members to date of the International Trust for Zoological Nomenclature. See Callomon, 2002a.

two parts like a wall and thus neatly – if unintentionally – symbolizing Japanese natural science. The division is not simply between two languages with incompatible scripts, but between two quite different ways of naming entities in nature. One – the "scientific" or "Western" method – is governed by international rules and based largely in English, though it claims to be language-neutral; the other is a far older and purely Japanese system, less objective but more adaptable, subtle and socially grounded. All three men to whom the imperial household had entrusted this prestigious work understood the ways of these two worlds, inhabiting and negotiating both with ease.

From my first encounters with Japanese shell collectors and scientists, I could see that Latin names were going to be of limited use. Stymied in explaining a point, I would look up a scientific name, hand the book over and watch as it was equated to a Japanese name using either an index or a figure caption. As soon as that link was made, however, understanding was magically achieved and the conversation resumed. As the number of such encounters increased, I found myself entering a parallel world in which knowledge surrounded a vernacular name like a cloud while nominally synonymous scientific names sat alone and apart. The two clearly did not represent the same thing.

In this work I will show how workers in modern Japanese natural science at all levels balance both ways of working, collaborating and creating knowledge locally that is then summarized and selectively excerpted for dissemination beyond the vernacular sphere. The most obvious symbol of this duality is the *wamei* or Japanese vernacular name, which has been the basic unit of natural knowledge there since before people could even write and remains so at all levels of nature study to this day.

The Knowledge and the Eye: skills in systematic biology

The focus and goal of systematic biology is classification - grouping related entities and arranging the groups to reflect higher lineages.[4] The methods for achieving this are all fundamentally comparative, and the ability to determine similarities - whether by eye or using statistics - is therefore a key skill. To become a specialist in a large and highly diverse group such as insects or mollusks there is no substitute for an apprenticeship during which one encounters in real time as many of its members as possible. This usually involves spending a period as a collector, often beginning in childhood.

Various factors cause people to become nature collectors. Competitive acquisitiveness is a common one and in some cases it is strong enough to sustain someone through an entire lifetime of collecting without ever learning much about the objects themselves.

For many collectors, though, an early drive to accumulate sheer volume is gradually replaced by a genuine curiosity and a maturing realization that one can make real contributions to human knowledge. He or she aims at both completeness in the collection and excellence in individual specimens. In some views the latter point divides the enthusiastic “amateur” from the dispassionate “professional”, to whom a specimen’s value lies more in intrinsic qualities such as its life stage, locality and relative rarity. Nevertheless, for the reasons given above most professionals in natural science have at least some background in collecting and are rarely unmoved by truly remarkable specimens.

Not everyone goes out in the field; most collectors purchase some or all of their specimens from dealers, whose credibility and thus client base depend on accurate identifications and evaluations. Dealers must therefore be at least as knowledgeable as collectors and many have become considerable authorities.

---

[4] See *e. g.* Bowker & Star, 1999; Farber, 2000.

Until relatively recently, the classification of the Mollusca was based almost entirely on the phenotype. Individual shell characters such as spines, ridges, grooves and color patterns were assessed using rubrics that date back to the days of Francis Bacon - presence, absence, distribution and degree of expression. Starting in the early nineteenth century malacologists increasingly studied the anatomy of the animals too, noting for example that the shape, layout and number of teeth in the feeding apparatus differs among genera, and discovering that the snails found on land are divided into those that breathe air directly and those that retain the gills of their aquatic ancestors.

Since the 1980s the isolation and sequencing of DNA and the automation of comparative processes have added new dimensions to the classification of organisms. The analytical discipline known as cladistics originated in the 1930s, long before DNA became known, but is now largely employed to analyze molecular data and to construct hypothetical evolutionary lineages. Computers have massively increased the number of calculations in a single study, while the algorithms used in the analysis itself continue to evolve. Nevertheless, DNA results rarely disrupt the existing order of the Mollusca at family or genus level, tending more to support revisions to larger groups.

The primary skills of the systematist therefore remain observation and retention. Species are mostly distinguished through consistent but often subtle differences in gestalt; to the collector's eye they are like family members, faces instantly recognizable amid thousands of others in a crowd. Each is given a name when a description or depiction is made of a typical example, and these in turn allow the subtleties that only certain eyes can first detect to be reproduced and taught to anyone.

Squids, snails and clams: Malacology

Distinct from – though informed by – the studies of general evolution and ecology, zoology is more specifically ontological than either. Its specialisms are based on major evolutionary lineages – ornithology for birds, ichthyology for fishes, herpetology for reptiles and so on. The process of knowledge-making is cumulative and accretive and the tendency is thus always towards specialization. Specializing enables both a higher rate of new discovery and finer levels of distinction. The more specialized the field the more socially interactive specialists must necessarily become, however, which is in turn reflected in their working language and practices.

This paper examines the Japanese system of vernacular nomenclature with primary focus on malacology, the study of mollusks – snails, clams, squids and octopuses.[5]

Of the animals that are visible to the eye, the mollusks are exceeded only by the insects in terms of the diversity of species so far described and the estimated number that remain to be discovered. Mollusks inhabit almost every environment on earth, from alpine meadows to deep-sea trenches and from swift streams to dry deserts. Over a very long history that dates back to the pre-Cambrian they have adopted almost every known animal life mode, from sessile filter feeding through exo- and endoparasitism and commensalism to active predation. Similarly ubiquitous on land, they nevertheless differ from the insects in having emerged from their ancestral marine environments on several different occasions in prehistory.

Mollusks combine extraordinary diversity with often massive populations, and their ready availability has made them a human food staple since prehistory. Some of the oldest evidence of

[5] *Malakos*, Greek, "soft"; *mollis*, Latin, "soft", the root of "mollusk". The term thus refers to the soft body of these invertebrate animals, though the majority of published work in the field is actually based on the study of shells, which is also called Conchology. Nowadays, however, "conchologists" tends to refer to amateurs and "malacologists" to professionals, as reflected in the titles of the two major US societies, the Conchologists of America (COA) and the American Malacological Society (AMS). The distinction is nevertheless a false one in terms of knowledge-making as the majority of basic systematic work that is published does not involve the anatomy of the animals. In addition, molluscan paleontologists must all be conchologists as there are no animals to work with. See Robertson (1990); Vinarski (2014).

human civilization in the Yamato and Kantō regions of Japan is found in shell middens dating back to the Jōmon period[6] and perhaps beyond. Tools made from shells have also been found in excavations of the earliest Japanese cultures.

In addition to harvesting for food and practical use, intricate and elegant shells have been used as adornment, currency and badges of rank by humans across broad ranges of time and geography. Collecting them for their own sake is a pastime as old as civilization itself.

Nomenclature and types

The purpose of scientific nomenclature is primarily to name entities and only secondarily to depict relationships among them. Vernacular names are perfectly adequate for the former purpose, but less so for the latter. Whichever is chosen, however, once an entity – in natural history an organism – is named, it can be used in discussions, investigations, surveys and experiments.

The fundamental requirement for a name to be effective is that it should mean the same thing to everyone who uses it. In the schemes of zoological and botanical nomenclature that are based on the Linnaean system this means either linkage of the name by the original describer to an unambiguous type specimen or the subsequent selection of a type where determination is not possible using the original evidence. A clear distinction is made between whether a name is "available" – that is, whether it was introduced based on a type – and whether it is "valid", that is, the oldest available name for a discrete and unique taxon.[7] Where two or more available names exist for the same entity, a simple rule of priority applies and only the earliest is valid.

[6] Dating of the Jōmon culture is still uncertain, but 12,000 BC is often cited as the earliest part of the period. For more on Japanese shell mounds, see Morse, 1879; on US mounds see Christenson, 1985.

[7] Starting in 1905 successive revisions of the ICZN have tightened the requirements for the introduction of new names. However, for 150 years following Linnaeus's tenth edition of the *Systema Naturae* in 1758 (fixed as the earliest year from which new names can be available) zoological nomenclature was policed more by the consent of the governed than by any formal rules.

The exact meaning (as far as it is defined) of any available scientific name can be learned by anyone at any time by reference to its type, either directly or through pictures and descriptions. Work that uses only available names thereby has the scientific quality of reproducibility.

The current rules of zoological nomenclature are designed to be as unambiguous yet user-friendly and culturally neutral as possible. There has never been any stipulation that descriptions of new species be in English, or that they follow any particular format. Figures of the type specimens remain optional, and although it is recommended that they be deposited in a publicly accessible institution such as a museum or university collection, this too is not mandatory.

The system nevertheless has certain shortcomings. The overarching goal of achieving stability in nomenclature[8] can lead to immutable acts of fixation that further work reveals to have been premature if the aim was to most clearly define the entity. Most commonly, the type of a species is found to be not typical (in the normal sense) of the species as a whole. It might be a heavily worn or damaged specimen that is missing certain key features; a juvenile example of a species whose adult form is very different, an extinct geographical variant or an aberrant individual for some other reason. However, unless it can be shown via a fairly rigorous process not to adequately represent its taxon in any form, a type cannot be replaced.

The wamei or Japanese name

Scientific names for organisms are always in Latin and follow a specific formula no matter the language of the writer or speaker. They are used by scientists and by ordinary people functioning as scientists.[9] Vernacular names, on the other hand, are those used by ordinary people and scientists functioning as ordinary people; they are unique to each language and draw their etymologies and figurative meanings from its culture. The scientific system of nomenclature reflects a top-down assumption that as knowledge expands it will continue to

[8] Melville, 1995
[9] For an exploration of the role of scientist, see the Discussion.

accurately depict the scheme of nature through its pre-existing semantic structure. Vernacular nomenclature, meanwhile, starts with individual entities and constructs relationships only as far as is useful to its community.

By the time Japanese naturalists adopted Western methods as standards in the 1880s, the Linnaean system of binomial nomenclature had been stable for more than a century. Most Japanese vernacular names were far older, however, and many predated written language. In keeping with the modernizing trend of the Meiji period, Western taxonomy was enthusiastically adopted in Japan together with its Latin-based naming system. Older scholars appreciated its grounding in deductive reasoning from anatomical and morphological evidence and its elaborate hierarchies of classified groups appealed to many in Japan's highly codified society.

By contrast, the limitations of vernacular names were obvious. There were, for example, no rules as to the number or meaning of elements in a name and their formation and use were governed entirely by convention and precedent. Local variants abounded, with up to a hundred different names in use across the country for the same organism (fig. 10).

It may seem remarkable, then, that the Japanese nomenclatorial system has not only survived but has grown in scope and complexity and remains in common use today among professional scientists, students and researchers. Meetings such as that of the Malacological Society of Japan regularly feature PowerPoint reports on phylogenetic work based on DNA, cladistic analysis and other modern methods that use only Japanese names for many or all of the organisms studied. Papers by scientists from other countries that are submitted to Japanese zoological journals will have a Japanese summary added that gives vernacular names for species described or cited in the work – with new ones created on the spot where none already exist. It is standard practice for any new species described from in or around Japan to be given a vernacular name in a print venue, whether by its original author or another. In recent times,

Japanese names have also been created for many organisms that do not occur within thousands of kilometers of the country's borders.[10]

Although the study of natural history is as developed in Japan as anywhere on earth, only a translated subset of its literature is accessible to non-native readers. At the same time, only a small fraction of foreign natural history research is translated into Japanese.

As elsewhere in the world, a substantial part of published Japanese natural history is the work of amateurs, who report their results through a vast "local" literature consisting of specialist magazines, newsletters, privately published monographs, faunal lists and a growing number of web sites. At this level, the use of vernacular nomenclature is far more common than in major journals that aim at a specialist audience.

The persistence of the vernacular system begs a number of questions. Clearly it is valued by its user community, who often use it in conjunction with or instead of the western system. While other countries also have "common names" for their flora and fauna, perhaps nowhere is the vernacular system as detailed and vital as it is in Japan, where it permeates natural science at all levels. This leads to interesting questions concerning the roles played by language in creating local knowledge, in negotiating its broader dissemination and – crucially – in recruiting newcomers to science.

The present work

This paper is a product of more than 25 years' engagement with the shells of Japan, the people who collect them and the publications, both scientific and popular, in which they feature. I joined the Hanshin Shell Club in 1989 and attended my first Malacological Society of Japan (MSJ) meeting in 1993. Since then, I have co-authored and published two major books on

[10] Commentaries are occasionally published on newly-appeared Western books that either give the existing wamei for all the cited and figured species or create new ones. For example, between 1992 and 2002 Higo and Gotō issued fifteen of these for books on mollusks, creating thousands of new wamei.

Japanese marine mollusks[11] and numerous papers dealing both with the organisms themselves and the history of their study in Japan.[12]

For the present work, I conducted original literature research at libraries in Japan, the USA, the UK and France that are detailed in the acknowledgments. During 2014 I carried out a total of 39 structured interviews with Japanese scientists, museum workers and educators. I also conducted a survey of four Japanese-language journals whose results are presented in Appendix 1 and incorporated in the main text.

[11] Higo *et al*. 1999 & 2001
[12] e. g. Callomon & Tada, 2006; Callomon & Snyder, 2004-2009.

I. History of wamei

The Japanese term for a vernacular species name is *wamei*[13], a word composed of two kanji[14] characters: *wa* 和, meaning – in this application – "Japanese", and *mei* 名, meaning "name". The first character has considerable cultural significance. Composed of the symbols for "wheat" on the left and "mouth" on the right, it has three conceptual meanings: "harmony", "peace" and "Japan". Read literally, it is the root of the verbs *yawaragu* (to soften, abate, calm down) and *nagomu* (to be softened; to become luke warm), as well as the adjective *nagoyaka na* (peaceful, mild, gentle).[15] In its figurative, cultural sense, it forms half of the word *Yamato* 大和, the name of the earliest settled area in Japan and thus its oldest fixed civilization.

The strong emotional and historical resonance of *wa* means that terms to which it is attached as a prefix assume thereby an indigenous, familial nature. Examples include 和食 *washoku*, Japanese cuisine; 和室 *washitsu*, Japanese style rooms; 和紙 *washi*, Japanese paper, and 和文 *wabun*, Japanese literature. Conceptually, *wa* invokes an older, less political and more intimate sense of social belonging than 日本 *Nippon* or *Nihon*, the name of the modern nation-state. It embodies a timeless sense of popular values and – read more objectively – cultural exceptionalism.

One country, two languages

Wamei in spoken form predate the arrival during the sixth century of Chinese, Japan's first complete written language. Early attempts to write them down used either of the two native Japanese syllabaries or deliberately phonetic readings of kanji to encode their pronunciation, as they were not themselves Chinese words. Unable to express them directly in Chinese, authors

[13] An alternative reading is *wamyō*. Japanese nouns have no plural form, so "wamei" is used throughout.
[14] Kanji are Chinese characters that depict one or more concepts. These are articulated through multiple phonic readings and kanji can be configured variously as nouns, adjectives, adverbs and verbs. Japanese and Korean both use them and most retain their base meaning while generating different phonic readings in each language.
[15] For extensive examples of *wa* in compounds, see Halpern, 1990: 524-5 and Nelson, 1962: 664-665.

used lexicographical devices that tell us that many plants and animals already had vernacular names, and roughly how they were pronounced.

Japanese clerics and scholars learned the Chinese writing system and gradually adapted it to their native syntax, thus forming the basis of the modern Japanese language[16]. The oldest known accounts of the country's natural history that used vernacular names for plants and animals appear in the compilations *Kojiki* (*ca*. 712), *Fudoki* (713-733) and *Nihon Shoki* (720).[17] Then as later, plant names far outnumbered those for animals, reflecting the importance of plants in diet and medicine.[18]

Chinese remained the language of formal scholarship and high culture until the late Edo period, even as poetry, drama and other literary arts also flourished in Japanese, but from the start there was little traffic in the opposite direction and within Japan kanji were assimilated into a distinct indigenous syntax and semantic structure. Formal published scholarship retained a simulacrum of Chinese grammar, but increasingly the rows of kanji were annotated with diacriticals and local characters to allow them to be parsed into Japanese syntax, which is substantially different.[19]

***Bencao Gangmu* and *Honzō Kōmoku*: the organization of nature**

Medicinal botany is one of China's oldest scholarly disciplines and had become firmly established and codified long before periods of study on the continent became commonplace for Japanese scholars. Though principally transmitted orally via traditional master-apprentice relationships, Chinese pharmacology was also set out in books. In the early modern era the largest and most famous of these was *Bencao Gangmu* by Li Shizhen, which was published in 1596 and formed the foundation for vernacular nature study for nearly three hundred years.

---

[16] Shibatani, 1990.
[17] Tsunoda *et al*., 1958; Isono, 1996; for shell names in Fudoki, see Kanamaru, part 3 in 1930-58.
[18] For more on early plant names, see *e. g.* Isono, 2009.
[19] This developed as the *Kanbun* system, the bane of classical Japanese – and Chinese – scholars to this day.

This vast work went further in terms of classification than any of its predecessors by dividing plants and animals into sixteen sections, each comprising many subordinate groupings.[20] Some of the sections were based at least in part on comparative classification; trees, for example, were distinguished from vegetables, as were herbs and fruits, and birds, quadrupeds and "shelled things" each occupied a separate section. Other sections embodied older and less rigorously ontological traditions, however, including "waters", "fires" and "earths".

All the names in *Bencao Gangmu* were of course Chinese and referred to species known in that country. Within a short time of its publication it had at least been seen, if not acquired, by Japanese scholars, and a copy was presented by Hayashi Razan to the retired shogun Tokugawa Ieyasu in 1607.[21] The work was republished in Japan in 1637 as *Honzō Kōmoku*[22] with annotations to help local readers.[23] It was by no means the first such work known in Japan, but was by far the most comprehensive up to that time.[24] *Honzō Kōmoku* was frequently revised and reprinted in numerous editions that featured new illustrations and commentaries based on local Japanese flora and fauna, but in the field of general science at least its scheme of classification remained the standard until well into the nineteenth century.

Three decades later came the first major Japanese illustrated encyclopedia, Nakamura Tekisai's *Kinmō Zui* (1666) (fig. 1). This broad-ranging work was the first book to equate Chinese names for natural species with wamei by linking both to the same illustration. The first full-scale

[20] For a listing of the sections and more on *Bencao Gangmu*, see chapter 2 in Marcon, 2015.
[21] Marcon, 2015.
[22] 本草綱目, the Japanese reading of the kanji in the Chinese title.
[23] From this title derives the Japanese term 本草学 *honzō-gaku*, often shortened to *honzō*. A full account of this broad and somewhat nebulous field of learning is beyond the aim of this paper, but Marcon (2015) is a good guide. *Honzō* is often translated as "materia medica" and most definitions agree that it involved the naming and description of natural products primarily for medicinal purposes. The ways in which *honzō* overlapped with, presaged or predicted natural history (博物学 *hakubutsugaku*) and science (究理 *kyuri*) are the subject of growing debate and study, however, and together with certain other long-standing popular preconceptions about the Edo period - that Japan was entirely closed off, the Samurai were a warrior class and so on - the notion of *honzō* as a single field of learning has been increasingly disputed in recent years.
[24] Prior to that, Razan had published a Japanese summary of the work as his *Tashikihen* (1630).

encyclopedia dedicated specifically to Japanese natural history was Kaibara Ekiken's 16-volume *Yamato Honzō* of 1709.

Wahin and the making of indigenous knowledge

The history of malacology (and, in a broader sense, all natural history) in Japan can be classified into three overlapping phases or eras. The first is the *Honzō* era, stretching from the introduction of written Chinese to the development of indigenous naming and classification in the early Edo period. During this period, mollusks – an important food item since prehistory – were inventoried as natural resources and occasionally studied for their use in medicine. Many compendia had a section listing those "shelled things"[25] that were used in treatments. In most such works, however, the mere possession of a shell was enough to earn a place in this category and turtles, sea urchins and crabs were thus depicted alongside snails, clams and barnacles. The aim of these works was admittedly not to classify relationships among species, but simply to provide a pictorial key to the Chinese names used in contemporary medical texts. This phase lasted until the early nineteenth century, though what little growth it experienced had ceased by the eighteenth.

The second phase is that of the *Kai-ya*, or shell collector. It began in the mid eighteenth century, when shell collecting as a leisure pursuit became sufficiently popular and dealing in shells sufficiently profitable that practitioners started generating their own literature, much of it illustrated. Books of this period demonstrate rapid improvement in the observation and depiction of shells, and most of the species figured in later works are readily recognizable.

Finally comes the Modern phase, when Western methods in nomenclature, taxonomy and systematics were adopted following the opening of Japan in the 1860s. Within a few short years, Japanese shell books were illustrated with high-quality lithographic and copper plates, followed

[25] 介品 *kaihin*; also often 魚介 *gyokai*, "fishes and shells"

rapidly by photogravure and offset printing (fig. 7). At the same time, the vernacular system of nomenclature expanded to reflect names of higher groups in the Linnaean system, though not - as will be explained below - necessarily to represent their taxa.

During the earliest period, efforts to reconcile Chinese names with Japanese things formed a distinct field of scholarship: *meibutsugaku*,[26] the study of named things. However, once books began to deal with indigenous Japanese species for which no Chinese name existed, these were classified as *wahin*[27] or "Japanese things". In *Yamato Honzō* there were only 43 *kai-rui*[28] entries. However, Ekiken created new names for the wahin that remain in use today such as *Asari*, *Takobune, Nejigai* and *Tairagi*.

In 1719 Kanda Gensen published the first specialist encyclopedia of Japanese fish and shelled animals entitled *Nittō Gyofu*[29] and featuring 95 *kai-rui* entries. Matsuoka Gentatsu further restricted himself solely to shelled things in his *Igansai Kaihin* (1758) (fig. 2). He also distinguished as wahin the 72 species (out of a total of 124) that had no Kanji name.

Up until Ekiken's work, shells had been arranged without any distinction between gastropods, bivalves and so on. However, in *Nittō Gyofu*, they were divided into groups, the main ones of which were *nishi* (gastropods), *hamaguri* (bivalves) and *kai* 貝(cowries).

Isono (1996) cited the so-called "*Kyōhō – Genbun Sanbutsu-chō*" as a useful work for determining roughly how many shelled animals ordinary people could name during the Edo period. This was a survey of current affairs in the entire country that started in the last years of the Kyōhō period (1716-1736) under a directive issued by the government to all the provinces. Regardless of whether they used them or not, each village had to list all its plants and animals.

---

[26] 名物学

[27] 和品. The term *hin* has a different connotation than the more usual *butsu* (物) or *mono* (物, 者), "thing"; it specifically implies an item or commodity rather than an ontological entity. The choice of *hin* may thus reflect the more materially typified nature of Japanese names.

[28] 介類, "Shelled things" This inclusive term variously covered turtles, barnacles and other shell-bearing organisms, and in fact no pre-Meiji Japanese work confined itself entirely to the Mollusca.

[29] 日東魚譜. See http://www.wul.waseda.ac.jp/kotenseki/html/ni15/ni15_00712/

These lists were gathered by the provincial administrations and sent to Edo. The majority of provinces had compiled their reports by 1738.

There are considerable differences among the provinces, but sixteen of them reported between 12 and 68 mollusk species, with an average of 40. Coastal people can thus be said to have been able ordinarily to distinguish several tens of shelled animals. However, the Kii Province, as is explained below, was a special case. By the eighteenth century it was already famous among collectors for its shells, as shown by the large number of somewhat ornate names in the *Kii sanbutsu-chō* that clearly originated with collectors, such as *Tsukihigai* (Moon and Sun Shell)*, Uzuragai* (Quail Shell) (fig. 2)*, Kujaku-gai* (Peacock Shell) and *umi-no-hana-gai* (Flower of the Ocean). There are over 130 such names, and the total for the work greatly exceeds that of any of the other provinces.

Japanese names for Japanese things: wamei versus Latin

Although Dutch, English and Portuguese traders in the 16th century introduced some Western language to Japan, their banishment and the almost complete closure of the country after 1635 to cultural influence from outside meant that the ongoing development in the West of a stable system of nomenclature and the accompanying revolution in the methods of classification went largely unnoticed.

This was the Edo period, during which the country was governed by successive shoguns[30] of the Tokugawa family from their castle in Edo (present-day Tokyo) via a sophisticated bureaucracy, feudal-style fealty and a system of taxation based on land and crop values. With the exception of a trading station run by the Dutch East Indies Company at Dejima in Nagasaki, direct intercourse with foreigners was forbidden along with international trade and travel in either direction.

[30] Military governors; the nearest Western equivalent might be the roughly contemporaneous Oliver Cromwell.

During the late 18th and early 19th centuries a considerable amount of western scientific literature was nevertheless translated and studied, mostly by scholars in the government and domain schools and with a particular focus on medicine. By contrast, local publications remained entirely in Chinese or Japanese and there were few attempts to construct schemes of classification beyond those implied by common elements in the vernacular terms. In most Japanese works *Bencao Gangmu* continued to provide the framework for higher classification.

In Europe, meanwhile, the study of nature enjoyed growing patronage that during the seventeenth and eighteenth centuries reflected at least in part its role as a stalking horse for non-religious philosophy. Thinkers such as Spinoza and Locke looked as much to nature as to scripture for the universal laws that they felt should guide a rational, modern society. From the late eighteenth century in particular, scholarship in medicine and other natural sciences increasingly competed with piety and military prowess as drivers of upward social mobility. At the same time that respectability was accruing to the systematic study of botany and zoology, the intrepid voyagers of the Age of Exploration were returning with ample new material for the cabinets and museums of Europe. Explorer-scholars such as Banks, La Condamine and Humboldt leveraged royal favor and patronage in setting up research institutions, botanical gardens and museums that would in turn nurture new generations of natural scientists.[31]

This enthusiasm for nature studies was reflected in a stream of often lavishly illustrated books with plates laid out in a scheme originally developed for the comparative illustration of antiquities.[32] The first major iconography of shells was Filippo Buonnani's "Ricreazione" of 1681. Buonnani deduced relationships by comparing similar-looking organisms, and placing them together accordingly. The figured shells were numbered and described in this way:

[31] O'Brian, 1997
[32] Moser, 2014.

> 274 *Purpura Echinophora fiuè Echinata, fic dicta a validis aculeis in prima circumuolutione ementibus. Appellatur etiam marmorea è testa ponderosa, & dura. Vt plurimum albescit in parte exterior, quae partim videtur malleo contuse, partim in puluillos tumet, oris autem labrum spissis strijis aspersum mire multis in locis circumplicatur. In Adriatico frequens.*

Individual taxa thus did not usually bear names that were separable from their descriptions.

By the 1750s, however, two factors brought about the shortening and detachment of names from the test. One was simply logistical: large books required indices, chapters and paragraph headings to allow fast look-up of individual entities. At the same time too, authors were increasingly creating names for *groups* of species that shared one or more distinguishing affinities. At the lowest level these group names were nouns (that often still correspond to modern genera) and the species names were all adjectives. The group and species names thus formed a simple couplet, known as a binomen, though at first the species name could still be any number of adjectives. The first work considered to be consistently binomial, with each taxon represented by one group name and one species name, was Linnaeus's tenth edition of the *Systema Naturae*. It was published in 1758, and this date was subsequently fixed as the genesis of the modern Western nomenclatorial system, with all names published prior to it losing any status under that scheme.[33]

[33] Melville, 1995.

II. Schools and society in the Edo period[34]

Education

The emergence of the scholar as a social figure in Japan dates from the early years of the Edo period. Prior to that, the only figures who could be identified as intellectuals – that is, people whose social standing derived purely from learning and not from commerce, profession or family – were Buddhist monks or members of the Imperial court. Starting in the first decade of the seventeenth century successive shoguns gradually established the role of public scholar through selective sponsorship and patronage, partly in order to supplant the Buddhist clergy as the seat of learning.[35]

Although the shogunate stressed the importance of schooling for the ruling classes, at no point during the Edo period did the national government establish general education. Nevertheless, as the eighteenth century progressed, the number of elementary schools or *Terakoya*[36] administered by the heads of individual villages grew to the point where most children had at least the chance to attend one. The teachers were all volunteers and despite the considerable social standing that went with the title, no qualifications were required and little if any compensation was offered.

Although some education was compulsory for all ranks of the Samurai, opportunities also existed for commoners from suitable backgrounds and with sufficient means to receive training in practical fields such as engineering, astronomy and medicine – and through the latter, natural history. For young adults this instruction normally followed the classic master-apprentice arrangement, but children of merchants and other commoners with sufficient ambition and ability could gain a place in one of the official Samurai schools. At a more local level, most of the

[34] This section draws in part on Passin, 1965 and Marshall, 1994.
[35] Marcon, 2015.
[36] 寺子屋

roughly 280 domains into which Edo Japan was divided operated their own schools, accommodating a mixture of commoners and Samurai. These domain schools[37] grew rapidly in number during the last decades of the Edo period and were operating up until the establishment of national education by the Meiji administration in 1872. Throughout the Edo period, the domain schools maintained a distinction between science in all forms and the teaching of classics and ethics. The former was of largely Western derivation and thus deemed less appropriate for the children of the governing classes than Neo-Confucianism and latterly Japanese "national study",[38] a mixture of history and practical ethics.

At the same time, and independently of the school system, the social role of scientific scholar emerged, complete with conventions of dress and conduct but rarely with any substantial remuneration. Livelihoods therefore often depended on a mixture of patronage and private tutoring. The more enterprising scholars set up their own schools, offering to a mixture of Samurai and commoners a relatively liberal curriculum in which science and other Western subjects were taught in tandem with the more conventional Confucian ethics and Chinese classics. The best chance at a scientific education during the Edo period would thus be at one of these private academies.[39]

From the point of view of wamei, the activities of early Edo scholars such as Hayashi Razan and Kaibara Ekiken led to an increase in dictionaries, lists and indexes that directly equated Chinese names with existing Japanese ones. Though their mode of inquiry was primarily lexicographical rather than experimental, popular engagement with natural science nevertheless grew as they lectured to an ever broadening range of audiences.

---

[37] 郷学 *Gōgaku.*
[38] 国学 *Kokugaku.*
[39] 私塾 *Shijuku.*

Nature collecting and shell books[40]

Of the taxon-specific divisions of natural science, malacology is probably the most useful in the study of the modern history of wamei. Although botanical names have deeper roots in the Honzō era, a larger proportion of them were imported names that did not refer to Japanese plants.[41] Chinese works featured very few mollusks, however, while Japan already had a fairly large body of vernacular names for them. During the Edo period shells were the subject of some of the most detailed new works of identification and produced the fastest-growing body of new wamei for any group of organisms. The reasons for this are bound up in part with a growth in leisure time and a fashion for nature collecting among the higher echelons of society, including the wives and concubines of domainal officials.[42]

Japan has one of the richest molluscan faunas of any country on earth, with a particularly grand diversity in shallow and shoreline marine habitats. An hour's beach collecting almost anywhere on the Pacific coasts can yield dozens of species. The former province of Kii[43] lies roughly in the center of the country and is probably unique in the world for its molluscan diversity. The warm, shallow Black Current[44] runs northwards from the Philippines and washes the shores of the southwestern part of the Kii Peninsula before turning southwards towards the Ogasawara Islands. Its influence supports a huge fauna in tide pools and shallow water that includes many species known from as far away as Australia and East Africa.[45] At the intermediate depths reached by fishermen's nets, however, there are also many species that are

[40] This section draws in part on the works of Isono, especially 1996, and Kanamaru, 1930-58.
[41] Fukukoka, 2012.
[42] Isono, 1996.
[43] Present-day Wakayama Prefecture in central Honshū.
[44] 黒潮 *Kuroshiō.*
[45] Many mollusks spend part of their lives as larvae, swimming in the plankton. Species can therefore be distributed over very wide distances, and in a few cases are effectively known worldwide.

endemic to Japan, and deeper still there is a different fauna linked to the deep, cold Linan Current that runs southwards from the Okhotsk Sea beyond Hokkaido.[46]

Kii has been famous for shells since early times, and they featured prominently in the collecting boom of the Edo period. Its relative proximity to the mercantile city of Osaka and the imperial capital of Kyōto meant that shells brought in by fishermen found their way via dealers into private collections throughout the region, a connection that continues today.

The lively trade in shells during the Edo period is reflected in three works by the Kii-based dealer Sakaiya Kiemon.[47] The first is *Kishū kaihin kakiage*, a list of 337 local shells produced to order for the provincial government in 1813. The second is *Tanabe kai karoku*, a price list of 261 shells from the following year. Kiemon also published a similar undated price list under the title *Nayose kai karoku*.

For collectors in the capital, meanwhile, a day's ride from Edo would bring them to Kamakura on Sagami Bay, and in particular the island of Enoshima with its famous shell shops. These were mentioned in the first printed book on shells, Ōeda Ryūhō's *Kai tsukushi ura no nishiki* (1749).[48] Although much of the content relates to cultural aspects of shells such as poetry and shell-matching games, this book also contained figures of 212 species. An important feature is the classification of the shells into six divisions: 蚌(*bō*), 蛤 (*hamaguri*),螺 (*ra*), 無対(*mutai*), 異類(異形) (*ikei*) and 貝 (*kai*). *Bō* are long, slender bivalves; *Hamaguri* are round bivalves; *Ra* are coiled gastropods; *Mutai* are abalones, limpets and other flattened forms (nowadays mostly classified as gastropods); *Ikei* are sea urchins, starfish, barnacles and others and *Kai* are cowries. This was the first work to distinguish *Mutai* and *Ikei* as independent classes, and most subsequent shell books followed suit.

---

[46] Higo *et al*., 1999.
[47] Little is known about Kiemon except that he was active as a shell dealer from at least 1813 to 1836.
48 貝尽浦の錦

A complement to *Kai tsukushi ura no nishiki* was *Nagisa no Tama*[49] or *Kai yose no ki*[50] by the famous collector Kimura Kenkadō (1736-1802). This undated work gives an overview of the shell-collecting hobby from its origin onwards, listing famous localities and drawing on literature and poetry from as far back as the *Kii-manyō*. From Kenkadō's introduction, it seems his intention was to create a companion book of pictures of rare shells. This was never published, but the manuscript survives today with the title *Kikai-zufu* (fig. 4). This work is famous for the first picture anywhere of a Recent slit shell (as *Mumei-gai* or "nameless shell")[51] together with other rarities.

In the middle part of the Edo period, medical botanists were joined in their investigations of the indigenous flora and fauna by a small but energetic and growing community of true naturalists – people whose interest lay in defining and cataloging diversity for its own sake. Rather than studying botany, many of these *aigansha*[52] collected minerals, shells and other durable natural objects. They developed, arranged and displayed their collections with the same pride and enthusiasm as did their counterparts in Europe. A few such collections survive today, perhaps most notably that of the above-mentioned Kimura Kenkadō, which is still largely intact and in what are thought to be its original cases.[53]

Books on particular groups of animals and plants began appearing during the middle part of the Edo period. Apart from the shell books detailed above there were several on insects and arthropods, including Kurimoto Tanshū's *Tanshū Chūfu* (1811) and Mashiyama Masakata's

---

[49] 渚の宝
[50] 貝よせの記
[51] *Mikadtrochus beyrichii* (Hilgendorf, 1877). The Slit Shells are so-called "living fossils"; the first to be named scientifically was *Perotrochus quoyanus*, described from a shell by Fischer and Bernardi in 1856 but not found alive until 1879.
[52] 愛玩者 "One who loves and nurtures" – literally an amateur.
[53] Masutomi *et al.,* 1982.

Chūchijō (1807-12); birds, typified by Hotta Masa'atsu's *Hotta Kinpu* (late 17th century), and fishes, notably Okugura Gyosen's *Suizoku Shijō* (ca. 1801).[54]

However, not all such works were printed. In many cases the original was hand-drawn and was subsequently copied by laying thin paper over each page and tracing the images and often - though not always - the captions. Color was often added to the copy, though monochrome versions of color originals also exist and vice-versa.[55] Books were loaned specifically for the purpose of copying, and nowadays a copy often provides valuable clues as to the date and authorship of the original, particularly where the latter is lost.

Clubs and fairs

From the middle Edo period onwards, amateur naturalists formed clubs for the purpose of displaying their collections and exchanging information. The best known among historians today are the Shabenkai in Toyama,[56] the Shōhyakusha in Nagoya[57] and the Yamamoto Dokushōshitsu in Kyoto.[58] The members of these clubs were predominantly aristocrats and high-born Samurai, but in order to gather more detailed local information on plants and animals, they and others began to open up their private meetings to a broader audience by holding regular expositions called *Bussan-kai*.[59] Members of the public were encouraged to bring specimens, drawings and anecdotes to these events and to share their knowledge with the organizers. To attract more people the expositions featured exotic animals and demonstrations of interesting new

[54] For more on these works, see Kimura *et al*., 1988
[55] A copy made directly from an original is called a *shahon* 写本; one that was itself made from a copy is a *tenshabon* 転写本.
[56] Marcon, 2015.
[57] Fukuoka, 2012.
[58] A modern equivalent is the Ikimono Bunkashi Gakkai, a club for nature lovers whose patron is Prince Akishino, younger brother of Crown Prince Naruhito. Its meetings and publications bring together scholars from many fields along with teachers, students and members of the public. www.net-sbs.org For more on contemporary shell clubs in Japan, see Appendix 1.
[59] 物産会, literally "conferences of things and products". Alternative names were *yakuhinkai* (medicinal product meetings), *honzō-kai* (medicinal plant meetings) and *hakubutsu-kai* (natural science meetings). Aso, 2014.

discoveries such as static electricity.[60] Widely advertised via handbills and posters, these meetings grew in scale and frequency from the middle seventeenth century and became an established form of popular entertainment at which people of different social strata could freely mix. In this way, independent scholars such as Hiraga Gennai (1729-79) were also able to gather local knowledge efficiently by attracting potential sources and encouraging them to share.[61] For their part, the organizers of bussan-kai published catalogues, guides and commentaries that added to the growing body of Edo natural science literature.[62]

It was through these three developing activities – dealing in natural specimens, gentlemen's science clubs and local citizen science fairs – that the vernacular system gained breadth and detail as the eighteenth century led into the nineteenth. By the end of the Edo period, the number of vernacular names for shells might have been around two thousand. Iwahashi San's 1869 work *Kaihin Ikai* compiled 1,836 names from existing literature, and though it is impossible to tell how many individual species they represented this is a considerable sum (table 2).

[60] Haga, 2003.
[61] Roberts, 2009.
[62] For more on Bussan-kai and Yakuhin-kai see Isono, 2001 and Endō, 1985.

III. The Meiji period: national learning

The Meiji reforms and national education[63]

The opening of Japan to western trade that began with the Treaty of Kanagawa in 1854 and accelerated following the Meiji Restoration of 1868 inspired a radical revision of official attitudes to western science and culture. The Meiji government dispatched missions to Europe and the USA to observe and assimilate the latest practices in fields such as civil administration, engineering, medicine, chemistry and military technology. At the same time, foreign advisers and teachers were invited to Japan to help establish new schools and universities and they in turn chronicled in books and articles the rapid progress of Japan's new technoculture.[64]

Botany began to advance earlier in the Meiji than zoology or Mineralogy, with Linnaean taxonomy having been tried out even before the transitional period between Perry's 1853 landing and the restoration of the emperor in 1868.[65] However, old habits die hard. As evidence of the still considerable influence of Honzō over early Meiji natural science, Ueno (1931) cites the earliest post-restoration botany text book *Shokugaku senkai shohen* (Monbushō, 1874) in which author Ono Motoyoshi states "I translate 'Physiological botany' as *seiri honzō* and 'Systematical botany' as *bunka honzō*", reflecting the continued confusion and commingling of Honzō and Western botany. This was not surprising; many of the leading figures in early Meiji biology were former samurai whose careers were rooted firmly in the honzō era, including Itō Keisuke and Tanaka Yoshio.

Before the establishment of the universities, the Natural History Division[66] of the Education Ministry played an important role in advancing and disseminating biology. Under its influence

---

[63] This section draws in part on Ueno (1931), Marshall (1994) and Hasegawa (1999).
[64] See e. g. Griffis, 1876; Hartshorne, 1902; Morse, 1917.
[65] The *bakumatsu* or "end of the shogunate" period.
[66] 博物局 *Hakubutsu-kyoku*; later transformed into the Imperial Science Museum, now the National Museum of Nature and Science.

natural history was added to the new elementary school curriculum in around 1872. At the same time, efforts were made to more firmly establish the terms *dōbutsu* and *shokubutsu* for animals and plants respectively and thereby to bring the still somewhat nebulous sense of natural system more into line with Western practice.[67]

Zoology textbooks in the Meiji period and the evolution of the modern wamei

Helped by newly purchased Western printing presses and typesetting systems, Japan's already developed and highly competitive publishing industry produced a vast number of titles in support of the Meiji administration's goal of improved public education.[68] In addition to the many stand-alone works, large encyclopedias such as *Hyakka zensho*,[69] published by the Education Ministry between 1876 and 1883, also contained volumes on zoology. The Ministry produced wall charts and teaching manuals for school use, including:

Tanaka Y. (Ed.) 1872-1877. 動物掛図 *Dōbutsu kakezu*. Five charts.
Ono, M. 1873-1878. 植物掛図 *Shokubutsu kakezu*. Five charts.
Katayama, J. 1876. 博物教授書 *Hakubutsu kyōju-sho*. Four volumes.
Shima, S. (Ed.) 1876. 博物教授法 *Hakubutsu kyōju-hō*. Three volumes.
Ono, M. & Abe, T. (Eds.) 1877. 博物図教授法 *Hakubutsu-zu kyōju-hō*. Two volumes.

In addition it published full text books, including Itō Yuzuru's "Concise Botany";[70] "Simple botany",[71] edited by Tanaka Yoshio, Ono Motoyoshi and Kubo Hiromichi, Matsumura Jinzō's "Elementary Botany"[72] and many others (fig. 6).

The separate Natural History Division of the Ministry of Agriculture and Commerce[73] also sold framed sets of specimens for teachers, including "Samples of useful Japanese animals"[74]

---

[67] Miller, 2014.
[68] For a history of the early publishing industry in English, see Kornicki, 1998.
[69] 百科全書
[70] 植学畧解 *Shoku-gaku ryakkai*, 1874.
[71] 植学浅解 *Shokugaku senkai*, 1875.
[72] 植物小学 *Shokubutsu shōgaku*, 1881.
[73] 農商務省 *Nōshōmushō*. The Natural History Division 博物局 *hakubutsu-kyoku* was established in 1881.
[74] 日本有用動物見本 *Nihon yūyō dōbutsu mihon*, 1879.

selected by Yoshio Tanaka and "Samples of useful Japanese plants"[75] selected by Ono Motoyoshi.[76]

Like many other industries, educational publishing in the Meiji period was principally centered in Tokyo. A location in the city offered quick access to government offices and enabled vertical integration with local firms engaged in all aspects of book production, such as typesetters, printers, engravers and binders. However, regional publishers also produced school books; Osaka, Japan's second city and the home of much of its commerce, had its own publishing community, as did many of the former domainal capitals. Many of the pioneers of Meiji zoology authored and edited text books, including Iijima Isao, Tanaka Yoshio, Ishikawa Chiyomatsu and Mitsukuri Kakichi.

The majority of the works listed in appendix 2 here were intended as study guides or text books for specific levels or fields of education. Titles include terms such as *Kunmō* (beginners) *Shogaku* (elementary scholar), *Chūgaku* (intermediate scholar) and *Juken* (examination). School levels indicated in titles include *Shōtō* (primary), *Chūtō* (middle school) and *Kōtō* (high school), and there were numerous compilations of *Mondō* or "questions likely to arise in examinations", with their answers. For the general reader there were *Futsū* (everyday) and *Tsūzoku* (popular) zoology books, and others aimed at *Joshi* (students at girls' schools). New works and editions appeared constantly, and in the spirit of competition the same title was often shared by books from different authors and publishers. The terms *Shinsen* (new selection) and *Shinpen* (new compilation) were added to increase the market appeal of new editions.

In its early years the Meiji government exerted little control over the content of teaching materials, but from 1887 the Education Ministry began formally vetting all text books sold to schools and after 1903 it established a monopoly on the publication of elementary school texts

[75] 日本有用植物見本 *Nihon yōyū shokubutsu mihon*, 1876.
[76] The cheap (5 sen) books and wall charts were known as 教草 *oshiegusa*, literally "teaching leaves".

that lasted until 1945. Though aiming chiefly at setting the correct moral tone and expunging undesirable concepts such as communism and anarchism from school curricula, the requirement that all school books bear an official permit was extended even to uncontroversial subjects such as zoology.

Even as Western science drove Japan forward into full industrialization, however, the pages of late nineteenth century zoology text books reflected the reassertion of a purely vernacular idiom after the experimentation with foreign languages in the early Meiji period. The Japanese reader was introduced to many new terms and concepts during this period, and it was up to authors and publishers to determine the form in which they would enter the Japanese sphere. There were three methods, which could be freely mixed even in the same work: to use Latin and English directly, set in Roman type; to transliterate foreign terms phonetically, using one or both Kana scripts, or to use a combination of existing and new vernacular terms expressed purely in Japanese text.

Early in the Meiji period – year 5, or 1862 – one of the first works of the new era appeared. *Hakubutsu shinpen*[77] was a general encyclopedia that included engineering, astronomy and other scientific topics. Volume 3 covered zoology and included four plates of animal figures (fig. 5) but its organization remained that of the Edo period – mollusks were included in the *konchū-rui* or insects. The work was based on a book written in Chinese by the English missionary and physician Benjamin Hobson (1816-1873),[78] translated and published by Komuro Sei'ichi. It ran to several editions, but was clearly of an earlier age in respect to the natural sciences.

The science encyclopedia *Shogaku shūchi*[79] was published by the Ministry of Education in eleven parts between 1875 and 1876.[80] It was basically a translation of Garrigues's "Simples

[77] 博物新編 "Natural History, New Edition".
[78] His Chinese name, reproduced on the title page, was 英國 合信 – "Englishman *Hap'sin*" or Hobson.
[79] 初学須知

lectures sur les sciences, les arts et l'industrie, à usage des écoles primaires", a large general work first published by Hachette in 1862 and reissued in revised and enlarged editions for over forty years.[81] In converting it into a Japanese text book, the translators had to deal not only with foreign names for things but with European measurement systems. At least in the fields of science and engineering, Japan was heading towards imposing the metric system over the existing one,[82] and the French terms were simply transliterated: メートル *mētoru* for "meter" and サンチメートル *sanchimētoru* for "centimeter".

Naming animals was not quite so simple, however. The figure captions in the zoology section[83] display an eclectic approach that uses Kanji names flanked by katakana renderings of the relevant French term. For example: figure 42 is of a pearl; it is captioned with the kanji for the Japanese term, 真珠 *shinju*, but alongside that is the kana ペル *peru* (perle), thus typifying via the figure a direct equivalence between the meaning of both terms. In the same way, the coral in figure 44 is captioned 珊瑚 *sango* with コライユ *koraiyu* (coraille) alongside and the beaver in figure 12 is a 海狸 *kairi*, with the kana カストル *kasutoru* (castor). This direct phonetic transliteration appears in the text too, with terms such as タランチュール *taranchūru* for "tarentule" (tarantula), a creature that lacked an existing kanji name as it is not known in Asia[84]. Given the large number of new terms used in *Shogaku shūchi*, it is not surprising that a dictionary of them quickly appeared (Shimizu, 1876-77), though from a different publisher.

---

[80] It was subsequently also issued by other publishers, such as Ekichikan in Kanazawa.

[81] The 26th edition appeared in 1905; from the 1880s the work was revised and co-authored by Louis Maurice Boutet de Monvel.

[82] As was the case in the UK and remains so in the USA, the metrication of units of land and area measurement, such as yards and acres, and volume, such as pints and gallons, lagged behind that for the linear measurement units used in science.

[83] Volume 5, divided into either two or three parts depending on the edition; translated by Tanaka Kōzō.

[84] The history of this standard is interesting. Animals that were familiar to people within the Chinese-speaking sphere such as camels (駱駝 *rakuda*) and tigers (虎 *tora*) were denoted from early times in Japan using their kanji names, despite not being part of the Japanese fauna. However, the South American tarantula was a stranger to everyone in Asia at first. It later acquired a kanji name too, 鳥食蜘蛛 *torikui-gumo* or "bird-eating spider", but the transliteration

In 1884, Maruya (now Maruzen) published *Nippon shokubutsu mei'i*[85] with the English title "Nomenclature of Japanese plants in Latin, Japanese and Chinese". This was a dictionary of plant names compiled by Matsumura Shinzō and Yatabe Ryōkichi that listed Latin names in Roman type, Japanese names in kana and Chinese names in kanji. It is an interesting work that follows the indigenous standard for transliteration, the Kunrei system. A little historical context will help here. Within the Japanese language there have been many conventions for the phonetic transliteration of words (both native and foreign) via kana, and the stable one-to-one linkage of symbols to sounds that modern learners enjoy is actually no older than the end of World War II. Prior to that, the same sound could be portrayed using different combinations of kana; for example, "kai" could be written カイ or カヒ; "ko" could be コ or カウ, and so on. The situation had been fluid for centuries, with different cultural fields tending to favor particular conventions, but no national standard existed for published works.[86]

The relevance of this to our story is that Japanese orthography, both within the language and in transliteration to Roman script, was highly fluid during the 19th and much of the 20th centuries, and that names could be written using various spellings and scripts, none of which was "wrong". Unlike scientific names, the validity of wamei relied only on their being recognized and not on a particular spelling.

E. S. Morse and the Imperial University

The study of zoology using Western conventions in Japanese schools and universities began with the establishment of Tokyo University in 1877, where the American Edward Sylvester Morse (1838-1925) was the first professor to teach classes on general zoology and the principles

---

taranchura is almost exclusively used in Meiji literature. Note that it was corrected to "tarantula" from "tarentule" as English replaced French and German as the base standard for scientific literature.

[85] 日本植物名彙

[86] And still does not. For more on this subject, see Shibatani, 1990.

of evolution.[87] In common with most of the foreign professors he lectured in English, though a few others chose French or German.[88] None of them used Japanese, of course, and foreign teachers were actually discouraged from learning Japanese at all.[89] Students were expected to take notes and keep up through their own efforts, but at the same time the university established an English preparatory school, the Tokyo Eigo Gakkō, for aspiring future undergraduates.

Morse was keenly aware of the social aspects of science and in 1878 he and Yatabe Ryōkichi[90] founded the Tokyo Biological Society, which steadily grew into the present-day Zoological Society of Japan. They also established the Misaki Marine Biological Station in 1886, where Morse's field work focused on mollusks and other marine invertebrates.

A group of graduate students had early on begun distributing to their fellows Japanese translations of important lectures. In 1888, the Zoological Society took over this role and began publishing the *Dōbutsu-gaku Zasshi* (Zoological Magazine) using Western and Japanese vernacular nomenclature in a consistent, side-by-side fashion that continues today (fig. 7). The magazine's content and style evolved over its first two decades into a stable layout that became

[87] An accomplished zoologist in several fields, Morse had been a student and protégé of Louis Agassiz at Harvard. Apart from his writings in science, his highly curious mind and trained draftsman's hand created books such as "Japanese homes and their surroundings" (1886) and "Japan day by day" (1917). See Howard, 1935 and Wayman, 1942.

[88] These were the only three languages permitted by the Journal of the Faculty of Science, founded in 1887. The preface to the first issue stated: "The necessity for this tri-lingual character springs, of course, from the very peculiar but well-known conditions under which Science has been cultivated in Japan and by the Japanese".

[89] Montgomery (2000: 220) states "…no part of the government's plan ever involved teaching foreign professors the Japanese language. Those…who did learn it were discouraged from using it in their professional work. Their books, articles and lectures were translated by students, who therefore carried out the national plan for knowledge control by maintaining control over the development and use of scientific discourse itself. Westerners, that is, very rarely added to this discourse themselves in any direct way". This assessment might overestimate somewhat the influence of college students on national policy; it is equally likely that they were simply concerned with graduating and thus not disgracing their families. That foreign lecturers did not have direct access to government decision-makers is unremarkable, but their teachings - particularly of evolutionary theory - profoundly affected Meiji political theory.

[90] Yatabe Ryōkichi (1851-1899) was the first Professor of Botany at the Imperial University. A former teacher at the Kaisei Gakkō, the forerunner of the university, Yatabe studied at Cornell from 1871-6 and joined Morse as a founder of the science faculty in 1877.

the model for numerous others publications, including Hirase's Conchological Magazine (1907-1915).

The use of English as the language of natural science in Japan clearly was a temporary arrangement that it would be difficult to maintain once the first generation of native students themselves became professors. By 1891 the Imperial University had begun publishing a compilation of entrance examination questions and answers in science that contained not a word of English or Latin, or indeed any Roman type at all. Diagrams were captioned solely in Japanese and numbered using traditional Chinese numerals instead of Arabic numbers (figs. 8, 9).

It was around this time that the government decided to return all formal education to the Japanese sphere and the Education Ministry thus began actively suppressing the use of foreign languages in teaching.[91] Eisai Shinshi-sha's *Juken hitsuyō dōbutsu-gaku mondō* ("Questions and answers in zoology necessary for sitting examinations") of the same year similarly featured only Japanese, as did its 1892 counterpart of the same title published by Kawai Unosuke and the 1896 *Dōbutsu-gaku mondō* ("Questions and answers in zoology") by Fuzanbō (fig. 9).

Thus it was that the emergence of the first generation of modern Japanese natural scientists in the early 1880s coincided with a more general conservative movement to limit the westernization of education and both had clear implications for the future of wamei. Modernizing Japan had no intention of abandoning the investigative rigor of Western science, but could not promote social integrity through its education system if science continued to depend on foreign languages. Though the use of Latin notation in scientific journals and books continued, therefore, it vanished entirely from school and college texts. Furthermore the proposals by some early Meiji reformers - never widely supported, it must be said – that English

[91] Passin, tom. cit.

could supplant Japanese at popular level, or at least that the alphabet would replace kanji and kana, were quietly retired.

Western works on Japanese Malacology

To Japanese shell collectors the first sight of mid-nineteenth-century Western works on their fauna must have come as a shock. During the Edo period, a small number of foreign shell books were already present in private hands[92] and these did illustrate some species that are present not only in Japan but over a broader range in the Pacific and Indian Oceans. However, the more recent books that arrived after Perry (including Jay's report on the Japanese mollusks collected by the Perry Expedition itself) were more sophisticated in their taxonomy and illustrations by an order of magnitude.

Western authors who worked on Japanese mollusks, like Dunker (1861), Lischke (1869) and Kobelt (1879), routinely referred to works on the fauna of other regions in order to place the species in genera and families that had been named a century earlier by Linnaeus, Lamarck and others.

These works used the new technique of lithography to depict with almost photographic realism Japanese shells whose original owners had obtained them piecemeal, mostly through the Dutch settlement at Dejima. In addition to books, Meiji Japanese scientists also encountered papers by (among others) Arthur Adams,[93] Edgar Albert Smith[94] and Augustus Addison Gould[95] that described shells dredged directly off Japan's guarded coasts during expeditions mounted by the British and United States governments. Before Japanese authors had a chance to start formally naming indigenous species, therefore, they realized that much of the fauna had already been worked up – but only in Latin.

---

[92] For instance, Hiraga Gennai owned a copy of Rumphius's "d'Amboinischer Raritäten-Kamer" of 1705. Haga, 2003
[93] Trew, 1992
[94] Trew, 1993
[95] Johnson, 1964

Western literature thus introduced Japanese workers to a taxonomical scheme that extended outwards in both time and space and placed their familiar species in broader networks. In this sense, it challenged the essentially local knowledge embodied in wamei by presenting a more extensive and putatively accurate portrait of a nature free of geopolitical barriers. Japanese authors faithfully reproduced this scheme of higher classification and created equivalents for both its terms and the various group names. As demonstrated below, however, the wamei remained the basis of species - and genus-level determination. Japanese genera were not necessarily the same as Western ones.

Modern scientists: Ishikawa Chiyomatsu, Iwakawa Tomotarō and the Zoological Magazine

In the field of mollusks, the reforms of the Meiji period gave Japan its first modern scientists. Ishikawa Chiyomatsu (1861-1935) was one of Morse's first students, graduating in 1882 and joining the staff as an assistant professor the following year. He then spent three years in Germany, studying at Freiburg under the noted evolutionist August Weismann and returning to work first in the Faculty of Science and latterly (1890-1924) as a full professor in the College of Agriculture. Among a vast body of published studies his work on freshwater fish culture is particularly noted, but he also worked on squid and other marine invertebrates. Ishikawa's most significant works, however, were his translations and original pieces on evolutionary theory, including Japanese summaries of Morse's lectures[96] and of Darwin's writings[97]. Interestingly in regard to wamei, in 1926 Ishikawa was elected the first Japanese member of the Commission for Zoological Nomenclature.[98]

Iwakawa Tomotarō (1855-1933) can claim to be Japan's first true malacologist. Though he initially studied engineering at a domain school in present-day Aomori Prefecture, Iwakawa also

[96] As *Dōbutsu Shinkaron* [Animal Evolution], 1883.
[97] See Ishikawa, 1935-6. Some material here is from *Nippon dai-hyakka zenshō* (Nipponica) published on line by Shogakukan at https://kotobank.jp
[98] For a discussion of the broader political significance Darwin's theories in Meiji Japan, see Miller, 2014.

learned English under the guidance of Charles Wolff at the newly established Tō'ō Gijuku High School. He went on to the Tokyo College of Foreign Languages and finally Tokyo Imperial University, where he studied under Morse and his successor Charles Otis Whitman and was part of the first graduating class of the Department of Zoology in 1881. From 1886 he was a professor at the Kōtō Shihan Gakkō[99] moving in 1898 to the Joshi Kōtō Shihan Gakkō.[100] He was also curator of the mollusk collections at the Tokyo Imperial Museum.[101]

Iwakawa was a lifelong promoter of the systematic study of mollusks. His most important contribution in terms of wamei are his catalogs of the collections of the Imperial Museum (1900-1919), in which he explicitly created hundreds of new names in order both to expand the vernacular system of molluscan names to the same level of detail as Western taxonomy and to re-introduce to the vernacular sphere those species that until then had only been named in Latin.

By the late 1890s invertebrate zoology was firmly established in Japan, with workers such as Gotō Seitarō and Uchiyama Ryūtarō regularly publishing on mollusks. Following Morse's lead, molluscan paleontology was also flourishing through the diligent work of Matajirō Yokoyama, Shigeyasu Tokunaga, Jirō Makiyama and many others.

[99] The present-day Tsukuba University in Ibaraki Prefecture.
[100] The present-day Ochanomizu Women's University in Tokyo.
[101] Iwakawa, 1900 - 1919.

IV. Wamei in the present day

Structure and formation of wamei

Wamei all contain at least one noun that either stands alone or is modified by adjectives, adjectival phrases or other nouns in apposition. Transliterated into the Roman alphabet, they vary in length from one syllable (e. g. *Bai*, the sea snail *Babylonia japonica*) to longer phrases such as *Kusabi-otohime-gokoro-gai* or *Hoso-juzukake-kudamaki*.[102]

Most Japanese nouns are compounds, formed from two or more kanji:

車 *sha* (wheel) + 軸 *jiku* (axis) = 車軸 *Shajiku*, a spindle

These can be joined to make compounds by simple apposition:

Shajiku-matsumushi[103]

Harabuto-shajiku[104]

or by using particles such as the possessive *no*:

Takonomakura (a kind of sea urchin): *tako* (octopus) + *no* (possessive) + *makura* (pillow), thus "octopus's pillow"

Writing conventions

Wamei in text books and papers are nowadays written using Katakana, one of the two 51-character phonetic syllabaries that augment kanji in written Japanese. This practice goes back to the early Honzō era, when (as outlined above) idiomatic Japanese readings based on existing oral tradition were created for written Chinese characters. These syllabic renderings gradually displaced Kanji altogether, though up until the early twentieth century both Hiragana and Katakana were used interchangeably. The former is now used for all grammar and regular prose,

[102] "Wedge-shaped princess heart shell" and "Slender pipe-thread covered with beads" respectively. Wamei are nothing if not poetic. The longest of all is thought to be the plant name *Ryūgū-no-otohime-no-motoyui-no-kirihazushi* ("A cutting from the hair ribbon of the Princess of the Dragon Palace"; also known more conveniently as *Amamo*) for the sea grass *Zostera marina*.
[103] *Columbellopsis hirundo* (Gaskoin, 1851)
[104] *Turridrupa cerithina* (Anton, 1838)

while Katakana is reserved almost exclusively for phonetic renderings of foreign loan words and writing wamei.

A collection manager and museum educator interviewed for this study astutely pointed out the distinction between names written in kanji and those in katakana: "Writing wamei in kanji gives a "cultural"[105] impression, as that is how they might appear in old literature, whereas written in katakana they seem more objectively to represent the organism itself. If a newspaper article reported the finding of an animal and gave its wamei in Kanji, it would give a very uncomfortable[106] impression. Within science the standard is to write wamei in katakana in order to indicate reference to the organism and not the cultural entity." This emphasis on the ontological transparency of wamei is important, and is discussed more below.

When written in Japanese, no spacing or other notation divides a compound's elements.[107] To make them more easily readable in the Roman alphabet, therefore, hyphens and occasionally apostrophes are used:

Takonomakura: *Tako-no-makura*

Masaaki (a male name): Masa'aki

Elements of wamei

Core nouns

As outlined earlier, the oldest wamei predate Japan's adoption of the Chinese writing system and their original derivation is thus unknown. Early encyclopedias such as *Honzō Kōmoku* and *Yamato Honzō* phonetically encoded these Japanese names using special readings of

[105] 文学的 *bungakuteki.*
[106] *sugoku kimochi ga warui*
[107] This is also the case with some English vernacular names, such as "blackbird" or "dogbane", but not with others, such as "horse chestnut" or "praying mantis".

kanji.[108] These were then linked to kanji with a specifically molluscan meaning (figs. 1, 3). The latter often contain the element 虫 *chū*, which nowadays is taken to mean "insect" but in the Honzō era encompassed other invertebrates, such as worms and leeches:

蝶 *mate*, a razor clam (Solenidae)

蠣 *kaki*, an oyster (Ostreidae)[109]

Apart from these earliest names, however, the majority of the core nouns in mollusk wamei invoke objects that in some way resemble the shell, and the wamei are thus metaphors:

Tsuno-gai (tusk + shell), the family Dentaliidae. Shells in the type genus of the family, *Dentalium*, resemble elephant tusks and are also known in English as Tusk Shells.

Kumo-gai (spider + shell), the genera *Lambis* and *Harpago*, also known in English as the Spider Conchs.

Modifiers

It is in the modifiers used to separate similar names – and thereby to imply relationships, whether intentionally or not – that the profound cultural grounding of wamei is most visible. Many are simple adjectives, such as *Ō*- (大, large), *Naga*- (長, long) and *Hoso*- (細, slender). A sense of size and strength is conveyed by *Oni*- (鬼, demon or ogre) and fatness is conveyed by *Futo*- (太, fat). For large, rounded shells there are also prefixes based on ranks in sumō wrestling: *Sekitori*- (関取) *Yokozuna*- (横綱) and so on. *Daiō*- (大王 great king) gives an impression not only of size but of nobility too.[110]

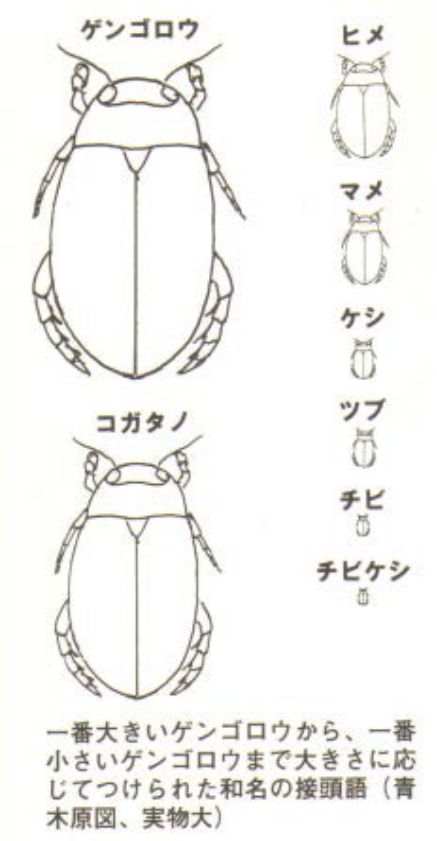
At the other end of the scale, Aoki (2002c) shows how prefixes in entomological wamei are used

[108] A common system was *manyōgana*, in which kanji were assigned phonetic readings based on those used in the 8th-century poetry collection *Manyōshū*.

[109] That these readings are phonetic reproductions of earlier spoken names is proven by the lack of any relationship between the idiomatic Japanese pronunciation and the original Chinese one (here *chung* and *li*, respectively). Cases such as 貝 (Japanese: *bai*; Chinese: *bei*), however, show that some wamei do derive from Chinese names. The wamei *kaki* has also been written using many different Kanji combinations, reflecting the importance of oysters in Japanese life.

[110] Okamoto & Okutani (1997).

to indicate relative size with some precision. He gives the example of *Gengorō* beetles, with a figure.



Term	**Body size range**
Gengorō	35-40mm
Kogata-no-gengorō	22-28 mm
Hime-gengorō	8-14 mm
Mame-gengorō	5.5-11.5 mm
Keshi-gengorō	3.5-5.0 mm
Tsubu-gengorō	3.0-4.9 mm
Chibi-gengorō	*Ca*. 2.0 mm
Chibi-keshi-gengorō	1.4-2.0 mm

(Table 1) Aoki's order of beetle sizes

This level of precision is rarely sustained in other fields, however, and many of these prefixes are elsewhere used interchangeably.

Ōno (2002a) lists wamei prefixes that indicate ecology or habitat, including *Hamabe*- (beach), *Iso*- (cliffs or rocks), *Nagisa*- (shore), *Kawara*- (river bank), *Nohara*- (field), *Hayashi*- (woods), *Tanbo*- (rice paddy), *Hatake*- (garden or plantation), *Kawa*- (river), *Numa*- (marsh), *Sunaji*- (sandy soil), *Nurechi*- (wetland), *Hora'ana*- (cave), *Kuchiki*- (rotten wood), *Ie*- (house) and

Kamado- (hearth). *Ochiba-* (fallen leaves) is frequently used for spiders and other leaf-litter invertebrates.[111]

Takakuwa (2002d) shows how the construction of descriptive wamei using prefixes can get out of hand when they are then used as group names. His example is the insect family *Toge-toge* (lit. "spiny-spiny"; the leaf beetles, Chrysomelidae), which as the name suggests, are covered in sharp spines. There is a subgrouping within the family that does not have spines, and this has the root wamei *Toge-nashi-toge-toge* (spineless spiny-spiny). One of these, however, has spine-like projections on the body, earning it the specific name *Toge-ari-toge-nashi-toge-toge* (spined spineless spiny-spiny).

Wamei group names

Until their numbers exploded in the nineteenth century, the same wamei could define both individual species and broader "kinds" such as *ga* (moths) and *ka* (mosquitoes). The adoption of modifiers as outlined above, however, created a *de facto* classification as a modified wamei implies – whether intentionally or not – a relationship to the original. The group formed by this relationship could itself be named, using as the root the name of the first or – more logically, but less frequently – the most typical species. This practice of deriving one name from another and forming groups was common in Western literature by the eighteenth century, but had also arisen independently in Japan long before Linnaean taxonomy came into regular use a century later.

The development of a clearer definition of species led to rapid growth in the number of wamei, which thus gradually divided according to specificity into general terms and species-specific names.

[111] A discussion of the roots of mollusk wamei forms part of the introduction to Okamoto and Okutani (1997)

Even in present-day Western nomenclature, ranks exist that have no formal standing. Between the subfamily and genus is the tribe, for example, and below the subspecies is the form (also known as variant or morph). These are attempts to subdivide the natural scheme more finely than is allowed by the use of the sanctioned divisions of family, subfamily, genus, subgenus, species and subspecies. However, unless they are specifically converted to group names with a suffix indicating rank (科 *-ka*, family; 亜科 *-aka*, subfamily; 属 *-zoku*, genus and 亜属 *-azoku*, subgenus) and placed within a formal hierarchy, wamei may refer (in Western terms) to a species complex, a species, a subspecies or a form. In this regard they are broader in meaning and less prescriptive concerning their relationship to each other than scientific names. This relative ambiguity compared to Linnaean ranks is seen as both an advantage and a drawback.

A name can be linked to a typified concept in two ways. In the binomial system, individual taxa have immutable epithets but are placed in genera whose membership can vary. The genus has a type species that defines it, but all other placements are conditional and apart from the type any taxon can be moved into or out of any genus.[112] The wamei, however, is a single immutable phrase. Many were coined by their authors to deliberately infer a relationship, but if that is latterly refined or disproved the name itself cannot be changed. The resulting drift away from the meaning of the original name is consistently cited as one of the most serious problems with wamei.

Above species level the Linnaean system of classification encountered no competition from any of the rudimentary Japanese ones, which in any case had never been formally codified. However, the reestablishment in the 1880s of the wamei as the basic nomenclatorial unit in the

[112] The type species of a genus cannot travel independently of its genus name. It can be placed into another genus, but in that case the younger of the two genera becomes a subjective junior synonym of the other. If the same species is the type of more than one available genus name, then they are objective synonyms and only the oldest is valid.

teaching of natural science then led to the wholesale creation of wamei-based equivalents for Linnaean higher group names.[113] In those cases where the type of the genus is present in Japan, the wamei group name may reflect correctly the type of the Latin group name:

Latin	**Japanese**
Family Turbinidae	*Ryūten-ka*
Genus *Turbo* Linnaeus, 1758	*Ryūten-zoku* Kuroda, 1928
Turbo petholatus Linnaeus, 1758	*Ryūten*[114]

However, in most cases the type of the Japanese group name (as inferred from the wamei) is different:

Latin	**Japanese**
Family Lepidopleuridae	*Samehada-hizaragai-ka*
Genus *Lepidopleurus* Leach, 1826	*Samehada-hizaragai-zoku* Kuroda, 1932
Lepidopleurus hirasei Taki & Taki, 1929	*Samehada-hizaragai* Taki & Taki, 1929

Here we see that the wamei nominally equivalent to the genus *Lepidopleurus* and the family Lepidopleuridae are based on *Samehada-hizaragai*, which refers to the Japanese species *L. hirasei*. The type of *Lepidopleurus*, however, is *Chiton cajetanus* Poli, 1791, which is known from the Mediterranean and northeastern Atlantic Ocean.[115] *Lepidopleurus* and all higher taxa based on it are thus typified differently in the wamei sphere and represent separate concepts. In this regard the wamei sphere uses a more locally relevant taxonomy, the advantages of which will be explored later on.

In the Linnaean system, as later codified by the ICZN, the name of a genus automatically becomes the root of all higher group names of which it is the type:

[113] All wamei group names here are taken from Higo & Gotō, 1993.
[114] The wamei *Ryūten* was first recorded in the book *Roppyaku Kaihin*, cited by Higo & Gotō (1993) as 1809-1824 but by Isono (1996) as having been completed at least in its original version by 1808, when it was cited in another work.
[115] Poppe & Gotō, 1991

Latin	**Japanese**
Superfamily Cypraeoidea	*Takara-gai-chōka*
Family Cypraeidae	*Takara-gai-ka*
Genus *Cypraea* Linnaeus, 1758	*Hoshi-dakara-zoku* Kuroda, 1928
Cypraea tigris Linnaeus, 1758	*Hoshi-dakara*

On the scientific side, the genus *Cypraea* is the type genus of the family Cypraeidae and thus of the superfamily Cypraeoidea, all of which automatically date from Linnaeus, 1758. In the wamei system, however, this need not occur. In the case of *Cypraea*, the type species (*C. tigris*) is present in Japan, but despite having been illustrated since the eighteenth century has the relatively recent wamei *Hoshi-dakara*.[116] The wamei of the genus *Cypraea* is *Hoshi-dakara-zoku*, mirroring the scientific arrangement, but that of the family Cypraeidae is *Takara-gai-zoku*. Despite most wamei in the Cypraeidae being derived from it (*Ryūkyū-dakara, Okinawa-dakara, Hara-dakara* etc.) there is no species with the wamei *Takara-gai* which is instead the direct equivalent of "Cowry", the English vernacular name for a cypraeid which similarly does not denote any given species.[117] In scientific nomenclature, however, a higher group cannot be typified by a gestalt or concept but only by a species, regardless of whether it is any more typical of the group than any other.

Another aspect of this case highlights the more democratic nature of wamei. Kuroda's 1928 wamei *Hoshi-dakara-zoku* has been universally adopted for *Cypraea* in preference to Iwakawa's *Baishi-zoku*, despite the latter being older (1919). *Baishi*[118] is a term used in Honzō literature for the cowries, which, as discussed later, were treated as a discrete group from the other coiled gastropods. Why Kuroda objected to the older name – of which he must have been aware, having owned and used Iwakawa's catalogs – is not clear, though as a self-taught systematist

[116] The wamei *Hoshi-dakara* was first recorded in Musashi Sekijū's book *Kōkai gunbun hin'i* (1836). See Isono (1996). *Takara* becomes *–dakara* in combinations.
[117] Cowries have long been among the most prized shells among collectors, and not surprisingly all the well-known species have English vernacular names – Tiger Cowry, Deer Cowry, Mole Cowry and so on. English vernacular names in popular groups can therefore be very similar to wamei, having arisen out of a similar community of collectors.
[118] 貝子

who began his studies after 1900 he evinced a strong affinity for the Western system and may thus have preferred to propagate the wamei for *C. tigris* upwards to reflect its typification of *Cypraea*. Whatever the reason for its creation, however, Kuroda's genus wamei has prevailed through popular usage and not by any rule of priority.

Groupings implied by wamei

With the notable exception of botanical names, many wamei contain common elements that – originally at least – imply relationships. Consider this example from the gastropod family Babyloniidae:

Latin	**Japanese**
Babylonia japonica	Bai
Babylonia kirana	Usu-iro-bai
Babylonia formosae	Taiwan-bai
Babylonia lutosa	Yamaguchi-bai
Babylonia areolata	Zōge-bai

The element *bai* links each wamei to a *Babylonia* species, and as long as none leaves *Babylonia* there might seem a direct equivalency.[119] However, in the adjacent family Buccinidae we find:

Latin	**Japanese**
Buccinum inclytum	Himo-maki-bai
Buccinum eugrammatum	Futo-himokake-bai
Buccinum surugonum	Suruga-bai

Given that the Babyloniidae was until recently a subfamily of the Buccinidae, this could simply broaden the meaning of *bai* to "buccinid". But then there are *Usu-tsumu-bai* (*Kanamarua adonis,* family Colubrariidae), *Kinshi-bai* (*Alectrion nipponensis*, family Nassariidae) and many others, albeit most still within the superfamily Buccinoidea. The term *bai* thus has at best a gestalt meaning – a rounded gastropod with a pointed spire – and together with other historically

[119] Though here again, the "genus" represented by *bai* has a different type (*Babylonia japonica*) to *Babylonia* itself (*B. spirata*, which is known from the Indian Ocean and not present in Japan).

derived terms such as *nina* (an elongated gastropod) and *bora* (a pointed gastropod with a large aperture) it is not well-enough defined to have any meaning in biology.

Such anomalies can be corrected within the wamei sphere if sufficient authority dictates it, whereas the Linnaean system is less flexible.[120] Aoki (2002d) relates how the Arachnological Society of Japan changed the family-level wamei for the Lycosiidae, which was formerly *Doku-gumo* or "poison spiders". Though some lycosiids are very poisonous, none of the Japanese species is dangerous to humans. The females, meanwhile, demonstrate careful dorsal brooding, so it was decided to rehabilitate their reputation by changing *Doku-gumo* to *Komori-gumo* or "brooding spiders".[121] Aoki does not give details of the change, such as the voting process or the date, but clearly acknowledges the authority of the Arachnological Society as the arbiter of wamei in that field.

Manuscript names

Newly-recognized entities have often appeared in print under new wamei long before they were formally described as new to science – if they ever were. This happens less often nowadays, but the legacy of more than a century of this practice is a body of wamei that may or may not represent entities that science would recognize as species in nature. Higo & Gotō (1993), for example, list at least 349 mollusk wamei that are not linked to available species names.

The survey of journals in Appendix 1 showed that 34% (249 papers) of 734 papers in the vernacular literature that referred to species used only wamei, and that 34% of those (85 papers) contained species lists. A significant portion of the vernacular literature, therefore, could be citing as-yet undescribed entities with no way for the reader to distinguish them.

---

[120] An example of the latter is the marine gastropod *Cassis madagascariensis* Lamarck, 1822, which despite its name is known only from the Caribbean and tropical western Atlantic. Although *madagascariensis* is clearly an error, it cannot be changed; the ICZN governs acts, not intentions.

[121] 子守蜘蛛

In non-specialist literature such as handbooks or museum guides, scientific names are not normally cited together with their author and date of creation, as this would be confusing to lay readers.[122] This notation is standard practice in taxonomical work, however, and though it is not required by the ICZN most peer-reviewed journals insist on it. On the other hand, very few works that use wamei, even in tandem with scientific names, cite their authorship. By not establishing criteria for their use similar to those for scientific names the vernacular community acknowledges the role of wamei as more of a notation system than a scheme of classification.

In the field of mollusks, fortunately, there is an exception. The works of Shun'ichi Higo (e. g. Higo, 1973; Higo & Gotō, 1993) are remarkable for their careful attribution of the authorship and original kanji forms of wamei. This allows the recreation of the environments in which wamei were attached to formally undescribed species and thereby the recognition of historical patterns. The "wamei-only" cases in Higo & Gotō can be divided into two main kinds:

1. Wamei that were introduced for unpublished (or "manuscript") scientific names, either at the same time or by later authors. For example:

   Trochochlamys osimakiheijii Kuroda, MS. [wamei:] *Nippara-kibi* (Kuroda, 1953). [p. 484]

Here the date and author of the wamei are given, but the scientific name is clearly noted as unpublished ("MS", a manuscript name).

2. Wamei introduced for undescribed species with no manuscript name:

   Discoconulus sp. [wamei:] *Hanarejima-hime-bekkō* (Kuroda & Fukuda, 1944). [p. 488]

Here "sp." denotes a new species belonging to the genus *Discoconulus* that Kuroda and Fukuda had identified but not yet named scientifically.

These cases reveal again the subtle ambiguity of wamei. The only way the entities to which they refer could become actors in international science would be if they were formally described

[122] The author overheard a museum visitor at the ANSP remark on seeing a label for *Cassis cornuta* Linnaeus, 1758: "Look, this was collected in 1758!"

with available scientific names. However, their wamei already have equal status to others, especially in publications where scientific names are not used.

It is not coincidental that many molluscan manuscript names with wamei are attributed to Tokubei Kuroda. By publishing them, he gave notice that he was working on those taxa and thus discouraged others from doing so. The primarily Confucian authority structures in Japanese society made this an effective tactic, as no Japanese contemporaries would show disrespect by publishing available names for those taxa without Kuroda's blessing.

V. Cultural issues: ongoing discussions

The wamei debate

There has been active debate on the use and standardization of vernacular names in zoology[123] since the late Meiji era. Nagano (1905) made probably the first mention in print of formal laws for wamei and the issue was also examined by Yano (1905). Tanaka (1915) proposed four basic criteria for fixing standard (*hyōjun*)[124] wamei for fishes and later (1939) expounded on the general idea of standardization and the basics of nomenclature. Esaki (1934) published what became known as the "principle of restriction of wamei". In more recent times, Uchida (1999) and Sengoku (2000) set out very detailed guidelines for the establishment of *hyōjun* wamei. From the contrary viewpoint, however, Nishikawa (1997) refuted the need for a set of objective rules in order to solve the wamei problem.

The interviews conducted for this study elicited a broad range of opinions and assumptions concerning the standardization of wamei. Workers in some fields, such as Ichthyology and ornithology, broadly accept the most commonly used wamei as "standard" and point to certain encyclopedias or faunal lists as the basis of this assumption. Most are aware, however, that this is a matter of consensus and not of law. One ichthyologist I interviewed stated that the most important aspect of wamei is their commonality and that standardization is thus necessary. He did not feel any particular epistemic difference between fishes indicated with Latin or with wamei, but admitted that as a professional systematist his outlook in that regard might be different to that of ordinary people. Ordinary people, in his opinion, think wamei *are* scientific names, as do journalists and the media.

---

[123] The literature on Japanese botanical names is also extensive. See e. g. Shirai, 1933; Fukatsu & Kobayashi, 1985; Fukatsu, 1989; Fukatsu, 2000. The current "standard" list of Japanese plant names is the online Ylist http://ylist.info

[124] 標準 *hyōjun*, standard or norm.

Aoki *et al*. (2002) published in book form a series of articles on various aspects of the vernacular tradition. Though written for a general audience, this work sets out in considerable detail the advantages and shortcomings of wamei. In 2012 the journal Panmixia devoted a whole issue to the discussion of problems associated with wamei, including contributions from odonatologists and ichthyologists.

Meanwhile, specialists have written on the origins of wamei in their own fields. In the Mollusca these include Kanamaru (1930), Kira (1946a) and Ekawa (*e. g.* 2008; 2012). Starting in 1973, Higo Shun'ichi expanded Kira's (1946b) list of names for the Japanese fauna, further updating and expanding it to include terrestrial and freshwater taxa (with Gotō Yoshihiro) in 1993 and adding an English version restricted to marine species (with Gotō and the present author) in 1999. Okamoto and Okutani (1997) published a partial encyclopedia of molluscan wamei that gave etymologies for over 1,200 names.

Regional names

Given its long history of agricultural settlement and limited internal mobility, it is not surprising that the language of Japan comprises hundreds of distinct dialects. Names of animals and plants vary considerably from one region to another, and these variations have become a field of study in themselves. The *jigumo* (Earth Spider, *Atypus karschi*) may hold the record for the number of regional names. These were investigated by Nagao (1954), who identified exactly 100 different ones and mapped them to their regions. Aoki (2002f) overlaid Nagao's findings on a map of Japan (fig. 10).

Kawana (1988) published an extensive and detailed listing of more than four thousand regional names for mollusks, complete with the place in which each was recorded. This work clearly demonstrated that the same name means different things in different places; *Nishi*, for example, refers in various parts of Japan to 23 nominal taxa that are formally known under

different wamei, *Asari* to 20 and so on. Not surprisingly, the older and less complex a wamei the more likely it is to have different regional meanings.

Discriminatory names

Vernacular nomenclature everywhere is older than its scientific counterpart and as it is grounded in its parent culture it can perpetuate historical usages and terms that have vanished from everyday language. English bird names like "sparrow" and "finch", for example, go back to old German and earlier. As outlined above, the oldest wamei still in use today existed at least as far back as the fifth century and probably much further.

Figurative vernacular names can also reflect outdated social mores.[125] Like English, Japanese is historically rich in pejoratives and slang terms that are nowadays considered discriminatory. Following World War II the Occupation authorities encouraged the education system to address systematic discrimination against social minorities such as the Eta or Burakumin, Japan's equivalent of India's untouchables, and people of Korean and Chinese descent. Progress since has been fitful, but many former terms of abuse have gradually faded from everyday language.

Some live on in wamei, however, and there is considerable debate about them. Regarding malacology, at the January 2008 meeting of the Hanshin Shell Club the immediate revision of *Mekura-gai*[126] and others was advocated. The discussion started out looking at *mekura, semushi*[127] and others but then words indicating simple physical characteristics such as *chibi*

[125] An example in Malacology is the American freshwater mussel *Fusconaia ebena*, known in vernacular print until quite recently as the "nigger-head".
[126] *Mekura*, blind. Ekawa (2008) cites a 1956 Misora Hibari hit song in which a daughter leads her blind father, a former sailor, to a pier; she sings "…*toshi wa tottemo, mekura demo, mukashi narashita matrosu-san nya*" ["…even aged, even blind, you are a sailor who was once esteemed"]. Ekawa's point was that the word *mekura* was thus in normal usage as recently as the 1950s.
[127] 傴僂 *semushi*: hunchback.

[small][128] and *hage* [bald] as well as national denominators such as *Shina* [China] and *Chōsen* [Korea][129] were also criticized.

However, there are dissenting opinions too. Hiramatsu (2000) and Endō (2002) both criticized the revision of wamei that use discriminatory terms. A trenchant critic of political correctness, Ekawa (2008) traced in detail the historical origins of several "discriminatory" names and appealed against their revision on the grounds that the terms in question were either misunderstood homonyms or not pejoratives at the time the names were first published.

In an example cited by Ekawa (2012), the name *Semushi-umiusagi* was created for *Calpurnus verrucosus* (Linnaeus, 1758) by Iwakawa in his 1919 catalog of the collection of the Tokyo Imperial Museum. The term *verrucosa* refers to the prominent pustules at either end of the shell but Iwakawa's wamei clearly references the overall shape. Of several discriminatory names examined by Ekawa, this is the only one that is not figurative or derived from something else but that refers to an actual disability. The Japanese media treat *semushi* as a Class A "word requiring caution"[130] but like *mekura* it was once in normal use.

The wamei *Baka-gai*[131] is thought to refer to the resemblance between the soft foot of the animal dangling from the open shell and the lolling tongue of a mentally retarded person.[132] "Folk" versions of a number of plant and animal names include *baka*. Examples include *Uba-zame* (*Baka-zame; Baka-buka*)[133]; *Ibo-dai* (*Baka*)[134]; *Aka-eso* (*Baka-eso*)[135] and *Aka-ika* (*Baka-*

---

[128] A noun and adjective directly equivalent to the English "midget".
[129] Both *Shina* and *Chōsen* are pre-war terms that were standard usage in the Japanese empire. The present-day equivalents are *Chūgoku* and *Kankoku*. The former lives on in the geographical terms *Minami-shina-kai* and *Higashi-shina-kai* (South and East China Seas respectively), presumably because to substitute the modern term for the Chinese nation state might imply territorial prerogative. *Chōsen* has a particularly derogatory nuance; for example, it is the root of *baka-chon* (*chon: chōsen-jin*, a Korean person) a mild rebuke meaning "stupid idiot". However, it persists in the term *Chōsen-hantō*, the Korean peninsula, for the same reason as *Shina*.
[130] 差別表現・不快語・注意語要覧[Handbook of discriminatory expressions, discomforting terms and words requiring caution] published without authorship or date by Yomiuri Shimbun, Tokyo.
[131] *Baka* means "stupid" or "idiotic"; like the former, it is a common pejorative.
[132] Habe & Kosuge, 1967.
[133] Basking shark *Cetorhinus maximus.*
[134] Japanese butterfish *Psenopsis anomala.*

ika)[136] (the names in parentheses are considered "folk names" or *hōgen-mei*[137]; see Ekawa, 1983). However, the term *baka* in these names variously denotes "easy to collect or catch", "abundant", "not suitable for eating" and so on. The earliest record of the wamei *Baka-gai* is in Terashima Ryōan's mid-Edo work *Wakan Sansai Zue* (1713). In the shell section of volume 47 is the name 馬鹿蛤 with the reading "*baka-gai*" (fig. 1). The text reads "The meat of this shell is tough and not suitable for eating. In society we use *baka* to mean a person who through stubbornness or imbecility cannot be dealt with, and the meat of this shell is the same way. That's the reason for this name".

In December of 1997, the Entomological Society of Japan, in collaboration with the Japanese Society of Applied Entomology and zoology, presented a "Request concerning insect wamei that use discriminatory expressions" and in July of 1999 the former society approved the setting up of a working group on such terms in insect wamei. In June of 2000, the Tokushima Prefectural Museum circulated a questionnaire entitled "On the use of discriminatory names for organisms" to natural history museums and aquaria. The results were summarized by Satō (2002). The Ichthyological Society of Japan held a public symposium in October of 2000 entitled "Japanese names for fishes: what is to be done about discriminatory terms?" The efforts of the ISJ and other societies to revise names in public displays were reported on in the popular press, notably by Mishima (2007).

Individual authors have tackled specific cases. Miyamoto *et al*. (2000) revised the wamei *Mekura-kamemushi* to *Kasumi-kamemushi* though nominally in order to correct inconsistency in classification and without mentioning the discriminatory nature of the term *mekura*, whereas

---

[135] Red lizard fish *Synodus ulae.*
[136] Red squid *Ommastrephes bartramii.*
[137] 方言名

Ōishi et al. (2000) revised the wamei *Mekura-abu* to *Hanemon-abu* specifically the grounds of its social unacceptability.

As also with the case of poisonous spiders mentioned above, allowing wamei to be replaced with new ones of more appropriate meaning is certainly democratic in that it caters to the wishes of present users. However, it can arguably only work in a linguistically bounded community within which it is reasonable to assume that such decisions will come to the attention of - and be agreeable to - the majority of concerned workers. An inevitable consequence of constructing an international system, even one with a clear set of rules, is that such decisions cannot be allowed as the sheer number of interested parties and diversity of constituencies would ensure chaos.

Standardization and authority: the *hyōjun* problem

A certain flexibility with regard to changes, then, is a characteristic of wamei. As seen in the example of *baka-gai* above, a distinction was already being made in early honzō literature between wamei and "folk" or "vulgar" names. The use of the former was considered more scholarly, though typographically these works still prioritized the Chinese name over both (fig. 3). From early times, though, scholars sought to bring order to the confused field of vernacular and regional names by selecting one to be the standard.

Individual scientific societies have discussed the use of vernacular names, usually restricting the debate to their own fields. In 1955, the Lepidopterological Society of Japan held a symposium on wamei at its annual meeting. The 1995 meeting of the Ichthyological Society of Japan contained a symposium entitled "General problems with the names of fishes" at which Senō Hiroshi pointed out a variety of problems associated with wamei and recommended that the society draw up nomenclatorial guidelines. Hikida (2000) considered in general terms the laws for establishing *hyōjun* wamei. Imasaka (2002) argued for more discipline in the use of

wamei; he proposed a 15-character limit for new ones and rules for creating wamei for subspecies. At the closed first committee session during the annual meeting of the Ichthyological Society of Japan in October of 2002, Senō Hiroshi proposed establishing a special committee on *hyōjun* wamei. The following week, Sakurai Hiro, representing the same society, gave a presentation on "Proposals concerning the problems with Japanese fish names" to the Zoological Names Committee of the Japanese Association of Zoos and Aquariums.

The Japanese government, through various agencies, has issued semi-official lists of wamei for many years. Aoki (1994) took issue with the names printed in kana in the Education Ministry (Monbushō)'s 1954 *Gakujutsu yōgo-shū: dōbutsu-gaku-hen* [Catalog of scientific terms: zoology section]. In November of 2002, the Ministry of Agriculture, Forestry and Fisheries recommended the adoption of *hyōjun* wamei as a general principle in a directive entitled "Managing the display of fish and mollusk names". The Consumer Affairs Agency of the Japanese government currently publishes online "guidelines for the names of fish and mollusks".[138]

Some societies have proceeded to standardize the names in their field on their own authority. In July of 2000, the Herpetological Society of Japan established a committee on the selection of *hyōjun* wamei and began work on the confused situation in their field. At their 2002 annual meeting, the society approved standardized *hyōjun* wamei for all Japanese reptiles and amphibians.

Even in the absence of action by their governing organizations, a general consensus operates in some fields as to the "standard work" whose wamei are to be taken as authoritative. In Ornithology this is currently Yanagisawa *et al*. (2012); for mammals, Abe (2008) and Ōdachi *et al*. 2015; for fishes, Nakabō (2013) and for mollusks Okutani (2000) and Higo & Gotō (1993).[139]

---

[138] http://www.caa.go.jp/foods/pdf/151224_qa16-betu8.pdf

[139] Information on these works was provided by the research staff of the Osaka Museum of Natural History and the National Museum of Nature and Science at Tsukuba.

An amateur entomologist interviewed for this study said:

"I think there should be *hyōjun* wamei; even where two names for the same thing have been around a long time (like *Kabutomushi* and *Kachikachimushi*), there should only be one. A society should be responsible for doing this, though it should not be compulsory."

On the other hand, a professional botanist stated:

"It would be best to have a unified *hyōjun* name for each organism, though, as there are many variations. Some workers deliberately use different wamei to others, and confusion also arises when the original wamei is not a good or appropriate one but remains in use. It would be good in such cases if a new name were introduced and set as the standard. [Who should do that?] I think it better not to decide that. If it were up to the government or Education Ministry, they'd get a professor from Tokyo University or the National Science Museum to do it, and the result would reflect that person's tastes and inclinations. It would be better to let time and usage weed out the lesser names and declare the one that remains to be the *hyōjun*. If [the government] made such a list, within ten or twenty years it would go out of use. I think everyone should be involved in determining *hyōjun* wamei."

Surprisingly, in certain fields wamei are considered more stable than scientific names. A professional mycologist:

"The classification of fungi is still extremely confused, and some people apply several scientific names to the same species. There are many differences between Mr. Hongo's zukan, the 1985 zukan and the 1956 zukan. In many cases Japanese workers consider a species worthy of independent status. I personally think there should be types for wamei. There are often papers describing species as "new to Japan", and at that point [the authors] have specimens to hand. If they are new species, then the specimens used to cite them as "new to Japan" should go on to be the types. That would only be possible for post-war studies, though; before the war,

people often used simply to transfer images from European books and put Japanese names on them that stemmed from the Honzō era. Fixing a type for those names would be difficult."

Takakuwa (2002b) shows how prefixes with biogeographical implications can become misleading when more becomes known about the organisms. His examples are Kumoma- (雲間, "among the clouds"), Miyama- (深山 "deep in the mountains") and Takane- (高嶺 "high peak"), all of which refer to mountain or alpine habitats. The butterflies *Miyama-seseri*, *Miyama-chabane-seseri*, *Miyama-shijimi* and *Miyama-karasu-ageha* are now also known from lower, cultivated habitats. Takakuwa cites the case of *Kumoma-tsumaki-chō*, a butterfly that is found at around the 3000-meter mark, but also in cultivated areas 200m above sea level. This species is distributed from Europe to Japan, and is common in the warm coastal plain of southern France, so to classify it as an "alpine butterfly" is absurd.

The hyōjun problem highlights again the contrast between the popular but eccentric world of wamei and the more legalistic ICZN. Were a governing body with sufficient authority to take control of wamei and govern their use in the same way as the Code, they would cease to work as they do now and would become little more than a redundant second-class system of scientific names. In particular, revising them in such a way that they could change to reflect shifts in classification would rob them of the very qualities –familiarity and stability – that have sustained them since before records began.

Wamei in society

The opinions expressed above reflect the essentially consensual and participatory nature of vernacular nomenclature, which enhances its penetration of its parent culture but necessarily militates against standardization. In addition, "science" is no more a homogeneous community in Japan than anywhere else. However, tolerating the myriad idiosyncracies of wamei lets

Japanese naturalists keep the doors to their world wide open to newcomers, especially children and young people.

Many interviewees emphasized the culturally invested nature of wamei. A professional malacologist and museum curator:

"When I was younger I thought about applying a system [to wamei], but eventually concluded that it would not work. Wamei represent the formational history of Japan, and there are aspects of them that cannot be determined by rules; they follow customs and are thus natural names. There is also the problem of priority; if you were to prioritize some older names that are no longer in use, that would not be good. Some wamei were created as equivalents of scientific names, while others reflect the identity of the things themselves. In the former case, people who create such wamei think that when the scientific name changes the wamei should too; but if the identity remains the same, so should the name. It would be good if there were some way to reconcile these approaches. Another problem is that the rules for scientific names apply to all animals; however, with wamei customs vary between fields so to make a single wamei system for all zoology would be difficult."

A postdoctoral researcher in Mollusks:

"It is easier to become familiar[140] with wamei. They also say something; for example, if you see *-yadori-nina*, you know it's something that lives on something else (*yadoru*), so it's parasitic. That can spark interest. Children become familiar with wamei before they encounter scientific names".

An entomologist and retired university professor:

"[The greatest advantage of wamei is] their familiarity among ordinary people. Even in an obscure group like the one I work on, if you use scientific names people will be shut out,

[140] 親しみやすい *shitashimi-yasui.*

whereas with wamei they get at least some idea of the thing; for example, *hige-naga* shows that it has long antennae. Our field is pretty rarified, but even among specialists we use wamei in conversation."

A botanist and retired university professor:

"Because they are morphologically based, wamei can imply relationships where there are none; for example, a "something-*yuri*" that is not a lily, or a "something-*ran*" that is not an orchid. Scientific names, on the other hand, contain a genus name and thus reflect their lineage accurately. Scientific names change regularly, but wamei do not, which makes the latter easier to use. On labels or in reports scientific names are necessary, but in conversation there's no need for that level of definition; [wamei] are like nicknames."

Interviewees who were educators below college level stressed the usefulness of wamei. A school teacher:

"The connection between wamei and the things themselves is very strong. Scientific names seem to change quite often these days, whereas if you give something a wamei it won't change; so you only have to learn it once."

VI. Discussion

Consequential knowledge: the spurious unity of "science"

Speculation and discussion of the fundamental nature of the material universe is as old as human discourse itself. Though vast in number, the accounts that humanity has contrived nevertheless fall into only two groups, which one might characterize as the "hall of big truths" or theology and the "mountain of small facts" as represented by science and most post-enlightenment philosophy. The former sees the universe as vast but bounded and knowable, whereas the latter admits only those parts of the picture that have been credibly revealed. However, the notion of an all-encompassing natural principle, whether personified as one or

more deities or deduced through the unifying logic of physics, is the single common semantic concept in all human schemes of thought. It is literally inescapable.[141]

As proposed above, these two visions can alternatively be characterized as a "top-down" approach that presupposes a universal natural system within which even as-yet-undiscovered entities will conform to ranks that have already been set and a "bottom-up" one that deals only with that which has been proven, or at least sufficiently for active controversy to cease. The Linnaean system can be seen as embodying the former view; under its positivist ethos new discoveries might expand the number of families or orders, but will not fall outside the system altogether. In particular, entities cannot occupy two ranks at once or oscillate between them. Evolution poses something of a challenge to this approach, however, positing as it does that all species are transitional and that the "order of Nature" is nothing more than a one-time snapshot of a constantly changing situation.

During the twentieth century the study of science as a subject in itself grew exponentially. The history, sociology and philosophy of science each in turn acquired their own societies, journals and conferences. The 1960s and 70s were a particularly notable time, with the appearance of landmark works such as Kuhn's "The structure of scientific revolutions" (1962), Foucault's "The order of things" (1966) and Latour and Woolgar's "Laboratory life" (1979). Science, Technology and Society[142] has become a recognized field of study in universities worldwide, and research in its various sub-disciplines nowadays increasingly informs a broad range of policy and law.

Meaningful conclusions in the social analysis of "science" as a whole are extremely elusive, however, as the vast diversity of subjects and analytical techniques inevitably means that no

[141] Wilson, 1998.
[142] STS; also parsed as Science and Technology Studies.

two studies will be directly comparable. An anthropological study[143] of particle physics laboratories, for example, differs completely in methodology and theoretical basis from an investigation of credibility-building through the concept of objectivity in illustrations.[144] Both are studies of "science" but, as in the tale of the blind sages and the elephant, neither encompasses the whole thing. The notion of the "scientist" as a social role is similarly a mirage that disintegrates into many smaller ones the closer one approaches it. A police pathologist and a school teacher who studies insect larvae are both "scientists", but they need not share a common body of knowledge, educational background or philosophical outlook. Likewise, an astrophysicist and a mycologist are both considered scientists but throughout a lifetime's career their respective works might not share a single common term. Perhaps a more useful role is that of "scholar", which is discussed below.

Ultimately it might be more useful to abandon altogether the word "science" with reference to particular disciplines, practices and bodies of knowledge, and instead to treat it simply as an ethos, a way of thinking about the material world.[145] Peirce (1877) characterized the "method of science" as a rubric for the fixation of beliefs that transforms them into mutable but tangible elements with which useful work can be done but that are always open to challenge. Were one to assign "science" itself to that meaning it would then grant individual disciplines a broader semantic space in which to reach out to practices and people currently considered "outside science", something strongly advocated by posthumanists such as Michel Foucault and Donna Haraway.

To study "science" as currently understood, however, it must first be divided up lest quantum physics and botany be thought directly comparable. There are many different rubrics

[143] Traweek, 1988.
[144] Daston & Galison, 2007.
[145] The terms "good science", "bad science" and "unscientific" might also then be done away with.

for doing this, the most common (and probably oldest) of which is "theoretical" versus "applied". Sociological studies of natural history such as this one, however, point to a slightly different pair of criteria: "consequential" versus "inconsequential". Particle physics, for example, involves a great deal of mathematics and theory as well as massive (and massively expensive) experimental apparatus, but its continued funding by governments worldwide attests to its highly consequential nature in terms of power generation and weapons development.[146] Medicine too has always been consequential due to the potential practical applications embodied in all its studies, the large sums of money to be made from curing diseases and the political benefit that governments gain from funding uncontroversial fields such as cancer research.

On the other hand, natural history of the kind embodied in scientific and vernacular names arguably cannot ever become consequential. The bulk of original work in the field is observation and recording, and the goal is classification. The species it produces[147] might in turn be recruited as agents in more consequential fields such as agronomy or environmental policy, but they must first be defined and named by a dispassionate and apolitical discipline. Systematics – the naming of species and deduction of their relationships to each other – is an essential adjunct to evolutionary theory, but basically only as a guarantor of consistency between studies.[148] Indeed, even downright rejection of evolution need not hamper species-level classification work.

The scientific name, then, is a coin that passes among various fields of "applied" natural science, but it is minted largely in backwaters. By comparison the vernacular name, lacking a type, is literally a debased currency and thus ostensibly of no use to science – yet natural history is a field in which, perhaps more than any other, the role of scientist is actually performed and

[146] This could also be seen as a "theoretical/applied" situation within physics.
[147] The question whether natural science "discovers" or "produces" knowledge is a key theme in STS, but too large and controversial a matter to tackle here. See *e. g.* Latour (1987) and Golinski (1998).
[148] Evolutionary theory is scientifically settled but socially controversial; its tools, however, are rarely questioned in the way that its overall thesis is.

not bestowed. In our time, particularly, the growing presence in learning and daily experience of image- and video-based media at the expense of print has downplayed or removed many of the traditional symbolic qualifiers of a "scientist". As the surveys of journals and workers in natural history conducted for this study clearly show, there *is* such a thing as vernacular natural science. The problem, if there is one, lies only in naming its roles and ranks.

The sense of system

The naming of natural entities simultaneously defines and differentiates units of meaning.[149] Depending on the context, those units can range in precision from large groups, such as "Vertebrates", through discrete subdivisions like "Turtles" or "Lizards", down to local forms of individual species.

Biological nomenclature represents a fascinating case of the co-evolution of a concept and its codification. At the basic level, giving names to kinds classifies them in a way that is expandable and reproducible indefinitely. If it proves too broadly defined to indicate a single entity, a kind-name can be divided and/or become a group name. For example: if we agree that the name for someone who works raw metal is "smith" then that is how all people who do so can be classified – those deceased, those working now and those yet to be born.[150] The distinguishing of natural kinds with names is a fundamental aspect of language itself, as it allows vital information concerning practical characteristics such as edibility and predicted seasonal abundance or dearth to be communicated in the absence of the actual object[151].

---

[149] Foucault, 1971

[150] "Smith" is too generic a term to define a single trade, so it became a group name, present in the binomial terms "blacksmith", "goldsmith", "silversmith", "knifesmith" and so on. Nevertheless, any "smith" differs in *kind* from any "wright", someone who assembles different elements to make complex objects, and a term that again was subdivided: wainwright, wheelwright, shipwright *etc*. Even figuratively, the distinction applies: a wordsmith works with raw words, whereas a playwright constructs a script from sentences.

[151] The question whether kinds are distinguished or created by defining and naming them is a fundamental epistemological problem addressed by, among others, Foucault (1970) and Latour (1987), and latterly by Bowker & Star (1999).

Given the usefulness of naming, then, it follows that the degree to which a class of object is subdivided should reflect the practical importance of the distinction between the kinds. An example would be two similar-looking berries, one of which is edible while the other is poisonous. Experience would soon dictate that a linguistic distinction be made between them and taught to subsequent generations. The same people, on the other hand, might not think that two butterflies that differ only by the number of black spots on their wings required individual names. If observation were to prove that one arrived earlier in the spring than the other, however, then a distinction might be made. Both these cases suggest that knowledge of some meaningful characteristic of the object *precedes and requires* its naming. Meaningfulness is subjective, however; once primary predators and food sources have been named, a feature as simple as giant size or a loud cry might earn something a name even though it is practically no more useful than its smaller or quieter cousins.

A name may lose its practical connotation over time, particularly if the reason for the initial distinction is no longer a matter of concern. In social terms the difference is then no longer between two “things”, in the sense of objects within extended networks of meaning, but simply between two names. This process is reversible, however, and established names can be used to define new problems as needed.

The enthusiasm for naming species that first arose among naturalists in the eighteenth century and continues today reflected a less prosaic sense of the importance of morphological distinctions. For some, a growing body of nomenclature continued to celebrate the glory of creation; naming species was praising God, in other words. Others, however, glimpsed in the fine but consistent distinctions among species and the niches they occupy a vast mechanism whose individual components acted on each other like the gears and levers of some infinitely complex timepiece. That the universe operated in far finer detail than hitherto supposed was a

common theme in eighteenth century science but rarely uncontroversial in any of the various forms it took, especially if it was proposed that the underlying rules might follow some form of logic. Natural history, as noted above, played a somewhat subversive role in this regard; gentlemen of suitable social standing, including Darwin himself, could slowly foment revolution in humanity's understanding of the universe while never at any given time publishing on anything more controversial than the breeding of pigeons or the distribution of barnacles on a shore.

The evidence of individual cases accumulates, however, and at some point the universal mechanism passes from being a hypothesis in an individual work to a consensus-based framework for all new investigations. Precisely when this happened for the mollusks is not a settled matter, but many would point to the publication of "The Genera of the Recent Mollusca" by Henry and Arthur Adams in 1853-58. This three-volume work synopsized earlier work by Cuvier, Lamarck and others but added many new observations. Subsequent revisions quickly grew larger; Fischer (1880-87) managed to compress his "Manuel de Conchyliologie" into a single book of around 1,400 pages, but Tryon's Manual of Conchology ran to 45 volumes spanning 56 years (1879-1898; second series 1885-1935) by the end of which time the first parts were in need of revision. The sheer scale and diversity of the Mollusca mean that broad revisions of their classification based on original study are no longer possible. Modern "manuals" are instead syntheses of hundreds of published papers on individual groups. Published as books, such works can appear to be collaborative (e. g. Beesely *et al*., 1998) but are really coordinative, with editors ceding authority regarding each group to individual authors. A more fluid model underlies truly collaborative web sites such as the vast World Register of Marine Species (WoRMS)[152] that are constantly updated by editors who are also contributors. Interestingly, an

[152] www.marinespecies.org

increasing number of these feature vernacular names in various languages alongside scientific ones.

When mollusks were only culturally significant as food and medicine in China and Japan, there was no need for classification at levels above the individual "kind". Honzō authors grouped the "shelled animals" together for convenience, but in the absence of any higher theory of natural organization did not thereby imply a biological relationship between the individual entities. As outlined above, however, during the eighteenth century some rudimentary classification schemes for shells began to emerge, mostly in books by and for collectors. These groupings were based solely on shell morphology, and by contemporary Western standards were poorly defined. Nevertheless, they were named groups and this raises an important question: did this arrangement arise as a result of seeing foreign shell books – which by the mid eighteenth century usually incorporated some form of classification – or did it reflect a basic human desire to order and classify stochastic situations? Foreign books were certainly in private hands and the Shogunate's Yōgakusho[153] maintained an extensive library of European works on natural science. Nevertheless, the absence of correlation at any level with arrangements in Western books strongly suggests that the schemes of classification in works such as Kimura Kenkadō's *Mokuhachi-fu* (1843) and Kuroda Suizan's *Kaishi* (1849) were entirely original.

It is not as though the concept of classification itself was new, however. From earliest times, many dictionaries of Chinese and Japanese had arranged words according to the kind or class of thing to which they refer rather than in a meaning-neutral order such as the alphabet.[154] The classes in works such as Honzō Kōmoku, Yamato Honzō and Wakan Sansai Zue (1713) set a

[153] The Office for the Study of Western Science; the title was changed in 1856 to *Bansho Shirabesho* (Office for the Investigation of Barbarian Literature).
[154] Bailey, 1960.

precedent for the organization of nature and it can be argued that the authors of Edo shell books were simply applying the same methods to a certain group of organisms rather than the entire natural world. The difference, however, is that the classification schemes in those books were based directly on observation of the things themselves, and dealt not only with ancient names but with an increasing number of contemporary ones.

The distinction of cowries from other shells in Edo books is particularly significant. Their smooth, glossy surface, rounded shape and intricate patterning distinguish cowries from all other shells of similar size. They are commonly found in tide pools and beach drift over most of western Japan and are diverse, with at least 87 species recorded.[155] As seen above, the cowries were treated as a separate group (the *bai-shi*) in most Edo shell books with considerable consistency among authors and genres.

In my studies of wamei I have attempted to determine whether at least for mollusks a native system of nomenclature had begun to arise independently of outside influence during the Edo period. Evidence presented by Kanamaru (1930-58), Isono (1996), the fairly extensive literature in the contemporary debate over the use of Japanese names and my own studies of Edo works suggest that this indeed was the case. In particular, the increased sophistication of the classification systems in works such as Kenkadō's *Mokuhachi-fu* and *Kaikaku kihin-sen* seem to reflect incremental epistemological development rather than the sudden acquisition of new knowledge. This further tends to support the larger theory that the development of classification is a natural consequence of increasing literary sophistication, and thus that "to classify is human".[156]

What makes these Japanese examples so valuable in the study of emerging classifications is the high degree of linguistic and political isolation during the Edo period that makes it unlikely

[155] Higo *et al*., 1999.
[156] Foucault, 1971.

that this was a case of imitation. However, from a Western viewpoint the progress of the Japanese system was glacial and almost random compared with the huge strides made in the century separating Linnaeus and the Adams brothers. In this disparity we can perhaps see the difference between scholarship as one aspect of a broader social life and theory-driven science as an ethos against which studies are ranked and judged. An overarching theory of derivation provides a framework within which disparate studies can be aligned and compared across time and space, whereas classification based solely on individual entities remains bound by the limitations of its medium – the lecture or the printed page.

In terms of objectivity, the authors of Edo shell books certainly cited each other and used various devices to enhance the credibility of their own work such as giving the provenance of illustrated specimens (fig. 4) but their discourse lacked any theory that might link studies of, say, insects to those of birds or shells.

Left to itself, how far the Japanese system of classification could have developed at higher level is a fascinating question. The tidal wave of Western literature that arrived in the Meiji period, however, effectively put an end to its evolution. Although wamei ballooned in numbers after 1860, they were no longer organized in a Japanese way.

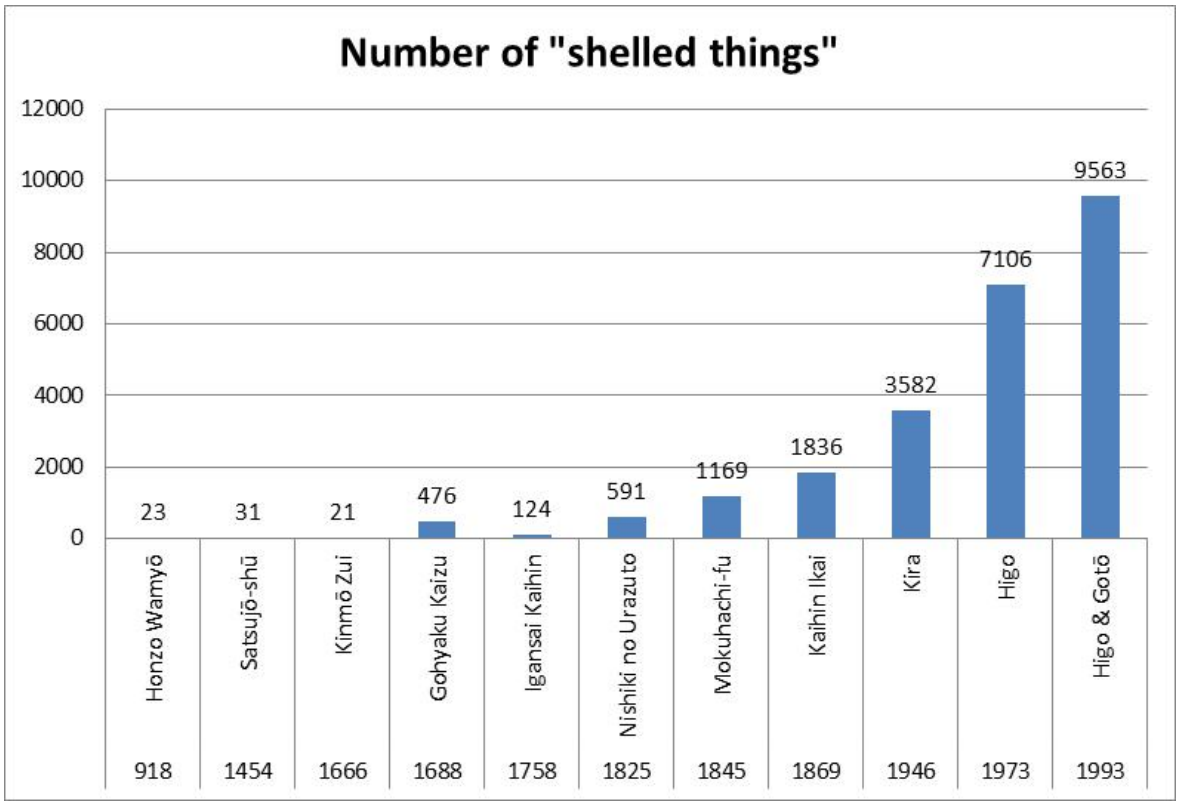


Table 2. A graph of the number of "shelled things" (介品, 貝品) in a selection of works. From *Gohyaku Kaizu* (1688) onwards, all the works are specifically on shells. *Kaihin-ikai* (1869) is a list of shell names from previous works and thus represents a rough total for the Edo period. Kira's 1946 list covered only marine species, as did Higo (1973),[157] but Higo & Gotō (1993) included all mollusca. These figures account for only one wamei per species.

The vernacular name as a boundary object

In contrast to scientific names, wamei are governed by consent and not by law. They can be and are modified, though – as seen in the cases reviewed above – changes to well-known names are not undertaken lightly. The broader debate around wamei concerns not only the validity or availability of names, as is largely the case with scientific names, but their suitability.

If a problem arises with a scientific name that cannot be solved by application of the ICZN, it can be referred for a ruling to the International Commission for Zoological Nomenclature, a council of active and retired scientists who are authorities on nomenclatorial case law. The

[157] Adding to Higo's figure the roughly 800 terrestrial species with wamei that were listed by Minato (1988) and those for freshwater species would bring the total near to that of Higo & Gotō. Growth in new species described from Japan remains steady but very few new wamei are now created for existing species.

rulings are regularly published as “opinions” but refer only to specific cases and not the principles of the Code itself.

This is an entirely suitable system for the control of names but is not intended to help describe nature. The role of scientific names is as meaning-neutral denominators, not units of knowledge. As shown above, they can be entirely meaningless as words[158] or be nominally misleading due to erroneous assumptions on the part of their authors.

The intention behind scientific names is nevertheless that they be universal boundary objects. As originally proposed by Star & Griesemer (1989) and expanded by Bowker & Star (1999), boundary objects are used by different communities of practice that constrain and conceptualize their meanings within their own field but without transforming them so far as to make them unrecognizable to other communities.[159] In advancing Latin as a universal language of science and building the rules of nomenclature on it, the Victorian progenitors of today’s ICZN attempted to be fair to everyone. (They of course were familiar with Latin already, but it would be disingenuous to suppose that by choosing it they sought some advantage).

Boundary objects serve to bridge diverse communities that have differing systems of standards. In complex situations where formal science and citizens are politically involved in dealing with the consequences of technology, such as environmental disasters or systemic pollution, identifying boundary objects is often a crucial step in defining the overall problem.

In the case of wamei, however, the concept is less tenable as their socially negotiated nature prevents them being objective synonyms of nominally equivalent scientific names. It is not simply the case that somewhere in the transition from the Japanese sphere to the broader

[158] For example: the hydrozoan genus name *Zyzzyzus* was coined by Stechow in 1921 with the intention that it appear last in any index.
[159] They need not be physical objects; the metric system is one, as is Christianity.

world of international science a wamei changes to a scientific name – nor vice-versa, as some of the examples given below show.

In preparing the manuscript for the Catalogue and Bibliography of the Marine Shell-bearing Mollusca of Japan (Higo *et al*., 1999) I had long discussions with the senior and third authors on this subject. Continuing the practice of their first two lists (Higo, 1973; Higo & Gotō, 1993), Mr. Higo proposed that any equivalence of a wamei with a scientific name of any rank should be an entry. The first two works had been written entirely in Japanese – though the scientific names were of course in Latin – and aimed solely at the domestic market. However, it was the intention of the publisher, Mr. Gotō, that the new work be in English, with wamei present but transliterated into Roman script. Although this was not articulated at the time, the new book would thus be a mirror to the previous works, based in an international idiom but reaching into the Japanese sphere of knowledge.

For this book to have credibility outside Japan, however, it would first be necessary to remove all wamei that were not linked to published names. The original 349 cases listed in Higo & Gotō (1993) had in the meantime been supplemented by new cases and rediscovered older ones, pushing the total over 400 in the new manuscript. By removing them, adding bibliographical references for every valid name cited and using exclusively Roman text, we thus reconfigured the new book as a work of “Western” science in which wamei nevertheless become available to non-Japanese readers.

Google Scholar so far lists 322 citations of the Catalogue, almost entirely in non-Japanese papers. An accurate figure for references to Higo & Gotō (1993) is more difficult to calculate as it is cited almost exclusively in Japanese journals that are not databased on line. However, a survey of printed issues reveals that it remains the single most-cited work in the Japanese sphere by a wide margin. Both versions are in wide use among collectors, museums and

scientists in Japan, but they are seen as complementary and not as two versions of the same work. In particular, users have told me “we know that the English version is more accurate, but the earlier one is in Japanese”.

Conclusion

More than 150 years since Western scientific literature became available to ordinary Japanese naturalists, the wamei is alive and well. For all the reasons explored here, the use of Japanese names continues to unite ordinary people and workers at all levels of science, from elementary school pupils to emeritus professors and even royalty. The vast richness of animal and plant references in popular culture such as theater, manga and novels attests to the close presence of the non-human in Japanese life. Contemporary artists and writers draw on a long and deep history of folk knowledge, citizen science and scholarship, throughout which vernacular names for natural things have proven remarkably stable.[160]

In those countries that do not primarily use English or the Roman alphabet, professional scientists often play a stronger role in translating, filtering and serving local knowledge across linguistic boundaries than in places where English is more easily understood. However, Japan is linguistically even more tightly bounded than many such countries and the coherence, durability and usefulness of wamei reflect their position within this protected environment.

The growing “borderlessness” of international science requires common rules in the name of avoiding chaos, but in turn endangers local schemes of communication that might, if their mechanisms were better understood outside their community, offer alternative and more effective ways of naming things in nature.

[160] Tsunoda et al., 1958

References

Abe, H. (Ed.) 2008. 日本の哺乳類　改訂 2 版 *Nihon no honyūrui. Kaitei ni-han* / A guide to the mammals of Japan. 2nd revised edition. Tokyo: Tōkai University Press. In Japanese.

Adams, H. & Adams, A. 1853-58. The genera of the Recent Mollusca. Vol. 1, 1853-54; Vol. 2, 1854-58; Vol. 3, (plates), 1858. London: J. Van Voorst.

Andō, I. 1915. 女子動物学教科書 *Joshi Dōbutsu-gaku kyōkasho* / Text-book of Animal Kingdom. Tokyo: publisher unknown.

Aoki, J. 1994. 動物分類名の表記に関する論議: 食肉目か，ネコ目か *Dōbutsu bunrui-mei no hyōki ni kansuru rongi: shokuniku-moku ka neko-moku ka* [The debate over systematic zoological nomenclature: *shokuniku-moku* or *neko-moku*?] Proceedings of the Japanese Society for Systematic Zoology **51**: 69-72. In Japanese.

Aoki, J. 2002a. *Dare ga tsuketemo onaji yō na namae ni natta – Ao-matsumushi*. *In* Aoki *et al.* (Eds), 2002: 1-2. In Japanese.

Aoki, J. 2002b. *Konna shu wa inai - Akatonbō*. *In* Aoki *et al.* (Eds), 2002: 2-3. In Japanese.

Aoki, J. 2002c. *Ōkii mushi, chiisai mushi – Ō-kuwagata, Keshi-gengorō*. *In* Aoki *et al.* (Eds), 2002: 8-9. In Japanese.

Aoki, J. 2002d. *Gakkai de kaimei o kettei – Komori-gumo*. *In* Aoki *et al.* (Eds), 2002: 18. In Japanese.

Aoki, J. 2002e. *Oya to wa chigau ko no namae – Zazamushi, Bōfura, Arijigoku*. *In* Aoki *et al.* (Eds), 2002: 19-20, fig. 3. In Japanese.

Aoki, J. 2002f. *Hōgen no ōsa dewa jigumo ga ichiban? – Harakiri-kanpei, Omen-kachi-kachi*. *In* Aoki *et al.* (Eds), 2002: 32-34, map. In Japanese.

Aoki, J. 2002g. *Dōrui to machigawareru namae – Mon-kagerō to Usuba-kagerō*. *In* Aoki *et al.* (Eds), 2002: 39-40. In Japanese.

Aoki, J., Okutani, T. & Matsuura, K. (Eds.) 2002. 虫の名、貝の名、魚の名。和名にまつわる話題 *Mushi no na, kai no na, sakana no na. Wamei ni matsuwaru wadai/* Anecdotes of Japanese names of insects, shellfish and finfish. Tokyo, Tokai University Press. In Japanese.

Aso, N. 2014. Public properties: museums in imperial Japan. Durham NC: Duke University Press.

Bailey, D. C. 1960. Early Japanese lexicography. Monumenta Nipponica **16** (1-2): 1-52.

Barrow, M. 2000. A passion for birds: American Ornithology after Audubon. Princeton, NJ: Princeton University Press.

Bartholomew, J. R. 1989. The formation of science in Japan. New Haven CT: Yale University Press.

Beesely, P. L., Ross, G. J. B. & Wells, A. (Eds.) 1998. Mollusca: the Southern Synthesis. Fauna of Australia, vol. 5. Melbourne, Victoria: CSIRO.

Bowker, G. C. & Star, S. L. 1999. Sorting things out. Cambridge MA: MIT Press.

Buonanni, F. 1681. *Recreatio mentis et oculi in observatione animalium testaceorum : curiosis naturae inspectoribus*. Rome, Tipografica Varesii. In Latin.

Callomon, P. 2002a. Tadashige Habe (1916-2002). The Nautilus **116** (2): 67-68.

Callomon, P. 2002b. Japanese malacologists of the 20th century no. 1: Tetsuaki Kira (1888-1965) by IwaoTaki. American Conchologist 30 (4): 17-19.

Callomon, P. & Snyder, M. A. 2004-2009. On the genus *Fusinus* in Japan, parts 1-5. Venus **63** (1-2): 13-27; **65** (3): 177-191; **66** (1-2): 19-47; **67** (1-2): 1-13; **67** (3-4): 159-172.

Callomon, P. & Tada, A. 2006. Yoichiro Hirase and his role in Japanese Malacology. Bulletin of the Nishinomiya Shell Museum 4: 52 pp, 18 pls. In English and Japanese.

Christenson, A. L. 1985. The identification and study of Indian shell middens in Eastern North America: 1643–1861. North American Archaeologist **6** (3): 227–243.

Conroy, H., Davis, S. T. W. & Patterson, W. (Eds.) 1984. Japan in transition: thought and action in the Meiji era, 1868-1912. Cranbury, NJ: Associated University Presses.

Daston, L. & Galison, P. 2007. Objectivity. New York, NY: Zone Books.

Dunker, W. 1861. *Mollusca japonica descripta et tabulis tribus iconum illustrata a Guilielmo Dunker*. Stuttgart: E. Schweizerbart.

Ekawa, K. 1985. *Nihon-san Riso-tsubo-ka kairui* Rissoidae *no zusetsu* [Illustrated guide to the Rissoidae of Japan]. Kyushu no Kai: Part 1, **24**: 21-34; part 2, **25**: 1-17; part 3, **26**: 7-13. In Japanese.

Ekawa, K. 1986-1989. *Nihon-san Tōgata-gai-ka kairui no zusetsu* [Illustrated guide to the Pyramidellidae of Japan]. Kyushu no Kai: Part 1, **27**: 1-26 (1986); part 2, **28**: 7-13 (1986); part 3, **29**: 1-15 (1988); part 4, **30**: 1-21 (1988); part 5, **31**: 1-17 (1988); part 6, **32**: 9-25 (1989); part 7, **33**: 7-21 (1989). In Japanese.

Ekawa, K. 2008. *Iwayuru sabetsu-teki wamei e no gimon* [Some doubts about so-called discriminatory wamei]. Kai Nakama **41** (2): 9-15. In Japanese.

Ekawa, K. 2012. *Iguchigai no wamei ga imi suru mono* [The meaning of the Japanese name *Iguchigai*]. Kai Nakama **46** (2): 19-24. In Japanese.

Endō, H. 2002. 差別表現問題と哺乳類の和名 *Sabetsu hyōgen mondai to honyūrui no wamei* [The problem of discriminatory expressions and the wamei of mammals] Honyūrui Kagaku **42** (1): 79-83. In Japanese.

Endō, M. 1985. *Dokushōshitsu, bussankai ni tsuite*. Jitsugakushi Kenkyū **2**: 33-84. In Japanese.

Eri, M. 1925. 動物学精義 *Dōbutsugaku seigi* [Zoology in detail]. Tokyo: Meguro Shoten.

Esaki, T. 1934. 和名問題に関する私見 *Wamei mondai ni kansuru shiken* [Personal opinion concerning the problem of wamei]. Konchū Sekai 2 (7): 36-40. In Japanese.

Farber, P. L. 2000. Finding order in nature: the naturalist tradition from Linnaeus to E. O. Wilson. Baltimore MD: Johns Hopkins University Press.

Foucault, M. 1970. The order of things (Les mots et les choses). New York: Random House.

Fujiwara, S. 2014. *Keratopushia? Tsunoryū? Tsunoryū? Wamei no konran o toku* [Ceratopsia? Tsunoryū? Tsunoryū? Explaining the confusion around wamei]. Pp 22-25. In Tsukagoshi, M., Fujiwara, S. & Hayashi, S. (Eds.), Triceratops – the lord of Laramidia. The Sengoku period at the end of the age of dinosaurs. 192 pp. Osaka Museum of Natural History/Yomiuri Shimbunsha. In Japanese.

Fukatsu, T. & Kobayashi, Y. 1985. 木の名の由来 *Ki no na no yurai* [The origins of tree names]. Tokyo: Nihon Ringyō Gijutsu Kyōkai. In Japanese.

Fukatsu, T. 1989. 植物和名の語源 *Shokubutsu wamei no gogen* [The derivation of Japanese plant names]. Tokyo: Yasaka Shobō. In Japanese.

Fukatsu, T. 2000. 植物和名の語源 探究 *Shokubutsu wamei no gogen tankyū* [Studies on the derivation of Japanese plant names]. Tokyo: Yasaka Shobō. In Japanese.

Fukuoka, M. 2012. The premise of fidelity: science, visuality and representing the real in nineteenth-century Japan. Stanford CA: Stanford University Press.

Golinski, J. 1998. Making natural knowledge: constructivism and the history of science. Cambridge UK: Cambridge University Press.

Gordin, M. D. 2015. Scientific Babel: how science was done before and after global English. Chicago IL: University of Chicago Press.

Grassle, J. F. & Maciolek, N. J. 1992. Deep-sea species richness: regional and local diversity estimates from quantitative bottom samples. American Naturalist **139**: 313–341.

Griffis, W. E. 1876. The Mikado's empire. Book I. History of Japan from 660 B. C. to 1872 A. D. Book II. Personal experiences, observations and studies in Japan, 1870-1874. 635 pp. New York, Harper & Brothers.

Habe, T. 1973. 学名及び和名の変更 *Gakumei oyobi ni wamei no henkō* [Changes to scientific and Japanese names]. Venus 32 (3): 68. In Japanese.

Habe, T. 1986. *Janbo-tanishi no gakumei to wamei* / Japanese and scientific names of the Apple Snail introduced from South America. Chiribotan **17** (2): 27-28. In Japanese.

Haga, T. (Ed.) 2003. *Hiraga Gennai-ten* [Catalog of Hiraga Gennai Exhibition]. Tokyo: Tokyo Shinbun.

Halpern, J. (Ed.) 1990. New English-Japanese character dictionary. Tokyo: Kenkyusha.

Hamada, T. 1983. *Okinawa hitori saishū-ki (1982-nen)* [Diary of a solo collecting trip to Okinawa in 1982]. Kyushu no Kai **19/20**: 35-39. In Japanese.

Hamada, T. 1989. *Janbo-tanishi no hidari-maki* [A sinistral form of the Janbo-tanishi]. Chiribotan **20** (3): 60. In Japanese.

Harasewych, M. G. 1997. The Life and malacological Works of R. Tucker Abbott (1919-1995). Nautilus **110** (2): 55-75.

Hartshorne, A. C. 1902. Japan and her people. 2 vols. Philadelphia, PA: Henry T. Coates

Hasegawa, W. 1999. Japan's system of post-secondary education. New York, NY: Columbia University.

Henmi, Y., Itani, G., Iwasaki, K., Satō, S., Satō, M., Taru, M. & Nishikawa, T. (Eds.) 2012. 干潟の絶滅危惧動物図鑑 *Higata no zetsumetsu kigu dōbutsu zukan* / Threatened animals of Japanese tidal flats: red data book of seashore benthos. Tokyo: Tōkai University Press.

Higham, N. J. & Ryan, M. J. 2013. The Anglo-Saxon World. New Haven CT: Yale University Press.

Higo, S. 1973. 日本列島周辺海産貝類総目録 Nihon rettō shūhen kai-san kairui sō-mokuroku / A catalogue of molluscan fauna of the Japanese islands and the adjacent area. Nagasaki: Nagasaki-ken Seibutsu Gakkai.

Higo, S. & Gotō, Y. 1993. 日本及び周辺地域産軟体動物総目録 *Nihon oyobi shūhen chi'iki-san nantai dōbutsu sō-mokuroku* / A systematic list of molluscan shells from the Japanese Is. and the adjacent area. Yao, Elle Kairui Shuppan. In Japanese.

Higo, S., Callomon, P. & Gotō, Y. 1999. Catalogue and bibliography of the marine shell-bearing Mollusca of Japan. Yao, Osaka: Elle Scientific Publications.

Higo, S., Callomon, P. & Gotō, Y. 2001. Catalogue and bibliography of the marine shell-bearing Mollusca of Japan: type figures. Yao, Osaka: Elle Scientific Publications.

Hikida, T. 2000. 本邦爬虫両棲類和名考 *Honpō hachū ryōseirui wamei-kō* [On Japanese names for native reptiles and amphibians]. Hachū Ryōseirui Gakkai Hō 2000 (2): 99-111. In Japanese.

Hiramatsu, T. 2000. 和名と差別語狩り (1) *Wamei to sabetsugo-gari* (1) [Wamei and censorship of discriminatory names (1)] Tokyo Kumo Danwakai Tsūshin **100**: 16-18. In Japanese.

Hirano, M. 1996. The *Shabenkai*, a *honzōgaku* botany study group of the Tempo era: events prior to this group, its founding and activities. *Shundai-shigaku* **98** (1): 1-46. In Japanese with English abstract.

Hosoya, T. 2012. *Furukute atarashii wamei mondai: kore made no nagare* [The wamei problem, both old and new: its course up to now] Panmixia **17**: 1-10. In Japanese.

Howard, L. O. 1935. Biographical memoir of Edward Sylvester Morse, 1838-1925. National Academy of Sciences Biographical Memoirs 17 (1): 2-29.

Iijima, I. 1918. 動物学提要 *Dōbutsu-gaku teiyō /* A manual of zoology. Tokyo: Dai Nippon Kokusho.

Ikeuchi, O. 1999. *Zukan* and the evolution of a genre. Japanese Book News **28**: 4-5.

Imahara, Y. (Ed.) 2016. 磯の生き物図鑑 *Iso no ikimono zukan* / A color guide to the rocky shores of Japan, field edition. Osaka: Tombow Shuppan.

Imaizumi, Y. (Ed.) 1988. 世界哺乳類和名辞典 *Sekai honyūrui wamei jiten* [Dictionary of Japanese names for mammals of the world]. Tokyo: Heibonsha. In Japanese.

Imasaka, S. 2002. 和名と亜種和名についての一提案 *Wamei to ashu wamei ni tsuite no ichi teian* [A proposal concerning wamei and subspecies wamei]. Gekkan Mushi **373**: 36-37. In Japanese.

Ishikawa, C. 1935-6. 石川千代松全集/*Ishikawa Chiyomatsu zenshū* [Collected works of Ishikawa Chiyomatsu]. 10 vols. Tokyo: Kōbunsha.

Isono, N. 1996. *Edo jidai kairui shokō* / Literature of shells in the Edo Period. Hiyoshi Review of Natural Science, Keio University **20**: 1-42. In Japanese.

Isono, N. 2001. *Yakuhin-kai, bussan-kai nenpyō (Zotei-ban)* / Exhibitions of natural products in the Edo period: a chronological table. Hiyoshi Review of Natural Science, Keio University **29**: 55-65. In Japanese.

Isono, N. 2006. *Tako no makura kō: uni ya hitode no komei* / Old Japanese names for echinoderms. Hiyoshi Review of Natural Science, Keio University **39**: 53-79. In Japanese.

Isono, N. 2008. *Shiryō betsu: sōmoku-mei shoken risuto* / A chronological list on [*sic*] the first appearance of Japanese plant names. Hiyoshi Review of Natural Science, Keio University **45**: 69-94. In Japanese.

Iwakawa, T. 1900. Preliminary catalogue of marine shells in the collection of the Natural History Department. Part 1. Tokyo: Imperial Museum.

Iwakawa, T. 1905. Preliminary catalogue of marine shells in the collection of the Natural History Department. Part 2. Tokyo: Imperial Museum.

Iwakawa, T. 1909. Catalogue of mollusca in the Natural History Department, Tokyo Imperial Museum, by T. Iwakawa, Rigakushi. Part 1. Marine Gasteropoda, including Scaphopoda. Tokyo: Imperial Museum.

Iwakawa, T. 1919. Catalogue of Japanese Mollusca in the Natural History Department. Tokyo: Imperial Museum.

Jansen, M. & Rozman, G. (Eds.) 1986. Japan in transition: from Tokugawa to Meiji. Princeton NJ: Princeton University Press.

Johnson, R. I. 1964. The recent Mollusca of Augustus Addison Gould. Bulletin of the United States National Museum **239**: 1-182.

Kanamaru, T. 1928-29. Bibliography of the conchological classics in Japan. *Venus* [Part 1] **1** (1): 32-38; [2] **1** (2): 55-58; [3] **1** (3): 82-87; [4] **1** (4): 132-136. In Japanese.

Kanamaru, T. 1930. 貝類和名に就いての私見 *Kairui wamei ni tsuite no shiken* [Personal opinion on Japanese names for mollusks]. Venus **2** (1): 26-31. In Japanese.

Kanamaru, T. 1930-58. *Nippon kairui-gaku-shi* / A history of Japanese Conchology. *Venus* [Part 1] **1** (6): 229-231; [2] **2** (1): 17-19; [3] **2** (2): 80-85; [4] **2** (3): 131-135; [5] **2** (4): 185-190; [6] **2** (5): 243-248; [7] **2** (6): 305-310; [8] **3** (1): 32-38; [9] **3** (2): 92-99; [10] **3** (4): 216-224; [11] **3** (6): 342-346; [12] **4** (1): 37-38; [13] **4** (3): 161-167; [14] **4** (4): 244-247; [15] **4** (6): 374-379; [16] **5** (2-3): 112-117; [17] **5** (4): 214-222; [18] **6** (3): 162-168; [19] **8** (1): 48-54; [20] **9** (1): 30-33; [21]

9 (2): 85-89; [22] **9** (3-4): 161-164; [23] **10** (3-4): 134-140; [24] **11** (2-3): 63-69; [25] **12** (1-2): 57-64; [26] **13** (1-4): 106-110; [27] **13** (5-8): 261-267; [28] **14** (1-4): 102-108; [29] **14** (5-8): 247-256; [30] **16** (5-8): 112-123; [31] **17** (2): 80-90; [32] **17** (4): 223-230; [33] **18** (3): 198-203; [34] **18** (4): 272-277; [35] **19** (1): 65-72; [36] **19** (2): 124-131; [37] **19** (3-4): 268-272; [38] **20** (1): 97-100. In Japanese.

Karube, H. 2012. *Wamei mondai o kangaeru – dōyatte kaiketsu sureba yoi no ka? Nihon Tonbo Gakkai ni okeru shikō* [The wamei problem – how can it be solved? An attempt by the Japanese Society for Odonatology]. Panmixia **17**: 45-49. In Japanese.

Kawana, T. 1988. 日本貝類方言集—民俗・分布・由来 *Nihon kairui hōgen-shū: minzoku, bunpu, yūrai* [Japanese regional names for mollusks: folk names, distribution and origins]. Tokyo: Mirai-sha. In Japanese.

Kira, T. 1946. *Kairui wamei-ron* [On Japanese names in the Mollusca]. Venus **14** (5-8): 256-264. In Japanese.

Kobelt, W. 1879. *Fauna molluscorum extramarinorum Japoniae*. Nach den von Professor Rein gemachten Sammlungen, bearbeitet von Dr. W. Kobelt. Frankfurt am Main: C. Winter.

Kohn, E. 2013. How forests think: towards an anthropology beyond the human. Berkeley, CA: University of California Press.

Kornicki, P. 1998. The book in Japan. Leiden: Koninklijke Brill.

Latour, B. 1987. Science in action: how to follow scientists and engineers through society. Cambridge MA: Harvard University Press.

Latour, B. 1988. Science in action: how to follow scientists and engineers through society. Cambridge, MA: Harvard University Press.

Linnaeus, C. 1758. *Systema naturæ per regna tria naturæ, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis.* Stockholm: Laurenti Salvi.

Lischke, C. E. 1869. Japanische Meeres-Conchylien : Ein Beitrag zur Kenntniss der Mollusken Japan's, mit besonderer Rücksicht auf die geographische Verbreitung derselben. Cassel: T. Fischer.

Low, M., Nakayama, S. & Yoshioka, H. 1999. Science, technology and society in contemporary Japan. Cambridge: Cambridge University Press.

Marcon, F. 2015. The knowledge of nature and the nature of knowledge in early modern Japan. Chicago IL: University of Chicago Press.

Marshall, B. K. 1994. Learning to be modern: Japanese political discourse on education. Boulder CO: Westview Press.

Masuda, O. & Uchiyama, R. 2004. *Nihon-san tansui kairui zukan* / Freshwater mollusks of Japan. Pisces Ecological Field Guide Series no. 2. Tokyo: Pisces Publishers. In Japanese.

Masutomi, K., Kajiyama, H. & Kaneko, S. 1982. *Kimura Kenkadō baiseki hyōhon* / Kimura Kenkadō's collection of fantastic stones and shells. Special Publications from the Osaka Museum of Natural History 14: 69pp.

Melville, R. V. 1995. Towards stability in the names of animals: a history of the International Commission on Zoological Nomenclature 1895-1995. London: International Trust for Zoological Nomenclature.

Miller, I. J. 2014. Bringing politics to life: *dōbutsu* and other creatures of the Japanese enlightenment. Japanese Studies 34 (3): 289-305.

Minato, H. 1988. 日本陸産貝類総目録 *Nippon rikusan kairui sō-mokuroku* / A systematic and bibliographic list of the Japanese land snails. Shirahama, Wakayama Prefecture: H. Minato.

Mishima, I. 2007. *Gyorui gakkai sabetsu-mei kaishō: ahō-dori, mekura-chibi-gomimushi wa kono mama de ii no ka*? [Revision of discriminatory names by the Ichthyological Society of Japan: is it all right to use *ahō-dori* and *mekura-chibi-gomimushi*?] Yomiuri Weekly **66** (10): 86-87. In Japanese.

Miyamoto, S., Yasunaga, T., Tomokuni, M. & Hayashi, M. 2000. メクラカメムシの代替名「カスミカメムシ」の提唱 *Mekura-kamemushi no daitai-mei Kasumi-kamemushi no teishō* [Proposal of Kasumi-kamemushi as a replacement name for Mekura-kamemushi]. Shokubutsu Bōeki **54**: 295-296. In Japanese.

Montgomery, S. L. 2000. Science in translation: movements of knowledge through cultures and time. Chicago IL: University of Chicago Press.

Morita, N. 1973. 山本政雄氏を偲ぶ/ *Yamamoto Masao o shinobu* [Mourning Yamamoto Masao]. Chiribotan **7** (7): 157-158. In Japanese.

Morse, E. S. 1879. The Shell Mounds of Omori. Memoirs of the Science Department, University of Tokyo 1 (1).

Morse, E. S. 1917. Japan day by day. 2 vols. Boston: Houghton Mifflin.

Moser, S. 2014. Making expert knowledge through the image: connections between antiquarian and modern scientific illustration. Isis **105** (1): 58-99.

Nagano, K. 1905. 鱗翅類の和名に対する卑見 *Rinshi-rui no wamei ni taisuru hiken* [My opinion on the Japanese names for Lepidoptera]. Pp. 5-10 *in* Nawa Entomological Museum Editorial Board (Eds.)日本鱗翅類汎論 *Nippon rinshi-rui hanron* [General guide to Japanese Lepidoptera]. Gifu City, Nawa Entomological Museum. In Japanese.

Nagao, I. 1954. 地蜘蛛考 *Jigumo-kō* / An Investigation on Zigumo. Kokugo-gaku **19**: 65-74. In Japanese.

Nakabō, T. (Ed.) 2013. 日本産魚類検索. 全種の同定. 第 3 版 *Nihon-san gyorui kensaku: zenshu no dōtei. Dai san-ban* / Fishes of Japan with pictorial keys to the species. Third edition. 3 vols. Tokyo, Tōkai University Press. In Japanese.

Nakayama, S., Swain, D. L. & Yagi, E. (Eds.) 1974. Science and society in modern Japan. Cambridge, MA: MIT Press.

Nelson, A. N. 1962. The original modern reader's Japanese-English character dictionary. Rutland VT: Tuttle.

Nishikawa, T. 1997. ムラサキイガイかチレニアガイか: 動物和名選定のケーススタディ *Murasaki-igai ka chirenia-gai ka: dōbutsu wamei sentei no kēsu sutadi* [*Murasaki-igai* or *Chirenia-gai*? A case study in selection of wamei]. Sessile Organisms **13** (2): 1-6. In Japanese.

Nishimura, K. 1982. *Nettai-tanishi, Janbo-tanishi* / "Jumbo Snail", a new aquacultural mollusc. Chiribotan **13** (2): 38-39. In Japanese.

Nomura, S. 2012. *Wamei ni tsuite no kangaekata* [Ways of thinking about wamei]. Panmixia **17**: 11-18. In Japanese.

O'Brian, P. 1997. Joseph Banks: a life. Chicago, IL: University of Chicago Press.

Ōdachi, S. D., Ishibashi, Y., Iwasa, M. A., Fukui, D. & Saitō, T. (Eds.) 2015. The wild mammals of Japan. 2nd edition. Tokyo: Shōkadō / Nihon Honyūrui Gakkai. In Japanese.

Ōishi, H., Yonetsu, A. & Nagatomi, A. 2000. 差別的表現のある和名に関する改訂の提言 *Sabetsu-teki hyōgen no aru wamei ni kansuru kaitei no teigen* [Proposal for revision of wamei that are discriminatory expressions]. Hana-abu (Dipteran Society) **10**: 107. In Japanese.

Okamoto, M. 2001. Molluscan taxa described by Tadashige Habe. 2 vols. Tokyo: The Committee for Celebrating Dr. T. Habe's Eightieth Birthday.

Okamoto, M. & Okutani, T. 1997. *Kai no wamei* [Japanese names in the Mollusca]. *Mitamaki*, special edition for 30th anniversary of Sagami Shell Club. Yokosuka: Sagami Kairui Dōkō-kai. In Japanese.

Ōno, M. 2002a. *Seikatsu kankyō o iietemyō – Ochiba-hime-gumo. In* Aoki *et al.* (Eds), 2002: 10-12. In Japanese.

Passin, H. 1965. Society and education in Japan. New York: Teachers' College Press, Columbia University.

Poppe, G. T. & Gotō, Y. 1991. European Seashells vol. 1. Polyplacophora, Caudofoveata, Solenogastra, Gastropoda. Wiesbaden, Germany: Christa Hemmen.

Putnam, R. 2001. Bowling alone: the collapse and revival of American community. New York, Touchstone / Simon & Schuster.

Rader, K. A. & Cain, V. E. M. 2015. Life on display: revolutionizing U. S. museums of science and natural history in the twentieth century. Chicago, IL: University of Chicago Press.

Roberts, L. 2009. Orienting natural knowledge: the complex career of Hiraga Gennai. Endeavour 33 (2): 65-69.

Robertson, R. 1990. Malacology or Conchology? The Nautilus **104** (4): 145-146.

Saitō, T., Matsumoto, Y., Hirashima, Y., Kuno, E. & Nagashima, T. 1996. 新応用昆虫学 *Shin ōyō konchū-gaku* [New applied entomology]. 3rd edition. Tokyo: Asakura Shoten.

Satō, K. 1978. 信州佐久の植物方言 *Shinshū saku no shokubutsu hōgen* [Regional plant names of Saku, Shinshū region]. Tokyo: Tabi to Shinano-sha. In Japanese.

Satō, K. 1985. *Fukuoka-ken-shita dewa hajime no Janbo-tanishi higai* [First report of damage by Janbo-tanishi in Fukuoka Prefecture]. Chiribotan **16** (3): 97. In Japanese.

Satō, Y. 2002. 博物館における生物の差別的名称の使用_アンケート調査から *Hakubutsukan ni okeru seibutsu no sabetsu-teki meishō no riyō. Ankēto chōsa kara* [The use of discriminatory names in museums. Results of the questionnaire]. In Tokushima Hakubutsukan Kenkyū-kai (Eds.) *Chi'iki ni Ikiru Hakubutsukan*. Tokushima: Kyōiku Shuppan Sentā. In Japanese.

Sengoku, S. 2000. 和名に対する考え方 *Wamei ni taisuru kangaekata* [Ways of thinking about wamei]. Hachū Ryōseirui Gakkai-hō 2000 (1): 36-39. In Japanese.

Senō, H. 2012. *Gyorui ni okeru hyōjun wamei no kangaekata to Nihon Gyorui Gakkai no torikumi* [Considering standard wamei for fishes, and the involvement of the Ichthyological Society of Japan]. Panmixia **17**: 37-44. In Japanese.

Shapin, S. & Schaffer, S. 1985. Leviathan and the air-pump : Hobbes, Boyle, and the experimental life. Princeton NJ: Princeton University Press.

Shibatani, M. 1990. The languages of Japan. Cambridge UK: Cambridge University Press.

Shirai, M. 1933. 樹木和名考 *Jumoku wamei kō* [Studies on Japanese tree names]. 9 vols. Tokyo: M. Shirai. In Japanese.

Star, S. L. & Griesemer, J. 1989. Institutional ecology, 'translations' and boundary objects: amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social Studies of Science **19** (3): 387–420.

Suzuki, K. 2012. *Kaisōteki wamei taikei no kōchiku* [Constructing a hierarchical system of wamei]. Panmixia **17**: 19-36. In Japanese.

Takakuwa, M. 2002a. *Kaimei surubeki ka hi ka? – Usuba-shiro-chō*. *In* Aoki *et al.* (Eds), 2002: 6-7. In Japanese.

Takakuwa, M. 2002b. *Yama fukaku seikatsu suru chō-tachi – Kumoma-tsumaki-chō*. *In* Aoki *et al.* (Eds), 2002: 16-17. In Japanese.

Takakuwa, M. 2002c. *Arufabetto ga wamei ni tsuita chō, tsukanakatta chō – Shii-tateha to Eru-tateha, Kitateha*. *In* Aoki *et al.* (Eds), 2002: 19-22. In Japanese.

Takakuwa, M. 2002d. *Mujun shita wamei no tsukekata – toge-ari-toge-nashi-toge-toge*. *In* Aoki *et al.* (Eds), 2002: 25-26. In Japanese.

Takakuwa, M. 2002e. *Gakumei kara kita aikōsha nara dewa no tsūzokushō – neki*. *In* Aoki *et al.* (Eds), 2002: 29-30. In Japanese.

Takeda, S. & Nishi, H. 2015. *Katatsumuri Handobukku* / The handbook of land snails. Tokyo: Bun'ichi Sōgō Shuppan. In Japanese.

Tanaka, S. 1915. 学名および和名に関する卑見 *Gakumei oyobi wamei ni kansuru hiken* [My opinion on scientific and Japanese names]. Dōbutsu-gaku Zasshi 326: 636-640. In Japanese.

Tanaka, S. 1939. 動物の和名に就いて *Dōbutsu no wamei ni tsuite* [Concerning Japanese names for animals]. Shokubutsu Oyobi Dōbutsu vol. 7, part 12. In Japanese.

Traweek, S. 1988. Beam times and lifetimes: the world of high energy physicists. Cambridge MA: Harvard University Press.

Trew, A. 1992. Henry and Arthur Adams's new molluscan names. Cardiff, UK: National Museum of Wales.

Trew, A. 1993. Edgar Albert Smith's new molluscan names. Cardiff, UK: National Museum of Wales.

Tsunoda, R., DeBary, W. T. & Keene, D. (Eds.) 1958. Sources of Japanese tradition. New York NY: Columbia University Press.

Uchida, H. 1999. 分類 *Bunrui* [Systematics]. In *Shin-shi'iku handobukku suizokukan-hen*, vol. 3. Tokyo, Nippon Dōbutsuen Suizokukan Kyōkai.

Uchiyama, R. 1900-04. 本邦産貝類図説 *Honpō-san kairui zusetsu* / On Molluscs of Japan. Zoological Magazine vols. 12, 13 & 16. For detailed pagination of parts, see Higo *et al*., 1999. In Japanese.

Ueno, M. 1931. *Seibutsu-gaku-ron* [On Biology]. In Meiji-shi kōza kankō-kai (Eds.) *Meiji kagaku-shi* [History of science in the Meiji era]. Tokyo: Nippon Bungaku-sha. In Japanese.

Vinarski, M. V. 2014. The birth of Malacology: when and how? Zoosystematics and Evolution **90** (1): 1-5.

Watanabe, M. (Trans. O. T. Benfey) 1976. *Nihonjin to kindai kagaku* / The Japanese and Western science. Philadelphia PA: University of Pennsylvania Press.

Wayman, D. G. 1942. Edward Sylvester Morse: a biography. Cambridge, MA: Harvard University Press.

Wenckstern, Fr. Von. 1895. A bibliography of the Japanese Empire: being a classified list of all books, essays and maps in European languages relating to Dai Nihon (Great Japan) published in Europe, America and the East from 1859-93 A. D. (VIth year of Ansei - XXXVIth year of Meiji). Leiden, E. J. Brill

Wenckstern, Fr. Von. 1907. Bibliography of the Japanese Empire: being a classified list of the literature in European languages relating to Dai Nihon (Great Japan) published in Europe, America and the East. Volume II. Comprising the literature from 1894 to the middle of 1906 (XXVII-IXLth year of Meiji). Tokyo: Maruzen

Wilson, E. O. 1998. Consilience: the unity of knowledge. New York, NY: Alfred Knopf.

Wilson, E. O. 1998. Consilience: the unity of knowledge. New York, NY: Alfred A. Knopf.

Yamashina Chōrui Kenkyūsho (Eds.) 1975-1983. 世界の鳥の和名 *Sekai no tori no wamei* [Japanese names of birds of the world]. 18 vols. In Japanese.

Yamashina, Y. 1986. 世界鳥類和名辞典 *Sekai chōrui wamei jiten* [Dictionary of Japanese names for birds of the world]. Tokyo: Daigaku Shorin. In Japanese.

Yanagisawa, N. et al. (Eds.) 2012. 日本鳥類目録　第 7 版 *Nihon chōrui mokuroku. Dai nana han* / Checklist of Japanese birds. 7th revised edition. Tokyo: Ornithological Society of Japan. In Japanese.

Yano, M. 1905. 昆虫和名私見 *Konchū wamei no shiken* [Personal opinion concerning Japanese insect names]. Hakubutsu no Tomo **28**: 250-256. In Japanese.

植物和名ー学名インデックス YList *Shokubutsu wamei‐gakumei indekusu Ylist* [Ylist: index of Japanese and scientific plant names]. http://ylist.info. In Japanese.

Appendix 1: A survey of four journals

To better understand the role played by wamei in contemporary works, I analyzed the content of four vernacular malacological journals over the calendar years 1980 to 1989. The number of articles across all four journals in the categories tabulated here (for details see below) during that period was 812, occupying roughly 2,000 pages and featuring 2,978 figures, 176 tables or graphs and 102 maps.

Founded in 1928, the Malacological Society of Japan (MSJ) publishes the Venus,[161] the country's oldest continuing publication in the field. The somewhat younger **Chiribotan** is the society's newsletter. Only a small proportion of MSJ members live overseas and while the predominantly English-language Venus fills the role of international journal the Chiribotan is aimed firmly at a domestic audience.

Kyushu no Kai is a regional journal. It was founded through an alliance among local shell clubs in Kyushu, Okinawa and Yamaguchi Prefecture to allow them to publish together a more substantial journal than any could individually.[162] The westernmost parts of Japan have a distinct regional identity in terms both of their malacological fauna and their identity within the scientific community.[163]

Whereas the MSJ meets only once a year, **Hitachiobi** and **Kai-Nakama** are the newsletters of clubs that meet monthly. They thus represent a somewhat different class of publication in terms of the granularity of content and their linkage to more regular meetings.

---

[161] Or Japanese Journal of Malacology, a title that replaced "Venus" for a time during the 1930s.

[162] In Kyushu no Kai, the home prefecture of each author is always given. Yamaguchi is the westernmost prefecture of the island of Honshu, but historically has aligned itself westwards towards Kyushu rather than eastwards. In particular, the alliance of the former domains of Satsuma (now mostly in Kagoshima Prefecture, Kyushu) and Chōshū (present-day western Yamaguchi Prefecture) was instrumental in the overthrow of the Tokugawa Shogunate and the establishment of the Meiji administration in the 1860s.

[163] Despite the region having a collective population of over 16 million and the country's sixth largest city (Fukuoka), the first – and so far only – annual meeting of the MSJ to be held in Kyushu since its founding in 1928 took place in 2011.

All four journals are distributed free to paid-up members of their respective societies and current issues are not openly sold. The Chiribotan originally published at least four scheduled issues per year, as did the Venus, but both have been through lean periods where "joint issues" appeared only twice or even once in a calendar year. This has usually been the result of delays in the editorial process that reflect the all-volunteer nature of the society's management.[164]

The aim in setting the start point of the survey period at 1980 was to situate it firmly in the period before text-based peer-to-peer communication via the Internet and e-mail began changing working practices and creating an often generational stratification in the use of digital resources. All three journals were edited, printed and distributed in a similar fashion, and communication between contributors of all ages and editors was accomplished by mail, phone or direct meeting.

Contemporary shell clubs

Shell clubs and their publications are a forum in which people from varied backgrounds meet, ostensibly to discuss a common interest. The spectrum of knowledge bases is very broad and formal job descriptions are of limited use in classifying participants. Apart from professional malacologists,[165] these include:

- Scientific professionals in other fields such as medicine and public health
- Educators in general biology at universities or schools
- Professionals in non-scientific fields including law, banking and commerce
- Non-professionals, students and retired people

[164] These issues are common to national and regional malacological societies in most countries, whose journals pass through similar "golden" and "blue" periods. Interestingly, the general decline in socialization among people with shared interests chronicled by Putnam (2001) seems not to have affected natural history clubs in Japan as badly as it has in the USA.

[165] Defined here as zoologists whose primary specialization is the Mollusca, and whose work is principally research and publication. In practice, this restricts the group to a small permanent body of museum curators and a larger temporary one of post-graduate and post-doctorate students. In Japan, the ratio of working professional malacologists to the overall population is roughly the same as in Europe and the USA.

- Shell dealers, both professional and part-time

- Artists, particularly illustrators and sculptors

All these people identify themselves as having a particular interest in shells and position themselves within the broad gamut of "shell collectors". Though their knowledge and experience bases vary widely and encompass every level of society, the common vector of their interest is an engagement with nature, whether in terms of biodiversity and ecology, history and culture or simply fascination with shapes and forms. Shell club members tend to know their most comfortable mode of engagement and maintain it; relatively few become noticeably more or less engaged over time, and almost none modify their professional or career status as a result of their interest.[166]

The first modern shell club in Japan was probably the Tengu-kai, which grew out of informal pre-war meetings among a group of collectors and scientists in the Keihanshin area of central Japan.[167] Following World War II, the club was more formally organized by Tetsuaki Kira, a school teacher and lay Buddhist priest, and met at his home in Shijonowate. It published its own journal, the Yume-Hamaguri, to which professionals including Kuroda, Habe, Ōyama and others contributed papers. Present-day shell clubs in Japan are thus clearly analogous to the nature clubs of the Edo era,[168] with the main differences being a higher level of specialization and a broader social base. Both these shifts occurred in the West too. In Britain, a group including members of the broadly-based Linnean Society (founded 1788) formed the more specialized Zoological Society of London (1826); some with a particular interest in mollusks then founded

[166] One exception being students, for whom early membership in a shell club can result in choosing biology as a career path. Notable examples in the USA include at least two former Philadelphia Shell Club members who are now career malacologists. Some shell clubs sponsor student awards that grant funds for research into Malacology by students at any level.

[167] The Keihanshin area encompasses the cities of Kyoto, Osaka, Nara and Kobe.

[168] There is, however, no indication of direct lineage. In evolutionary terms the emergence of shell clubs at different times and in different parts of the world are spontaneous events reflecting the tendency of any group of people with a common interest to meet and organize.

the Conchological Society of Great Britain and Ireland (1876) and its professional counterpart the Malacological Society of London (1893). In the United States, Malacology was organized nationally at professional level with the founding of the American Malacological Union in 1932, though the earliest club was the Conchological Club of Southern California, founded in 1902.[169] Shell clubs were founded in many American cities and grew in number with the upsurge in popular shell collecting that followed World War II. These included New York (Brooklyn Conchological Club, 1907; New York Shell Club, 1947), the Philadelphia (1955), Chicago (1964) and Pittsburgh (1966) Shell Clubs and dozens of local clubs, particularly in Florida and the Gulf states.

Science in regional journals

The papers in Japanese vernacular journals can be divided into actual malacology – that is, reporting of field work, experiments and dissections by the people who conducted them – and secondary work including syntheses of literature and historical research. An important element of the former category is species lists that are based on collecting trips or syntheses of various reports. These can be of considerable scale and often use only wamei. For example: Hamada (1983) reported on a collecting trip to Okinawa in 1982 listing 189 species from four localities, complete with collecting dates and notes on different habitats within the sites.

Hamada's paper also remarked on an invasive species, and club journals are one of the most useful sources of information on these. For example, freshwater pulmonate snails of the family Ampullariidae (Apple Snails) are a major agricultural pest in Japan, having originally been introduced to Asia from South America. They were cultivated as food in the post-war period, but have since acclimatized in the wild and cause severe damage to rice crops by eating the young shoots. The expanding range of these "*Janbo-tanishi*" (literally "Jumbo river snails") has been

[169] There was also the short-lived American Association of Conchologists, which existed for less than five years from 1892. See Nautilus, 1896, 10 (8): 94-96.

the subject of several detailed reports in club journals. Nishimura (1982) discussed their taxonomy, suggesting that the wamei actually represented multiple species. Satō (1985) recorded them for the first time from Fukuoka Prefecture, based on local newspaper reports. Hamada (1985) reported them together with several other invasive mollusks in Kumamoto Prefecture, and included details of diet and figures of oviposition.

In 1985, the MSJ announced in the Chiribotan a nationwide volunteer drive to report findings of *Janbo-tanishi* and map their spread. Habe (1986) addressed the taxonomy of three species that up to then had been lumped together under the wamei, stabilizing their nomenclature with figures and descriptions. Hamada (1989) recorded a sinistral form from Kumamoto Prefecture. As with other invasives such as the *Shima-menō-gai* (*Crepidula onyx*), a marine species native to the north Atlantic that arrived on American ships in the late 19th century, local observations and records in club journals give a detailed picture of their changing ecology and spreading distribution.

Another remarkable feature of club journals is the frequent appearance of dissection drawings. The layout and morphology of the genitalia is an important factor in the taxonomy of land snails, especially pulmonates, whose shells and body coloration can vary considerably across their geographical range. Detailed genitalia diagrams are a valuable resource for workers elsewhere, particularly those concerned with invasive and pest species.[170]

Citizen science initiatives

As a counterpart to national initiatives like that mentioned above for *Janbo-tanishi*, club journals occasionally also publish appeals for participation in faunal surveys. These "citizen

[170] The US Department of Agriculture's head malacologist, Dr. David Robinson, attests that any species inbound from Japan and its surrounding area is "actionable" and that detailed information on the reproductive anatomy in English would be of great value to inspectors and analysts. Pers. comm, 2016.

science" initiatives mirror bird surveys in the USA[171] or the more generalist "bio-blitzes" carried out in several countries. In 1987, for example, the Hanshin Shell Club published in the Kai-Nakama a form for a land snail survey of Hyōgo Prefecture. One page carried instructions for completing the form, such as how to specify the locality, and the other was the form itself. This consisted of a blank template for recording the date and locality, and then a list of 133 land snail species already known from the prefecture. Participants were asked to mark those found at the locality with a circle. If a species not included in the list was found, its name could be added by hand. All the names were wamei, however, and no illustrations were given. It was thus assumed that contributors could identify species correctly, and that the only naming used in analyzing the results would be vernacular.

Authors

In terms of their significance to international science, the authors of papers in these journals can be divided into two classes: those who also publish in English, and those who do not. The former class largely comprises professional scientists and includes leading malacologists such as Kuroda, Habe, Ōyama, Akihiko Matsukuma and Kazunori Hasegawa. The latter and much larger group encompasses a wide range of expertise and backgrounds. The most common profession among Japanese amateur malacologists who publish is school teacher, followed by medical professional. All over the world shell collecting is a famously classless hobby, and the clubs whose journals are surveyed here brought together students, housewives and public employees together with luminaries such as the chairman of Canon Inc, the founder of the JCB credit card corporation and at least two members of the Imperial family. Several non-professional authors are competent anatomists and many are keen field collectors.

[171] Barrow, 2000

In the vernacular sphere there are a handful of authors the breadth and depth of whose scholarship would qualify them as world-class malacologists if the world knew about them. Prominent among them is Ekawa Kazufumi, a polymath with a prodigious publication record both in scientific Malacology itself and more generally in the history of the field. Over more than fifty years Ekawa has built up probably the most extensive private malacological library in Japan and authored an inexhaustible stream of papers on Japanese molluscan science that often draw directly on primary Western works. He translates from English, French and German and is also an authority on the historical derivation of wamei. In the ten-year study period alone he published 59 papers in three out of the four journals surveyed. These ranged in content from notes on single wamei and commentaries on mollusks in ancient Japanese poetry anthologies to illustrated translations of the work of Arthur Adams.[172] Ekawa has also published original research on anatomy and ecology.

Chiribotan

The *Chiribotan* was established by the MSJ as a companion "newsletter" to the *Venus* in 1960[173]. For many years its format was smaller and less sophisticated than that of the *Venus*, but with the adoption of regular color printing and the same page size (both in 1996) it has become visually similar to its older sibling. During the period examined here papers in the *Chiribotan* were entirely in Japanese. An English abstract was only very rarely included, but an English title was given for every paper over a certain length. Although a printed English abstract for all

[172] Adams described several hundred species of marine mollusk from Japan while serving as surgeon aboard British survey vessels in the 1840s and 1850s. His descriptions, often of very small shells, were notable for their brevity and for not being accompanied by illustrations, both of which were bluntly deplored by Pilsbry in the introduction to his Marine Mollusks of Japan (1895). Ekawa cut and pasted figures from many subsequent Western works that have been determined to represent Adams's species and published illustrated Japanese summaries of many of them. These formed an extraordinarily valuable contribution to native knowledge of the Japanese fauna, but are unknown elsewhere. See e. g. Ekawa, 1985; Ekawa, 1986-90.

[173] The publication of a vernacular newsletter in tandem with a predominantly English-language journal is not unique to Japan; in Malacology there is, for example, the pairing of "Novapex" (formerly "Arion" and "Apex") and "Vie de la Societe" from the Société Belge de Malacologie and "Basteria" and "Spirula" from the Malacological Society of The Netherlands (Nederlandse Malacologische Verenigung).

articles was included as a separate sheet starting with volume 20 (2) this did not last long. Nowadays individual authors may choose to include one, but it is not required.

Other content outside the classes tabulated in this study included numerous book reviews, news of shells on stamps, indexes to prior volumes and lists of new society members.

Hitachiobi

The Tokyo Malacological Society[174] was established in 1974, with the first number of its newsletter *Hitachiobi* appearing in April of that year[175]. Like the other three journals surveyed, it remains in publication today.

The first editor was the artist Shimura Tatsuo but by 1980 his place had been taken by Katō Shigetomi. The format was overhauled after no. 112 in 2010, with the most important aspect being the adoption of full-color printing. Before that, illustrations in the text were either line drawings or monochrome photographs. However, from the beginning almost every issue came with a color photograph of one or more shells, printed by a commercial service and inserted loose. The caption for this was printed on the first page, and the intention was that subscribers glue the picture to the front cover.

There is now also a page on the club's web site for recent issues[176], and back numbers are sold by the society.

Kyushu no Kai

The journal of the Kyushu Shell Club[177] was founded with the club's launch in 1972. It appeared less frequently in the study period than the other journals examined here, with 17

---

[174] 東京貝類同好会 *Tōkyō Kairui Dōkōkai*.

[175] The club's predecessor, the Amateur Shell Club (*Amachua Kaigara Kurabu* アマチュア貝殻クラブ) had ceased meeting the previous year following the death of its founder, the painter Yamamoto Masao. Its newsletter, the *Amachua Kaigara Kurabu Ripōto* ["Amateur Shell Club Report"] ran for 56 issues between 1967 and 1973 and was the direct precursor to the *Hitachiobi*. Morita, 1973.

[176] http://www.tokyoshells.org/hitachiobi.html

[177] 九州貝類談話会 *Kyushu Kairui Danwakai.*

issues between 1980 and 1989 as opposed to 35 for the *Chiribotan* and 38 for *Hitachiobi*. It did not appear at all in 1987.

However, during this period *Kyushu no Kai* had a slightly larger page format than *Chiribotan* and *Hitachiobi*, and the maximum content on a page of print was 36 lines of 42 characters each, a total of 1,512 characters, 17% more than the Chiribotan (1,292) and 14% more than Hitachiobi (1,326). The editors during this period were society founders Yamamoto Aizō, a school teacher and an accomplished naturalist, and Hamada Toshiyuki, a collector and professor of pharmacology at Kumamoto University.

Papers in *Kyushu no Kai* during the study period almost never had English titles, unlike the *Chiribotan*.

Kai Nakama

The Hanshin Shell Club[178] is the successor to Kira Tetsuaki's *Tengu-kai*. Until the opening of the Nishinomiya Shell Museum in 1999, the club met every month at the Kikuchi-kai-kan (Kikuchi Shell Museum) adjacent to the Kaisei Hospital at Koroen in Nishinomiya where Kuroda Tokubei had become a permanent resident in 1966, the year of the club's founding following Kira's death in 1965. The museum's president, Kikuchi Norio, was the hospital's director and an avid collector who built and furnished the establishment from his own resources.

Of all the regional clubs, Hanshin could at the time claim the most illustrious membership. Regulars at its meetings included professionals like Kuroda, Habe and Ōyama - the three authors of Seashells of Sagami Bay - as well as major collectors including Ryōsuke Kawamura and Shin'ichi Ikebe.

[178] 阪神貝類談話会 *Hanshin Kairui Danwakai.*

Kai Nakama[179] began in 1967 as a photocopied handout at the regular meetings. It continues to the present day, having acquired an ISSN number in 1986. Its format is very similar to that of *Kyushu no Kai*, though during the study period the number of issues and articles was considerably higher, reflecting the more centralized and active nature of the club. It featured line illustrations and occasionally color photographs were tipped in. During the study period the cover illustrations were almost all pen-and-ink drawings by club member Kitao Kōji, with detailed captions on the inside front cover like those in Hitachiobi. The captions were often lifted from published zukan, but some were original contributions by club members.

Author diversity

Author diversity expressed as the ratio of the number of individual authors to the number of papers is:

Chiribotan: 144 / 502 [3.5]

Hitachiobi: 34 / 115 [3.4]

Kai Nakama: 48 / 212 [4.4]

Kyushu no Kai: 29 / 98 [3.4]

Apart from *Kai Nakama*, which has 29% fewer authors, the ratio is almost identical.

Popular professionals

As discussed abover, science is variously conceived as an objective principle-based practice[180] and a socially situated web of consensus negotiations.[181] A strong challenge to the former conception can be seen in the role professional malacologists have played within the amateur community. From the earliest emergence of the "scientist" as a modern social figure

[179] The title loosely translates as "Shell group", though *nakama* implies more precisely an intimate and familiar grouping of friends.
[180] *e. g.* Wilson, 1998.
[181] *e.g.* Latour, 1988.

within the broader ambit of "scholar" there have been key figures who are motivated to evangelize on behalf of nature study in general and their own field in particular. Although all professional naturalists publish their work to one extent or another, only some seek to engage on a personal level with amateurs, and only some of them in turn do not have ulterior motives. Charles Darwin famously consorted in pubs with pigeon fanciers and discussed with them the techniques and fine points of breeding, but his clear intention was to use their knowledge in his own research and he did not attempt to turn them into naturalists.

At the same time, many of the first Victorian scientists were professors and thus were obliged to convey at least generic knowledge to their students.[182] Others had independent means and worked in museums[183] for the pure pursuit of knowledge, however, and it is among these that the distinction between the gregarious evangelist and the introspective purist is of most interest. In all fields of natural science, certain professionals have devoted time and energy to inspiring public interest in their field through talks, popular books and active participation in clubs. In Malacology perhaps the most famous example is R. Tucker Abbott (1919-1995), a curator in turn at the Smithsonian Institution, the Academy of Natural Sciences of Philadelphia and the Delaware Museum of Natural History whose prodigious efforts to promote shell collecting through books and in person inspired several generations of professional and amateur workers.[184] Abbott had an almost exactly contemporary Japanese counterpart in Habe[185], a genial and similarly sociable man whose personal engagement with amateurs and students was of no less importance in recruiting people to malacology and transforming their collections and observations into published scientific knowledge. In the period and journals covered by the

[182] The difference between "scientific knowledge" and "my research" is one of the most significant factors in the organization of science, particularly within public institutions such as museums and universities. For the history of the relationship between museum scientists and their managements, see Rader & Cain, 2014.
[183] Museum curatorships were largely unpaid until the late nineteenth century, and even today many researchers are effectively self-financing.
[184] Harasewych, 1997.
[185] Callomon, 2002b.

present study, Habe published 103 articles – 94 in *Chiribotan*, nine in *Hitachiobi* and three in *Kai-Nakama*.

Abbott was a student of William Clench (1897-1984), himself an influential figure in malacology as curator of mollusks at the Museum of Comparative Zoology at Harvard, and Habe was the protégé of Kuroda, the prodigious Dean of Japanese Malacology. Both younger men shared the advantages of starting fresh in the field their mentors had helped build over decades and a greater familiarity with the changes that communication technologies were bringing to social practices in the post-war period. Their careers as scientists benefited to some extent from their interactions with amateurs,[186] but their promotion of shell collecting largely reflected genuine enthusiasm and the inclination of their gregarious personalities to share it. For both, the best vehicle for this was the shell club, the national society and the publications of both. Habe, therefore, published the majority of his vast oeuvre[187] in Japanese, and took care to use Latin wherever possible to set a good example.

Classes of paper

The papers in the study are divided into two main classes, depending on whether or not they involve analysis of primary data or observations.

Analysis: anatomy
: Deals specifically with internal anatomy (including radulae) via dissection and drawing or photography.

Analysis: behavior
: Deals with behavior of animal via field or laboratory observations.

Analysis: nomenclature
: Deals with formation and derivation of scientific names (not wamei); synonymy, homonymy, priority and availability.

Analysis: physiology
: Deals with the physical appearance, feeding or reproduction of animals, but not via anatomy.

[186] Abbott, for example, used his considerable personal charisma and scientific reputation to persuade several wealthy acquaintances to sponsor collecting expeditions aboard their own yachts and to fund a chair of Malacology at the Academy of Natural Sciences.
[187] Okamoto, 2001.

Analysis: taxonomy

Deals with the assignment of species to genera and families based on morphological or geographical factors.

Biogeography

Deals with the distribution of species; presence or absence in particular places, historic presence, new records and range extensions. Most species lists fall into this category.

Biography

Historical biographies and obituaries, lists of publications and celebratory articles for anniversaries.

Collecting trip report

Report of a journey or day trip specifically for or incidentally involving shell collecting. Often contains a species list. Differs from “Biogeography” in being an account of a specific trip.

Cover caption

Detailed explanation of shells featured in the cover photograph or illustration. The description is usually of the species, though the measurements and collecting locality of the figured specimen(s) are often also given. These pieces are thus basically taxonomic in nature, and this category is assessed here as a subset of “Analysis: taxonomy”.

Cultural piece

Shells in art; shells in historical accounts, poetry and literature; archaeology and ethnology involving shells *etc*.

History of Malacology

Deals with aspects of malacological history that are not exclusively biographical, such as histories of publications, institutions etc.

Literature review

Summarizes and/or analyzes one or more past works on Malacology. Does not include contemporary book reviews.

On wamei

Specifically concerning the meaning, derivation, history, application or synonymy of wamei.

Specimen report

A paper based around one or more specimens (not species) that are figured or described. Includes unusual forms, freaks and regional morphs.

Travelogue

Report of trip not primarily for shell collecting. Unlike “Collecting trip report” thus does not involve consistent collecting or recording methodologies.

The top five categories of article by number of individual appearances in the journals surveyed were as follows:

Chiribotan: Taxonomy (23.8%), Biogeography (17.3%), Biography (16.5%), Specimen reports (10.6%), Ecology (6.2%)

Hitachiobi: Taxonomy and Cover caption (10.4% + 21.7% = 32.1%), Collecting trip report (20.9%), Cultural piece (12.2%), Travelogue (8%)

Kai Nakama: Taxonomy and Cover caption (39% + 25% = 64%), Biogeography (46%), Collecting trip reports (21%), Literature review (17%)

Kyushu no Kai: Taxonomy (26.5%), Biogeography (21.4%), Collecting trip reports (18.4%), Anatomy (9.2%), Specimen reports/ecology/physiology/methods (4.8%)

These results demonstrate that the principal focus of these vernacular journals is the classification and distribution of mollusks, with relatively little space given to the more social aspects of the field. As the vernacular organ of the national society, however, the Chiribotan includes more obituaries than the others; these are often of people who rarely or never contributed to the Chiribotan or the Venus, but whose role in the field would be considered important enough by the society's members to warrant acknowledgment.

Appendix 2: Partial list of zoology textbooks published during the Meiji Period 1868-1912

The list given here is taken primarily from the holdings of the National Diet Library in Tokyo, and consists solely of titles containing the term *Dōbutsu-gaku* (zoology). Text books do not always survive the rigors of time, and from the advertisements in some of those listed below there were clearly many others that are not now to be found in the Japanese national library system. This list clearly shows the explosion in new works aimed at students at all levels during the Meiji period.

1874. Bromme, T. (Trans. & abridg. Tanaka, Y.; illust. Nakajima, G.) 動物学 / *Dōbutsu-gaku*. Tokyo: Imperial Museum.

1874. Slüys, J. A. P. (Trans. Ōta, M.) 動物学.初篇 / *Dōbutsu-gaku* 1. Kanazawa: Ishikawa-ken Gakkō.

1874. Itō, Y. 植学畧解 / *Shoku-gaku ryakkai*. Tokyo: Monbushō.

1874. Tanaka, Y. 動物学/ *Dōbutsu-gaku*. Tokyo: Monbushō.

1875. Tanaka, Y. 動物訓蒙 */ Dōbutsu-kunmō.* Tokyo: Hakubutsukan.

1875. Tanaka, Y., Ono, M. & Kubo, H. (Eds.) 植学浅解 / *Shokugaku senkai* . Tokyo: Monbushō.

1875-1876. Garrigues, J., trans. Tanaka, K. 初学須知(牙氏) / *Shogaku shūchi*. Tokyo: Monbushō.

1876-1877. Shimizu, S. (Ed.) 初学須知字引(牙氏) / *Shogaku shūchi jibiki*. Tokyo: Shimizu Tokuichirō.

1878. Nose, S. (Trans. & Ed.) 中学動物学.巻之 1, 2 / *Chūgaku dōbutsu-gaku* 1, 2. Okayama: Saikin-sha.

1880. Garrigues, J. (Trans. Tanaka, K.) 初学須知.巻之 5 (動物学) / *Shogaku shūchi*, vol. 5: *Dōbutsu-gaku*. Kanazawa: Ekichikan.

1880. Matsumoto, K. & Itō, K. 動物小学 / *Dōbutsu shōgaku.* Tokyo: Kinshinkaku.

1880. Nagata, K. 百科全書動物綱目/ *Hyakka zensho: dōbutsu kōmoku.* Translations of articles from Chambers Encyclopedia. Tokyo: Monbushō.

1881. Hirasaka, K. (Ed.) 訓蒙動物学 / *Kunmō dōbutsu-gaku*. Tokyo: Kōbunsha.

1881. Nakagawa, E. 訓蒙動物学字解 / *Kunmō dōbutsu-gaku jikai*. Tokyo: Kōbunsha.

1882. Murata, C. (Ed.) 小学博物書.巻之 1 動物学之部 / *Shōgaku hakubutsu-sho* 1. *Dōbutsu*. Tokyo: Kinkōdō.

1883. Tanba, K., Shibata, S. & Takamatsu, K. (Eds.) 普通動物学 / *Futsū dōbutsu-gaku*. Tokyo: Shimamura Risuke.

1883-1886. 百科全書 / *Hyakka zensho*. Tokyo: Yūrindō.

1883-1888. Neriki, K. & Takita, S. 応用動物学 / *Ōyō dōbutsu-gaku.* Vol. 1 (3 parts); vol. 2 (1 part). Tokyo: Chūkindō.

1884-1885. 百科全書 / *Hyakka zensho*. Tokyo: Maruzen.

1885-1888. Fitzinger, L. F. J., trans. & illust. Iwahashi, K. 動物学図解.巻之 1-3 上 / *Dōbutsu-gaku zukai*. 3 vols. Tokyo: Bunkaisha.

1887. Iwakawa, T. 動物通解 / *Dōbutsu tsūkai*. Tokyo: Monbushō.

1888. Kuryū, K. 動物学 / *Dōbutsu-gaku*. Kyoto: Wakabayashi Moichirō.

1888. Morse, E. S., trans. Yatabe, R. 動物学初歩 / *Dōbutsu-gaku shoho*. Tokyo: Maruzen.

1888. Takahashi, T. 動物学. 第 4・5 部 / *Dōbutsu-gaku*. Parts 4 & 5. Publisher unknown.

1888. Takenaka, T. (Ed.) 動物学 / *Dōbutsu-gaku*. Tokyo: Tokyo Kyōiku-sha.

1889. Iijima, I. 動物学教科書: 中等教育 / *Dōbutsu-gaku kyōkasho: chūtō kyōiku*. Tokyo: Keigyōsha.

1889. Iwasaki, T. (Ed.) 動物・植物・礦物・博物学問答 / *Dōbutsu shokubutsu kōbutsu hakubutsu mondō*. Tokyo: Iwasaki Tetsujirō.

1890. Nakatsukasa, S. (Ed.) 新撰動物学 / *Shinsen dōbutsu-gaku*. Kyoto: Bunkōdo.

1890. Seki, M. 動物学 / *Dōbutsu-gaku*. Tokyo: Hakubunkan.

1890. Keigyō-sha Editors 動物學 / *Dōbutsu-gaku*. Tokyo: Keigyōsha.

1891. Eisai Jinshi-sha Editorial Office (Ed.) 受験必用動物学問答五百題 / *Juken hitsuyō dōbutsu-gaku mondō gohyaku-dai*. Tokyo: Eisai Jinshi-sha.

1891. Iijima, I. (Ed.) 普通動物学教科書 / *Futsū dōbutsu-gaku kyōkasho*. Tokyo: Keigyōsha.

1891. Iwakawa, T. 動物学 / *Dōbutsu-gaku*. Tokyo: Bungakusha.

1891. Mita, S. 小動物学: 初等教育 / *Shōdōbutsu-gaku: shotō kyōiku*. Tokyo: Hakubunkan.

1891. Shinoda, S. 受験予備動物学問答 / *Juken yobi dōbutsu-gaku mondō*. Osaka: Shinoda Shōsaku.

1891. Tanba, K. & Shibata, S. (Eds.) 普通動物学 / *Futsū dōbutsu-gaku*. Tokyo: Shimamura Risuke.

1891. Tokyo Eigo Gakkō (Eds.) 動物学問答 / *Dōbutsu-gaku mondō*. Tokyo: Tokyo Eigo Gakkō.

1892. Hatta, S. (Ed.) 動物学新書 / *Dōbutsu-gaku shinsho*. Tokyo: Fuzanbō.

1892. Iwakawa, T. (Ed.) 動物学: 中等教科 / *Dōbutsu-gaku: chūtō kyōka*. Tokyo: Bungakusha.

1892. Nakatsukasa, S. (Ed.) 受験必携動物学問答 / *Juken hikkei dōbutsu-gaku mondō*. Kyoto: Kawa'ai Unosuke.

1892. Watanabe, E. (Ed.) 普通理科字典.第 1 巻 (動物学之部) / *Futsū rika jiten, vol. 1. Dōbutsu-gaku no bu*. Matsue: Hakkō-sha.

1893. Gotō, S. 中等動物学教科書 / *Chūtō dōbutsu-gaku kyōkasho*. Tokyo: Kinkōdō.

1893. Ishikawa, C. 動物学教科書 / *Dōbutsu-gaku kyōkasho*. Tokyo: Fuzanbō.

1893. Ishikawa, C. 石川動物学教科書 / *Ishikawa dōbutsugaku kyōkasho.* Tokyo: Fuzanbō.

1894. Ishikawa, C. 新撰普通動物学 / *Shinsen futsū dōbutsu-gaku*. Tokyo: Fuzanbō.

1894. Kōtō Gakujutsu Kenkyū-kai (Eds.) 高等学術講義 / *Kōtō gakujutsu kōgi*. Kōtō Gakujutsu Kenkyū-kai.

1895. Takahashi, A. 新編動物学 / *Shinpen dōbutsu-gaku*. Tokyo: Hakubunkan.

1895. Mitsukuri, K.通俗動物新論 / *Tsūzoku dōbutsu shinron*. Tokyo: Keigyōsha.

1896. Fujita, K. (Trans.) 動物学研究用薬剤便覧 / *Dōbutsu-gaku kenkyū-yō yakusai benran*. Tokyo: Fujita Tsunenobu.

1896. Ishikawa, C. 新撰普通動物学 / *Shinsen futsū dōbutsu-gaku*. Tokyo: Fuzanbō.

1896. Keigyō-sha Editors 動物学 / *Dōbutsu-gaku*. Tokyo: Keigyōsha.

1896. (Unknown) 動物学問答 / *Dōbutsu-gaku mondō*. Tokyo: Fuzanbō.

1897. Ishikawa, C. 石川動物學教科書.下卷 / *Ishikawa dōbutsu-gaku kyōkasho*. Tokyo: Fuzanbō.

1898. Gotō, S. 新編普通動物学 / *Shinpen futsū dōbutsu-gaku*. Tokyo: Kinkōdō.

1898. Oka, A. 新編中等動物学 / *Shinpen chūtō dōbutsugaku*. Tokyo: Rokumeikan.

1898. Ōmori, S. 新編動物学教科書 / *Shinpen dōbutsu-gaku kyōkasho*. Tokyo: Shōeidō.

1899. Oka, A. 新編中等動物學 / *Shinpen chūtō dōbutsugaku*. Tokyo: Rokumeikan.

1899. Oka, A. 近世動物学教科書 / *Kinsei dōbutsu-gaku kyōkasho*. Osaka: Miki Sasuke.

1899. Wakiya, Y. (Ed.) 新編動物学: 中等教育 / *Shinpen dōbutsu-gaku: chūtō kyōiku*. Osaka: Maekawa Zenbei.

1899-1902. 博物学: 女子教科 / *Dōbutsu-gaku: joshi kyōka*. Tokyo: Seibidō.

1900. Iizuka, A. 動物学本義 / *Dōbutsu-gaku hongi*. Tokyo: Dai-nippon Rika Tsūshin Kōshū-kai.

1900. Ishikawa, C. & Ichimura, T. 近世動植物學教科書 / *Kinsei dōshokubutsu-gaku kyōkasho*. Osaka: Sekizenkan Honten.

1900. Ishikawa, C. 中等動物学 / *Chūtō dōbutsu-gaku*. Tokyo: Fuzanbō.

1900. Mitsukuri, K. 普通教育動物学教科書 / *Futsū kyōiku dōbutsu-gaku kyōkasho*. Tokyo: Kansei-kan

1900. Mitsukuri, K. 動物學教科書: 普通教育 / *Dōbutsu-gaku kyōkasho*. Osaka: Kansei-kan.

1900. Ōmori, S. (Ed.) 中等動物学 / *Chūtō dōbutsu-gaku*. Tokyo: Shōeidō.

1900. Unknown 動物学: 生徒用書 / *Dōbutsu-gaku: seito-yōsho*. Tokyo: Fuzanbō.

1900. 新式動物学問答 / *Shinshiki dōbutsu-gaku mondō*. Tokyo: Shūgakudō.

1900, 1903. Gotō, S. 実験動物学.第 1, 2 卷 / *Jiken dōbutsu-gaku*. 2 vols. Tokyo: Kinkōdō.

1901. Ishikawa, C. 大動物学.第 1 卷 1, 2 / *Dai dōbutsu-gaku*. 2 vols. Tokyo: Fuzanbō.

1901. Ishikawa, C. 新撰普通動物学 / *Shinsen futsū dōbutsu-gaku*. Tokyo: Fuzanbō.

1901. Kawamura, M. 通俗動物学 / *Tsūzoku dōbutsu-gaku*. Tokyo: Hakubunkan.

1901. Kodani, Y. 動物学講義筆記 / *Dōbutsu-gaku kōgi hikki*. Yonago: Saihaku-gun Kyōiku-kai.

1901. Mitsukuri, K. 動物学教科書註釈: 普通教育 / *Dōbutsu-gaku kyōkasho chūshaku: futsū kyōiku*. Tokyo: Kaiseikan.

1901. Wakiya, Y. (Ed.) 新編動物学: 中等教育 / *Shinpen dōbutsu-gaku chūtō kyōiku*. Tokyo: Hakubunkan.

1902. Fujita, K. 日本水産動物学 / *Nihon suisan dōbutsugaku*. Tokyo: Shōkabō.

1902. Ishikawa, C. (Ed.) 動物学教科用掛図々解 / *Dōbutsu-gaku kyōkasho kakezu zukai*. Tokyo: Fuzanbō.

1902. Mitsukuri, K. 動物学教科書: 普通教育 / *Dōbutsu-gaku kyōkasho: futsū kyōiku*. Tokyo: Kaiseikan.

1902. Miyajima, M. 普通動物学 / *Futsū dōbutsugaku*. Tokyo: Seibidō.

1902. Oka, A. 簡易動物学講義 / *Kan'i Dōbutsugaku kōgi*. Tokyo: Kaiseikan.

1902. Oka, A. Text-book of modern zoology / 近世動物学教科書 *Kinsei Dōbutsugaku kyōkasho*. Tokyo: Kanseikan.

1902. Ōmori, S. 新編動物学教科書 / *Shinpen dōbutsu-gaku kyōkasho*. Tokyo: Kyobunsha.

1902. Terasaki, T. (Ed.) 動物学中教科書 / *Dōbutsu-gaku chū kyōkasho*. Tokyo: Keigyōsha.

1902. Yamashita, S. & Uno, E. (Eds.) 家畜寄生動物学. 上巻 / *Kachiku kisei dōbutsugaku*. Vol. 1. Tokyo: Nankōdō.

1903. Aida, T. 新撰動物学 / *Shinsen dōbutsu-gaku*. Tokyo: Hakubunkan.

1903. Gotō, Y. & Mizoguchi, S. (Eds.) 動物学: 女子教科 / *Dōbutsu-gaku: joshi kyōka*. Tokyo: Rokumeikan.

1903. Miyajima, M. (Ed.) 動物学: 女子教科 / *Dōbutsu-gaku: joshi kyōka*. Tokyo: Seibidō.

1903. Okano, E. (Ed.) 新撰動物問答: 附・鉱物学問答 / *Shinsen dōbutsu mondō: fu kōbutsu-gaku mondō*. Tokyo: Bunyōdō.

1904. Komatsuzaki, E. (Ed.) 水産動物学 / *Suisan dōbutsu-gaku*. Tokyo: Kyobunsha.

1905. Gotō, S. 實驗動物學.第 1 卷 / *Jiken dōbutsu-gaku*. Tokyo: Kinkōdō.

1905. Hakubutsu-gaku Kenkyūkai (Ed.) 動物界 / *Dōbutsu-kai*. Tokyo: Rokumeikan.

1905. Kyōka Kenkyūkai (Eds.) 中等教科図説全書 / *Chūtō kyōka zusetsu zensho*. Tokyo: Seirindō.

1906. Iijima, I. (Ed.) 普通動物学教科書 / *Futsū dōbutsu-gaku kyōkasho*. Tokyo: Gakkai-shi shinsha.

1906. Ishikawa, C. 農業動物学 / *Nōgyō dōbutsugaku*. Tokyo: Seibidō.

1906. Kashima, M. (Ed.) 家畜外寄生動物学 / *Kachiku-gai kisei dōbutsu-gaku*. Tokyo: Yūrindō.

1906. Mishima, K. 実用動物学表解 / *Jitsuyō dōbutsu-gaku hyōkai*. Tokyo: Rokumeikan.

1906. Oka, A. 最新動物学教科書 / *Saishin dōbutsugaku kyōkasho*. Tokyo: Rokumeikan.

1906. Shūbisei (*sic*). 変動物学 / *Hen dōbutsu-gaku*. Tokyo: Kinkodō.

1906-1907. Futsū Kyōiku Gakkai (Eds.) 動物学 / *Dōbutsu-gaku*. Tokyo: Shūgakudō.

1907. Hakubutsu-gaku Kenkyūkai (Ed.) 動物界 / *Dōbutsu-kai*. Tokyo: Rokumeikan.

1907. Iijima, I. 最新動物学講義 / *Saishin dōbutsu-gaku kōgi*. Tokyo: Nichia Kōshi.

1907. Iizuka, A. 海産動物学 / *Kaisen dōbutsu-gaku*. Tokyo: Hakubunkan.

1907. Ishikawa, C. 動物学叢話 / *Dōbutsugaku sōwa*. Tokyo: Hakubunkan.

1907. Kawanami, Y. 動物学要解 / *Dōbutsu-gaku yōkai*. Tokyo: Kanasashi Hōryūdō.

1907. Kotoiya, F. 女子動物学参考書 / *Joshi dōbutsu-gaku sankōsho*. Osaka: Tanaka Sōeidō.

1907. Nagata, T. 動物学表解: 言文一致 / *Dōbutsu-gaku hyōkai: genbun icchi*. Osaka: Tanaka Sōeidō.

1907. 動物学図解 / *Dōbutsu-gaku zukai*. Tokyo: Rokumeikan.

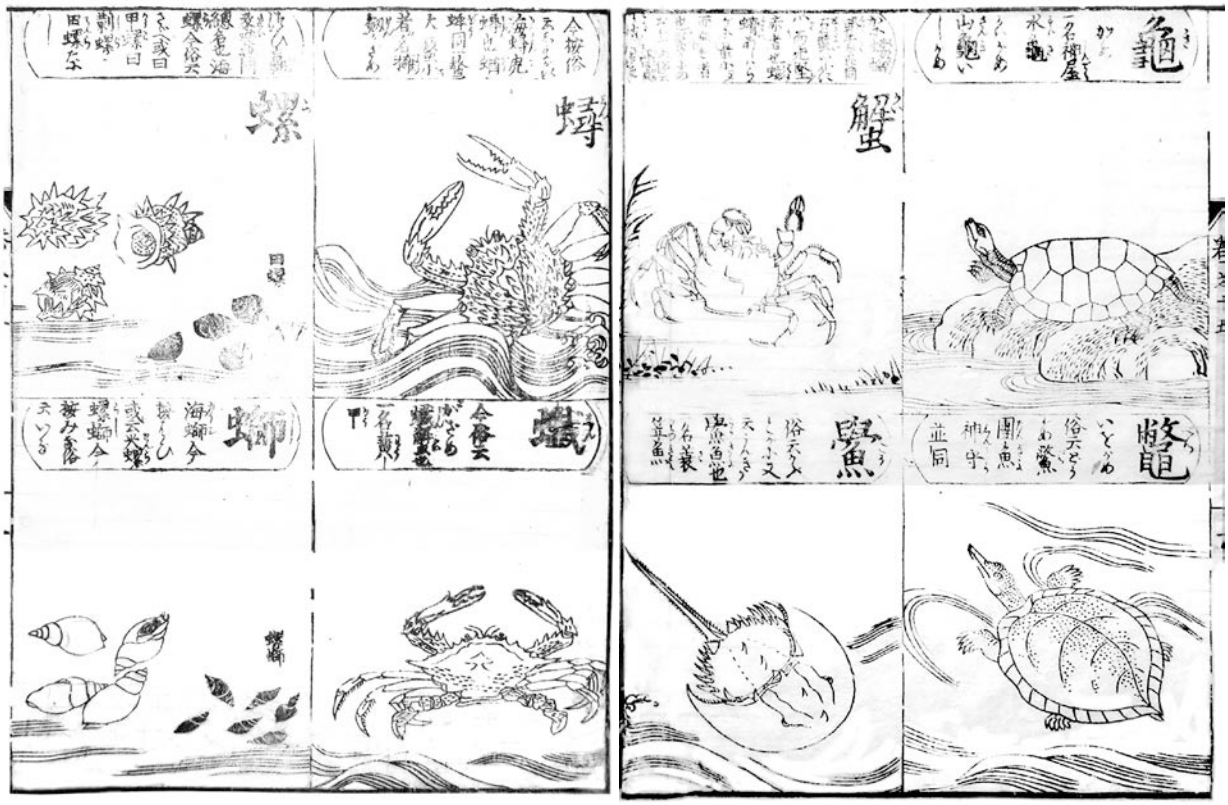
1908. Ishikawa, C. 進化論的動物学綱要 / *Shinkaron-teki dōbutsu-gaku kōyō*. Tokyo: Kōdōkan.

1909. Aoyama, S. (Ed.) 家畜外寄生動物学編 / *Kachiku-gai kisei dōbutsu-gaku hen*. Kanazawa: Yoshida Nōen.

1909. Hatta, S. 新撰動物学教科書 / *Shinsen dōbutsu-gaku kyōkasho*. Tokyo: Kaiseikan.

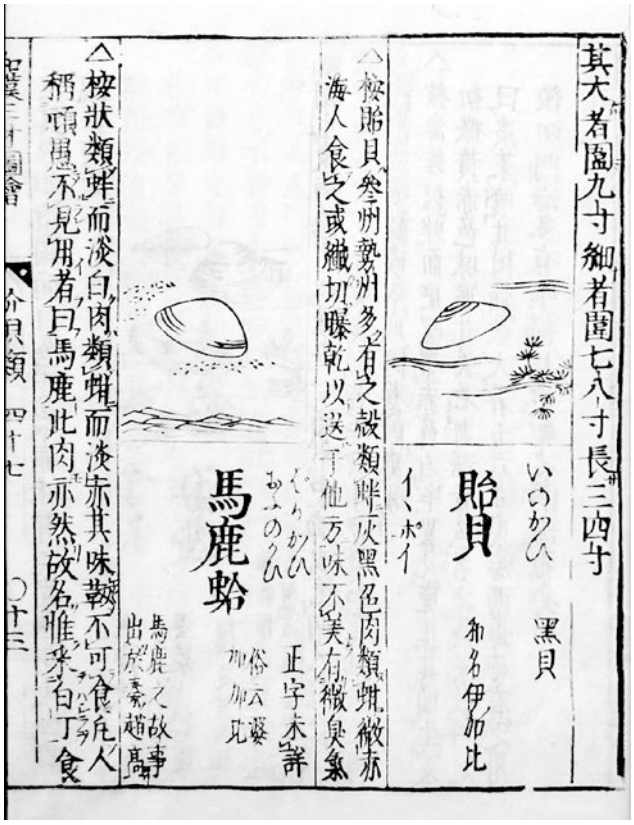
1909. Inoue, T. (Ed.) 俳諧動物学 / *Haikai dōbutsu-gaku*. Tokyo: Bunshō-kaku.

1910. Hatta, S. 新撰動物學教科書 / *Shinsen dōbutsu-gaku kyōkasho*. Tokyo: Kaiseikan.

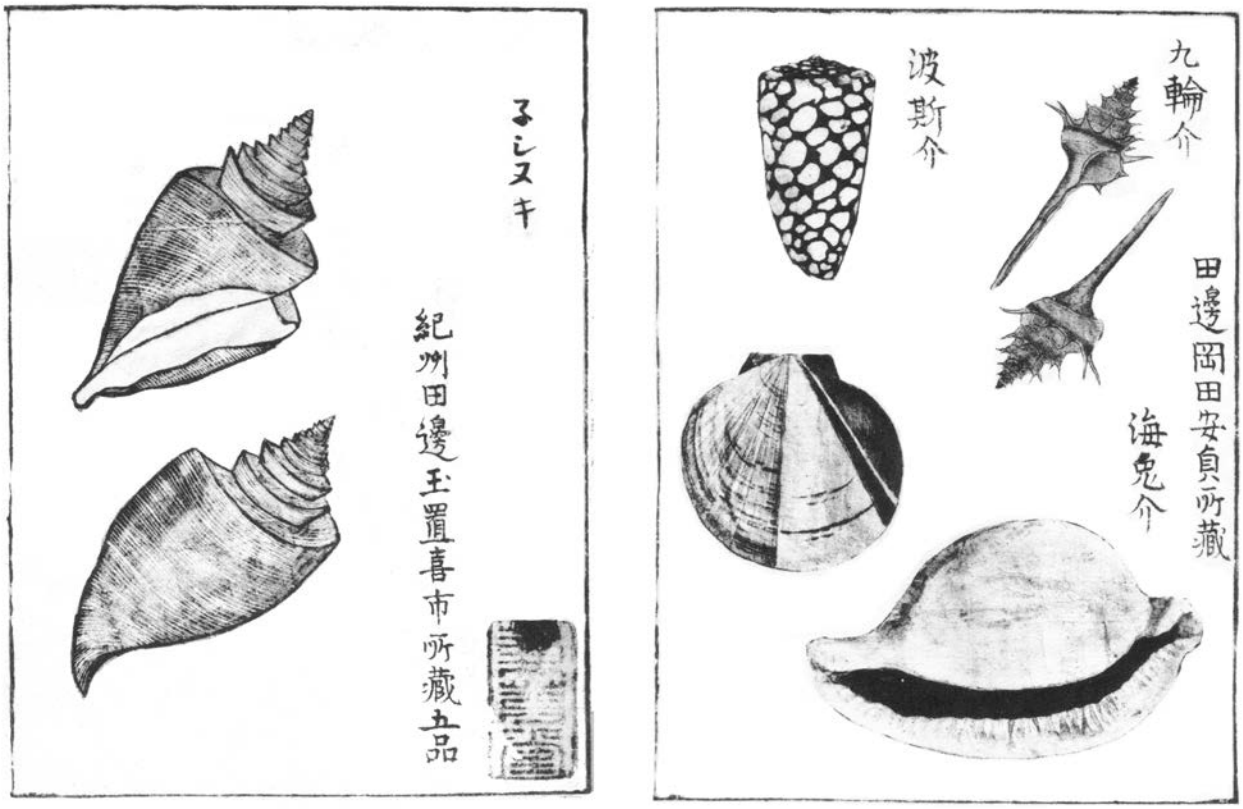


(Fig.1) “Shelled kinds” in *Kinmō Zui* (1666). The figure of a horseshoe crab is thought to be the first published anywhere. (Library of Congress)

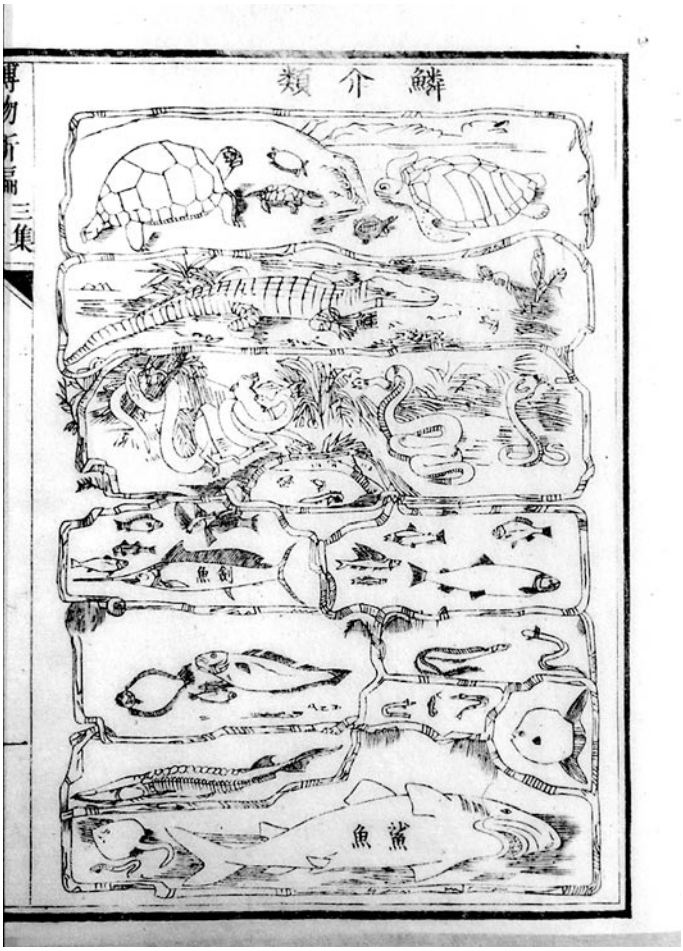
(Fig. 2) A page from Matsuoka Gentatsu’s *Igansai Kaihin* (1758). The wamei are (top left) *kome-nishi*, (top right) *tanishi* and (bottom) *uzura-gai*. The latter two remain in use today, though *tanishi* is now only generic whereas *uzura-gai* remains specific. (Author’s library)



(Fig. 3) A page from *Wakan Sansai Zue* (ca. 1764). In both entries the Chinese name is in bold kanji. In the left-hand entry the phonetic rendering *Baka-gai* is prefixed “colloquial name” (俗云). On the right, however, the phonetic reading *Igai* is prefixed “wamei” (和名). (NHM Library)



(Fig. 4) Two plates from a 1926 replica of the unpublished *Kikai Zufu* by Kimura Kenkadō, *ca*. 1775. On the left, the wamei is at top right in kana. The other text is the provenance of the shell: “Five examples in the collection of Tamaki Ki’ichi in Tanabe, Kii Province”. On the right the wamei are in Kanji and the provenance is “In the collection of Okada Yasusada of Tanabe”. (Author’s library)



(Fig. 5) *Rinkai-rui* (scaled and shelled animals) from *Hakubutsu Shinpen* (1862). No mollusks are figured. (Tokyo University)


第二小界　甲第三綱　二十五

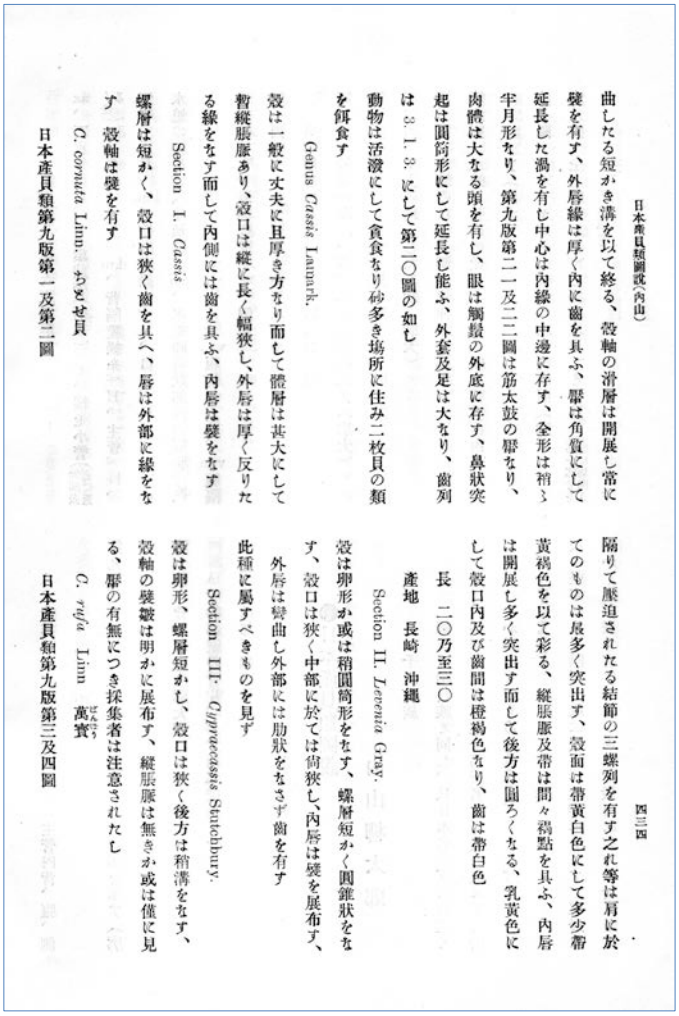
第百二十八圖

連リテ開ケリ、其肉ハ食用ニ供スベク、其殻ノ内面ハ光澤ヲ帶ブルガ故ニ、之ヲ種々ノ器具ニ彫嵌シテ、粧飾ト爲スベシ、

貝子（第百三十圖）ハ厚殻ヲ有シ、形楕圓ニシテ光澤ヲ帶ビ、數種ノ斑文ヲ

第百二十九圖

(Fig. 6) A page from *Hakubutsu Shinkai*, published by the Education Ministry in 1885. (Tokyo University)



曲したる短き溝を以て終る、殻軸の滑層は開展し常に
襞を有す、外唇縁は厚く内に歯を具ふ、鬘は角質にして
延長した溝を有し中心は内縁の中邊に存す、全形は稍〻
半月形なり、第九版第二一及二二圖は筋太鼓の鬘なり、
肉體は大なる頭を有し、眼は觸覺の外底に存す、鼻狀突
起は圓筒形にして延長し能ふ、外套及足は大なり、齒列
は 3. 1. 3. にして第二〇圖の如し
動物は活潑にして貪食なり砂多き場所に住み二枚貝の類
を餌食す

Genus *Cassis* Lamark.

殻は一般に丈夫に且厚き方なり而して體層は甚大にして
暫縦脹脈あり、殻口は縦に長く幅狹し、外唇は厚く反りた
る縁をなす而して内側には歯を具ふ、内唇は襞をなす

Section I. *Cassis*

螺層は短かく、殻口は狹く歯を具へ、唇は外部に縁をな
す 殻軸は襞を有す

C. cornuta Linn. かめぜ貝

日本産貝類第九版第一及第二圖

隔りて壓迫されたる結節の三螺列を有す之れ等は肩に於
てのものは最多く突出す、殻面は帶黄白色にして多少帶
黄褐色を以て彩る、縦脹脈及帶は間々點を具ふ、内唇
は開展し多く突出す而して後方は圓ろくなる、乳黄色に
して殻口内及び歯間は橙褐色なり、歯は帶白色

長 二〇乃至三〇

産地 長崎 沖縄

Section II. *Lerenia* Gray.

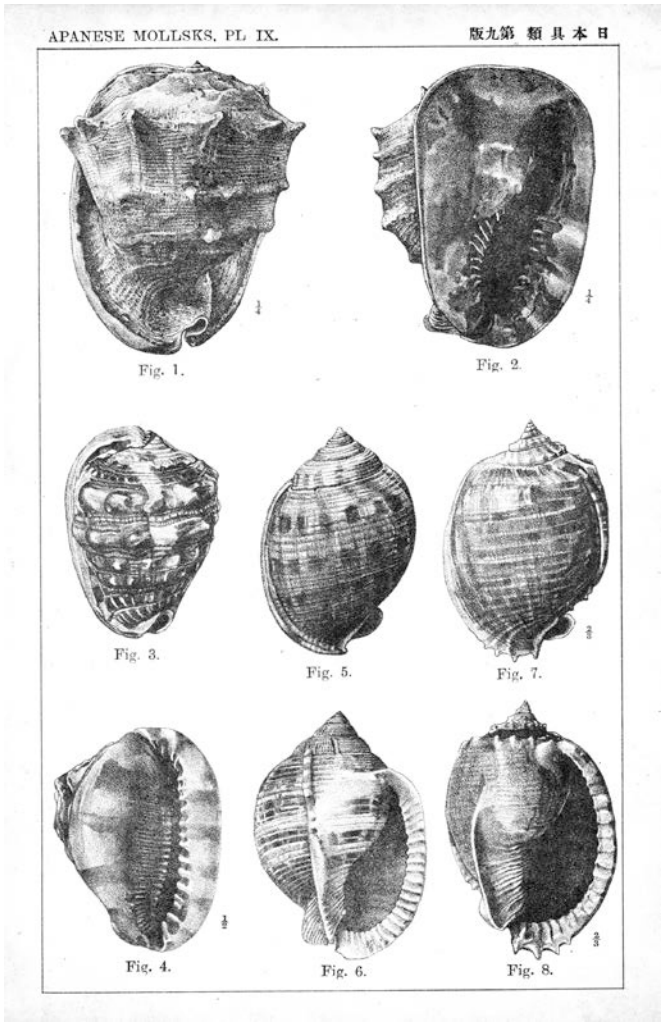
殻は卵形か或は稍圓筒形をなす、螺層短かく圓錐狀をな
す、殻口は狹く中部に於ては尚狹し、内唇は襞を展布す、
外唇は彎曲し外部には肋狀をなさず歯を有す
此種に屬すべきものを見ず

Section III. *Gyproecassis* Stutchbury.

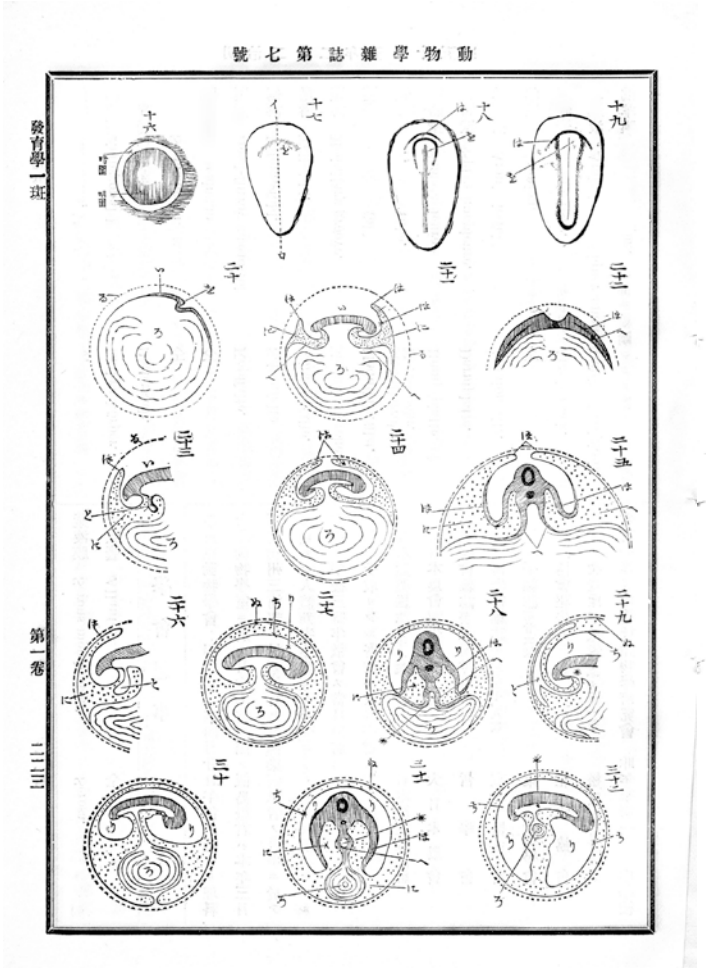
殻は卵形、螺層短かし、殻口は狹く後方は稍溝をなす、
殻軸の襞襴は明かに展布す、縦脹脈は無きか或は僅に見
る、鬘の有無につき採集者は注意されたし

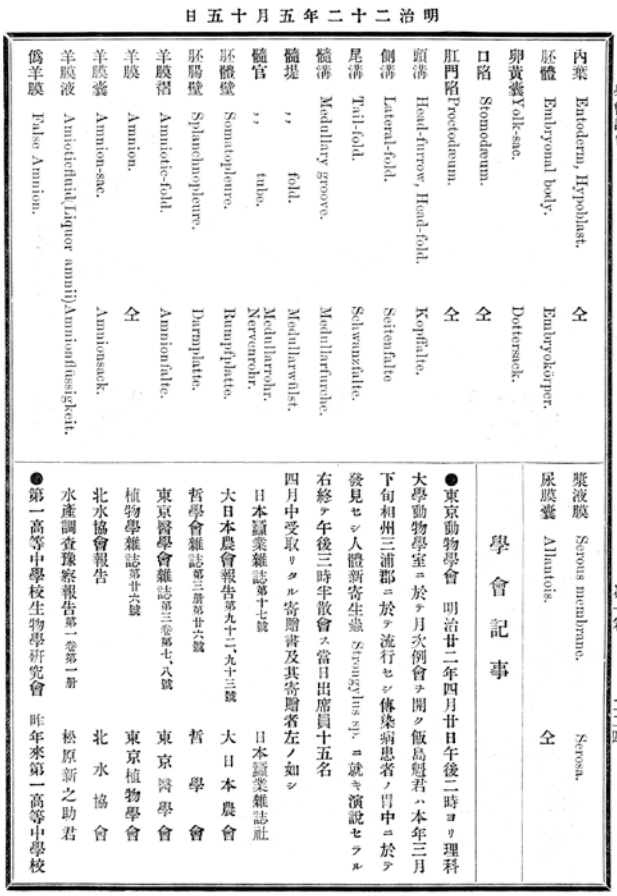
C. rufa Linn 萬寶

日本産貝類第九版第三及四圖

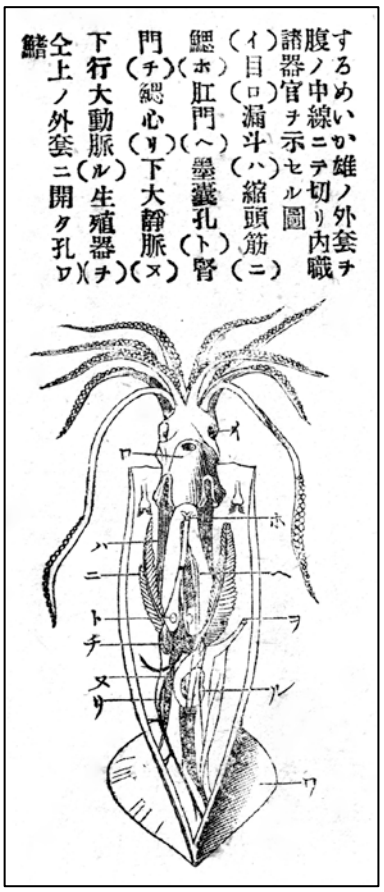


(Fig. 7) A page of text and the accompanying plate from Uchiyama's "Mollusca of Japan" in the Zoological Magazine (1901 in 1900-1904). The scientific names *Cassis cornuta* and *Cassis rufa* are given with the wamei *Chitose-gai* and *Manbō* respectively; the former has nowadays been replaced with the older name *Tō-kanmuri*. The development in the quality of images and analysis during the Meiji period is clear, but wamei remain.

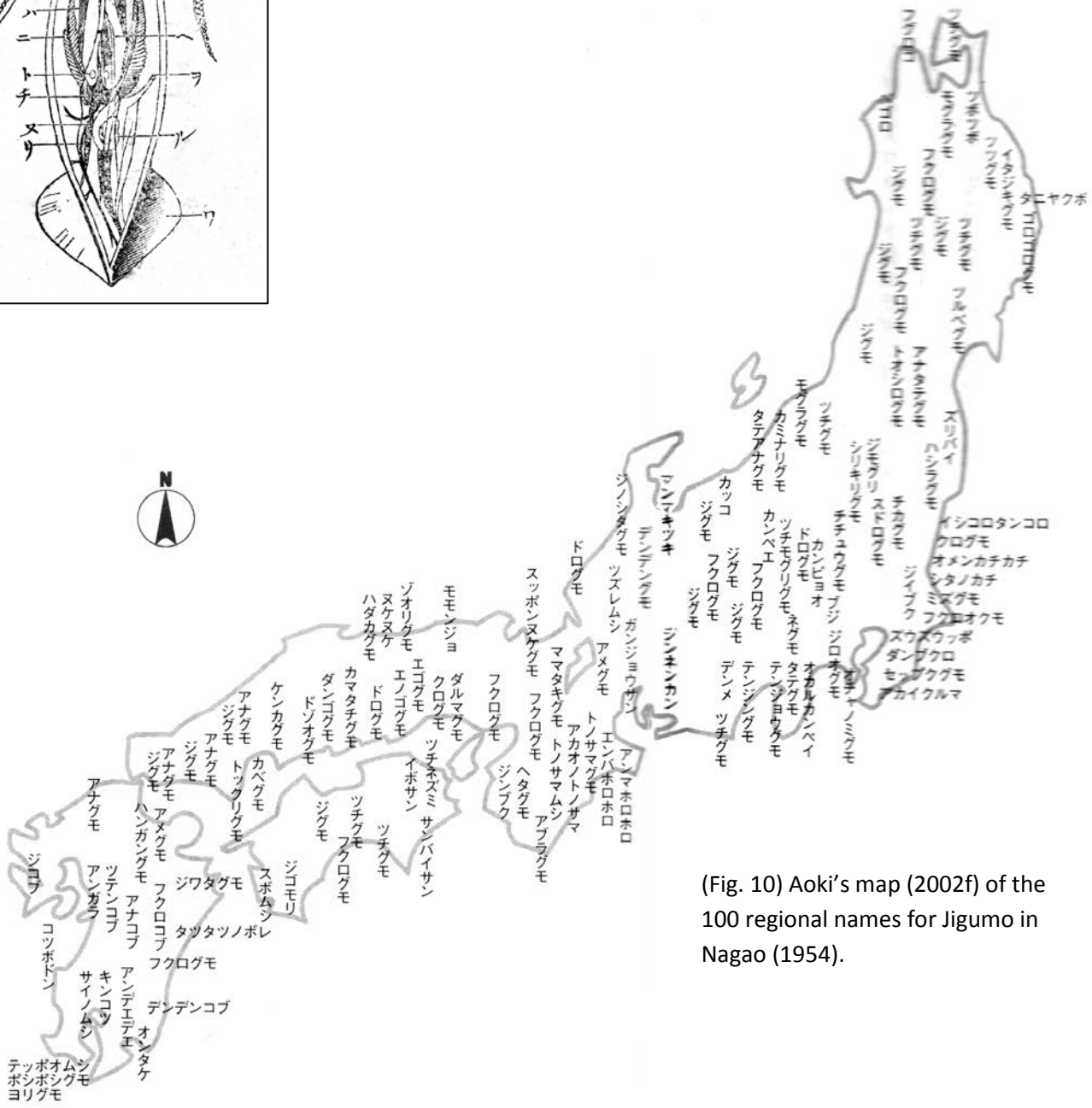




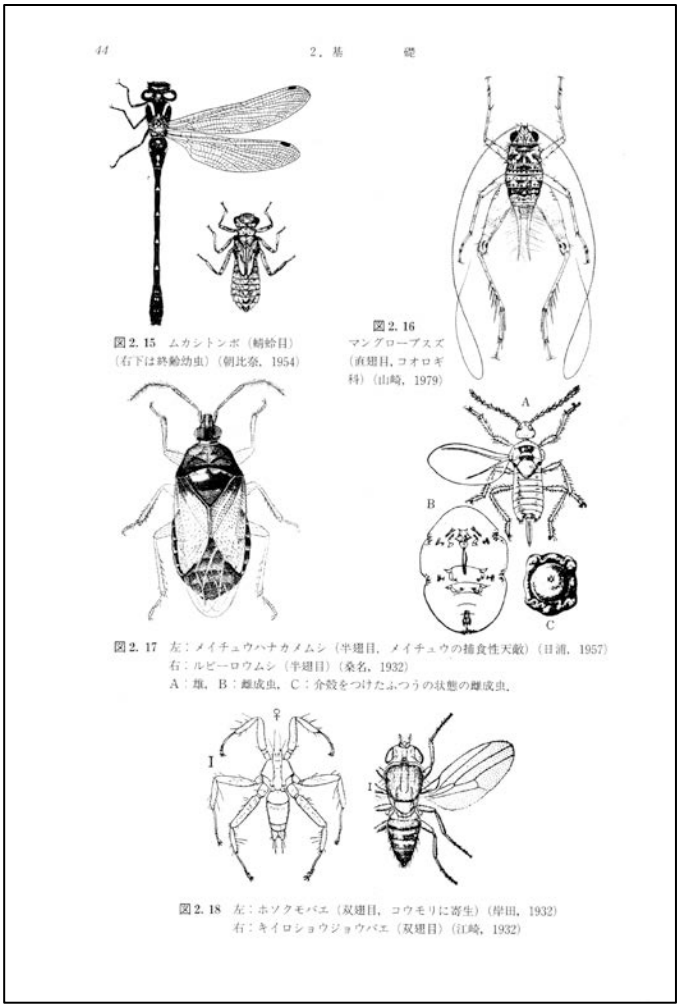
(Fig. 8) A figure and part of the text from Iijima's paper "On the development of the chick" from the Zoological Magazine (1889). The text is in part a glossary of English and German terms in embryology, but the plate uses Chinese numerals for each figure and the Japanese *i-ro-ha* ordering system for individual points. By the end of the 19th century, the magazine's format had become more standardized. (ANSP Library)



(Fig. 9) Internal organs of a squid, from *Dōbutsu-gaku mondō* ("Questions and answers in zoology") an entrance-exam primer published by Fuzanbō in 1896. The wamei (*Surume-ika*) is at top right.



(Fig. 10) Aoki's map (2002f) of the 100 regional names for Jigumo in Nagao (1954).



44　　2．基　　礎

図2. 15　ムカシトンボ（蜻蛉目）（右下は終齢幼虫）（朝比奈，1954）

図2. 16
マングローブスズ（直翅目，コオロギ科）（山崎，1979）

図2. 17　左：メイチュウハナカメムシ（半翅目，メイチュウの捕食性天敵）（日浦，1957）
右：ルビーロウムシ（半翅目）（桑名，1932）
A：雄，B：雌成虫，C：介殻をつけたふつうの状態の雌成虫．

図2. 18　左：ホソクモバエ（双翅目，コウモリに寄生）（岸田，1932）
右：キイロショウジョウバエ（双翅目）（江崎，1932）

2,2　昆虫の分類　　45

外翅群（不完全変態）・新翅群・準新翅群

6科500種，邦産40種．ヒトにはヒトジラミ，ケジラミが寄生．アザラシジラミ，アタジラミ，リスジラミ，サルジラミ，イヌジラミ．

カメムシ目（半翅目）　Hemiptera
形態は多様であるが口器は穿刺吸収型で，下唇が変化して口吻となる．長翅，短翅，無翅の3型あり．同翅・異翅の2亜目．同翅亜目（Homoptera）は均翅の翅をもつ．頭吻群（セミ，ツノゼミ，アワフキムシ，ヨコバイ，ウンカ，ハゴロモ），精吻群（オーストラリア，チリーなどに産し，邦産なし），腹吻群（キジラミ，コナジラミ，アブラムシ＝アリマキ，カイガラムシ）の3群に大別される．コナジラミとカイガラムシ（雄のみ）には蛹期がある．異翅亜目（Heteroptera）の前翅は基半部が革質化した半翅鞘．陸生カメムシ群（トコジラミ，メクラカメムシ，サシガメ，グンバイムシ，ナガカメムシ，ホシカメムシ，ヘリカメムシ，ツチカメムシ，カメムシ），両生カメムシ群（主として水面上に生活．アメンボ，カタビロアメンボ，ミズギワカメムシ），水生カメムシ群（ミズムシ，タイコウチ，コバンムシ，タガメ，マツモムシ）の3群に大別される．多数の農業害虫を含み，直接，間接（作物のウイルス病を媒介）の害が多い．かなりの益虫もいる．世界に50,000種，邦産1,000種．

アザミウマ目（総翅目）　Thysanoptera
小型，翅は細長く，長い縁毛をもつ．口器は左右非相称の穿刺式．前蛹期と蛹期がある．2亜目6科6,000種，邦産200種．俗称スリップス．クワノアザミウマは桑樹の害虫．ミナミキイロアザミウマは新来の農業害虫．

有翅亜綱

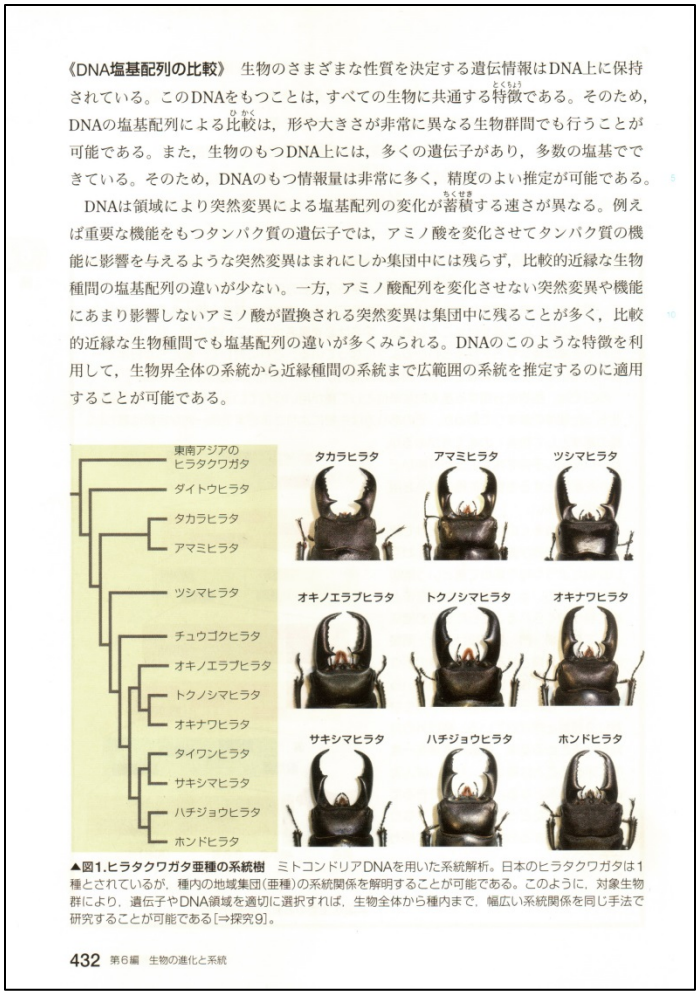
内翅群（完全変態）・新翅群・貧新翅群

アミメカゲロウ目（脈翅目）　Neuroptera
体は比較的柔軟，膜質でよく発達した前後翅はほぼ同形同大．静止時は屋根状に背上にたたむ．咀嚼口，食肉性．幼虫は時に水生で，気管鰓をもつ．裸蛹，広翅亜目（ヘビトンボ，センブリ），ラクダムシ亜目（ラクダムシ），扁翅亜目（クサカゲロウ，カマキリモドキ，ウスバカゲロウ，ツノトンボ）の3亜目あり．これをそれぞれ目と認める学説もある．25科5,000種，邦産16科153種．

コウチュウ目（甲虫目，鞘翅目）　Coleoptera
いわゆる甲虫類．生物界最大の目（30～33万種）．体長0.25 mm～150 mm．形態も多様であるが，前翅は翅鞘となり，体の正中線で左右両翅が接する．咀嚼口．前胸は大きくて可動．中・後胸と腹部は合体して翅鞘におおわれるのが普通．裸蛹，稀に被蛹（ハネカクシ），稀に過変態．4亜目に分類．始原亜目（ナガヒラタムシ）と粘食亜目（デオミズムシ）は小群．食肉亜目（Adephaga）はオサムシ上科のみ（ハンミョウ，オサムシ，ゲンゴロウ，ミズスマシ）．多食亜目（Polyphaga）は5系列19上科に分類される大群（ガムシ，エンマムシ，ハネカクシ，コガネムシ，マルハナノミ，ドロムシ，タマムシ，コメツキムシ，ホタル，カツオブシムシ，ナガシンクイムシ，カッコウムシ，ヒラタムシ，ゴミムシダマシ，ハナノミ，ツチハンミョウ，カミキリムシ，マメゾウムシ，ハムシ，ゾウムシ，キクイムシ）．ゾウムシの幼虫は無脚，生態も多様で，多数の農林・貯穀害虫のほか捕食性，食糞性の益虫も多い．邦産既知種9,000種，タマムシなど美麗種も多い．

ネジレバネ目（撚翅目）　Strepsiptera
超小型，顕著な雌雄異型の内部寄生虫．雄成虫は有翅（前翅は平均棍）で，自由生活だがきわめて短命．寄主はタイワンクツワムシ，ツチカメムシ，ウンカ，ドロバチ，ヒメハナバチ，アリ，他．世界に9科550種，邦産49種．エダヒゲネジレバネは稲作害虫トビイロウンカなどに寄生する農業上の益虫．

(Fig. 11) Two pages from Saitō et al. (1996). The major groups of insects are described in the table on the right-hand page, with figures of some typical examples to the left. In the text this work presents and explains hundreds of English terms in entomology as well as the Linnaean system and the rules of scientific nomenclature. Nevertheless, all figures of actual insects are captioned with wamei.



《DNA塩基配列の比較》 生物のさまざまな性質を決定する遺伝情報はDNA上に保持されている。このDNAをもつことは，すべての生物に共通する特徴である。そのため，DNAの塩基配列による比較は，形や大きさが非常に異なる生物群間でも行うことが可能である。また，生物のもつDNA上には，多くの遺伝子があり，多数の塩基でできている。そのため，DNAのもつ情報量は非常に多く，精度のよい推定が可能である。

DNAは領域により突然変異による塩基配列の変化が蓄積する速さが異なる。例えば重要な機能をもつタンパク質の遺伝子では，アミノ酸を変化させてタンパク質の機能に影響を与えるような突然変異はまれにしか集団中には残らず，比較的近縁な生物種間の塩基配列の違いが少ない。一方，アミノ酸配列を変化させない突然変異や機能にあまり影響しないアミノ酸が置換される突然変異は集団中に残ることが多く，比較的近縁な生物種間でも塩基配列の違いが多くみられる。DNAのこのような特徴を利用して，生物界全体の系統から近縁種間の系統まで広範囲の系統を推定するのに適用することが可能である。

▲図1.ヒラタクワガタ亜種の系統樹 ミトコンドリアDNAを用いた系統解析。日本のヒラタクワガタは1種とされているが，種内の地域集団（亜種）の系統関係を解明することが可能である。このように，対象生物群により，遺伝子やDNA領域を適切に選択すれば，生物全体から種内まで，幅広い系統関係を同じ手法で研究することが可能である［⇒探究9］。

(Fig. 12) A page from Asajima (2012), a standard high school science text book. The relationship between isolation and genotype expressed in DNA is discussed using as an example nine geographically separate subspecies of the Giant Stag Beetle (*Dorcus titanus*). Although only wamei are given, all nine subspecies have scientific names.

Top left to bottom right:

Takara-hirata-kuwagata	*D. t. takaraensis**
Amami-hirata-kuwagata	*D. t. elegans*
Tsushima-hirata-kuwagata	*D. t. castanicolor*
Okinoerabu-hirata-kuwagata	*D. t. okinoerabuensis**
Tokunoshima-hirata-kuwagata	*D. t. tokunoshimaensis**
Okinawa-hirata-kuwagata	*D. t. okinawanus*
Sakishima-hirata-kuwagata	*D. t. sakishimanus**
Hachijō-hirata-kuwagata	*D. t. hachijoensis**
Hondo-hirata-kuwagata	*D. t. platymelus*

While most of the scientific names refer to the species' geographical distribution, all the wamei do. However, the scientific names with an asterisk were created by Japanese authors at the same time as the wamei. Remove those and only one (*okinawanus*) refers to geography. For the purposes of this particular piece, therefore, wamei are more useful than scientific names.

(Fig. 13) Two pages from Masuda & Uchiyama (2004) that together with the following figure illustrate several aspects of wamei that are dealt with in this paper. *Melampus nuxeastaneus* has the wamei Hama-shiinomi-gai and is followed by a group of species whose wamei are derived from it. The scientific names and wamei are given here with their meanings:

M. fasciatus (banded)	Sujimaki-hama-shiinomi-gai (banded)
M. flavus (yellow)	Tsuya- hama-shiinomi-gai (glossy)
M. taeniolatus (banded)	Hoso-hama-shiinomi-gai (slender)
M. castanea (chestnut)	Kokutō-hama-shiinomi-gai (brown sugar)
M. sculptus (sculptured)	Niwatazumi-hama-shiinomi-gai (lives in damp places)
M. cristatus (crested)	Atsukuchi-hama-shiinomi-gai (thick-lipped)
M. parvulus (small)	Chibi-hama-shiinomi-gai (small)
M. sincaporensis (of Singapore)	Kinukatsugi-hama-shiinomi-gai (boiled taro)
M. nucleolus (nut)	Urushinuri-hama-shiinomi-gai (glazed)
M. granifer (grain)	Nunome-hama-shiinomi-gai (woven cloth)
M. sulculosus (grooved)	Kinume-hama-shiinomi-gai (matte)
M. phaeostylus (brown)	Toriko-hama-shiinomi-gai (rice powder)
M. sp.	Ōtō-hama-shiinomi-gai (cherry)
Detracia sp.	Denji-hama-shiinomi-gai (rice paddy)
Detracia sp.	Kometsubu-hama-shiinomi-gai (rice grain)
Detracia? sp.	Mushibotaru-hama-shiinomi-gai (firefly)

Only two wamei match the meaning of the scientific species name. One un-named species of *Melampus*, two of *Detracia* and one that might be *Detracia* all have wamei derived from Hama-shiinomi-gai and are treated in this book exactly like the others. Although the “type” of the Hama-shiinomi-gai group is the Japanese *M. nuxeastaneus*, the type of *Melampus* Montfort, 1810 is *Bulimus coniformis* Bruguière, 1789, distributed mostly in the Caribbean and eastern central America.

オカミミガイ科

デンジハマシイノミ

Melampus (*Detracia*) *ovuloides* Baird, 1873

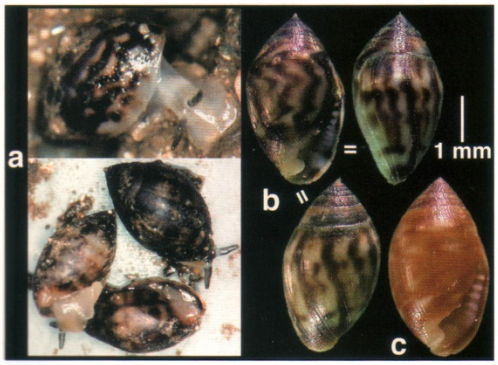
(a) 沖縄県名護市屋我地島饒平名　2009年　亀田勇一撮影
(b) 同　1996年　(c) 西オーストラリア州 Shark Bay　1996年
木村昭一撮影

評価：絶滅危惧 II 類
選定理由：個体数・個体群の減少，生息条件の悪化，希少
分布：沖縄島北部（塩屋湾，羽地内海），サモア，オーストラリア北部・西部．
生息環境・生態：河口マングローブ辺縁高潮帯の軟泥底・砂泥底に半ば埋もれた転石下にナラビオカミミガイ沖縄型，ナズミガイ，ウルシヌリハマシイノミ等とともに見られる．
解説：従来の国内の文献では学名未確定であったが，サモアの Tutuila 島から記載された *Melampus* (*Tifata*) *ovuloides* は日本産個体によく一致する．また本種とコメツブハマシイノミが属すとされてきた *Detracia* は現在 *Melampus* の亜属とされる．さらに，これら２種以外の本書所載の *Melampus* 属各種は従来様々な亜属に分けられてきたが，それらの亜属の区別は不明瞭なためすべて *Melampus s.s.* とした．本種は国内では沖縄本島北部の数カ所からしか知られておらず生息範囲も狭いため，マングローブの縮小と水質・土壌汚染等によって危機に晒されている．殻長 6 mm．（福田 宏・木村昭一）

オカミミガイ科

コメツブハマシイノミ

Melampus (*Detracia*) cf. *phaeostylus* Kobelt, 1869



(a) 宮古島平良久松　1995年　福田宏撮影　(b, c) 西表島大原
1998年　木村昭一撮影

評価：準絶滅危惧
選定理由：個体数・個体群の減少，生息条件の悪化
分布：南西諸島（奄美大島，沖縄島，久米島，宮古島，石垣島，竹富島，西表島，与那国島），台湾蘭嶼，フィリピン．
生息環境・生態：河口マングローブ辺縁高潮帯の砂泥底において転石や漂着物の下等に見られるが，湾口部や外洋に面した岩礁の飛沫帯にも生息し，ヒヅメガイ等が好む海蝕洞内にも個体群が形成される．
解説：インド・西太平洋には本種に近似した種が多く，学名はさらに検討を要する．竹富島から死殻のみ報告されたムシボタルハマシイノミはおそらく本種の個体変異と思われる．デンジハマシイノミに比べて広い範囲で産出が認められ，生息環境も内湾奥部の砂泥底と外洋に面した岩礁の両方にわたるが，マングローブでは生息可能範囲が狭められつつある．西表島大原の産地は最近の護岸工事で完全に消失した．殻長 6 mm．（福田 宏・木村昭一）

(Fig. 14) In contrast to the arrangement in fig. 12, Henmi *et al*. (2012) assign the scientific name *Melampus ovuloides* Baird, 1873 to the wamei Denji-hama-shiinomi and consider Kometsubu-hama-shiinomi-gai to be comparable though not equivalent ("cf.") to *M. phaeostylus*. Their figured shell most closely resembles the Mushibotaru-hama-shiinomi-gai of Masuda & Uchiyama, however, but as the latter did not assign a scientific species name to either wamei a conflict does not arise.

In this way, the stability of wamei allows differing opinions and evidence to be linked to a name that need not indicate more than a gestalt or unresolved problem, yet that clearly indicates a taxonomic entity whose resolution as a scientific species is actively being sought.

(Fig. 15) Two sets of pages from Takeda & Nishi's Handbook of Land Snails (2015). This comprehensive field guide to Japanese snails features very high quality images and dense, informative text. In the first section (top) the fauna is broken down by geographic region and species are aligned at relative size to allow identification. Only wamei are given, together with the relevant page number. In the more detailed species accounts (bottom), scientific names are given below the wamei, which are in larger, brown type. The progression is thus from nature to the wamei and thence to the scientific name.

▶
アカエラミノウミウシ *Sakuraeolis enosimensis* (Baba, 1930) **トモエミノウミウシ科**

体長 3 cm。多数並ぶ鰓突起（黄矢印）は鮮やかな赤色で先端は白い。頭部と背面はオレンジ色で小さい白点を散らす。前端に細長い頭触手（青矢印）、その後方にやや短い触角がそれぞれ 1 対ある。尾部は細長く背面の側部と共に白い。

すみ場所：タイドプールや潮間帯下部付近の水中。
分布：本州。

▶
サガミミノウミウシ *Phyllodesmium serratum* (Baba, 1949) **クセニアミノウミウシ科**

体長 4 cm。体の地色は水色。多数の鰓突起（矢印）が背面を覆うが、長くてカールする。その中脈は赤桃色。頭触手と触角は共に長い。

すみ場所：タイドプールや潮間帯下部付近の水中。
分布：本州、太平洋各地。

収眼目

二次鰓はない。伸縮自在の触角は下方から突出し、先端に眼を備える。ウミウシの仲間でなく、空気呼吸する有肺類である。

▶
イソアワモチ *Peronia* sp. cf. *verruculata* (Cuvier, 1830) **イソアワモチ科**

体長 5 cm。体は柔らかく、背面は疣状突起に覆われる。全体が黄色または灰色。ヤマトウミウシに似るが後方の二次鰓はない。触角は体の下から出る（矢印）。

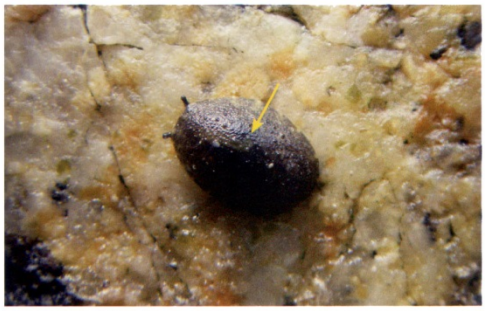
すみ場所：潮間帯岩上。
分布：石狩湾以南。

▶
ヒメアワモチ *Onchidella kurodai* (Taki, 1935) **イソアワモチ科**

体長 1 cm。楕円形で背面は膨らみ、やや固い。褐色地に黄色が混じり、小さなイボ（矢印）が散在する。潮が引いた直後の湿った岩上で活動し、乾燥してくると岩陰に隠れる。

すみ場所：潮間帯中部岩上。
分布：瀬戸内海、有明海。

（以上　山西）



(Fig 16) A page from Imahara (Eds.) 2016. The third entry from the top gives the wamei Iso-awamochi but indicates (with “sp. cf. *verruculata*”) that although it resembles *Peronia verruculata* this species does not have a scientific name. No such conditionality is applied to the wamei, however. Despite being aimed purely at the Japanese market, this field guide is exemplary in its use of scientific names.