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Small Shells of the Classic Turridae from Taiwan
Part 12b Clathurellinae: Misc. Genera: Species 184 to 197
By Chen-Kwoh Chang *

This article is laid out for filing printed pages with species descriptions pages opposite the associated illustration pages.

Species 184  Glyphostoma evadue (Melvill, 1912)
The shell is 4 x 2.5 mm, globose, golden yellow and has 4 inflated teleoconch whorls. The protoconch has 3 brown, decussate whorls. It is sculptured with strong, rounded axial ribs that are closely separated and crested spiral cords that are separated by about twice their diameter. The axial ribs are swollen widely in the area of spiral cords. There are 10-11 ribs and 3 spiral cords on the penultimate whorl. The aperture is narrow and somewhat sinuous. The anterior canal is short, open and curved. The outer lip is backed by a rib (variced) with a free edge.

Species 185  Heterocythara himerta (Melvill & Standen, 1895)
This shell is minute, 3.7 x 1.8 mm, ovate, turreted and is yellow in color maculated with ochre at the suture and periphery. It has 4-5 teleoconch whorls that are angulate to both sutures. The protoconch has 1+ smooth, convex, cream or white whorls. All the sutures have a quasi-crenulation [by axial ribs]. There are 9-10 ribs and 4 spiral cords on the penultimate whorl. The outer lip is strongly variced and fimbriate without distinct teeth inside.

Species 186  Heterocythara rigorata Hedley, 1922
This buff colored shell is 3.5 x 1.5 mm, ovate-biconic with 3+ teleoconch whorls and a protoconch of 2+ convex, smooth whorls. It is sculptured with prominent, curved, steep-sided axial ribs crossed by narrow spiral cords separated by about their diameter. There are about 10 ribs and 5 cords on the penultimate whorl. The aperture is narrow-ovate and the sinus is U-shaped. The outer lip is variced and finely denticulate on the inner edge.

Species 187  Heterocythara erismata Hedley, 1922
This 4.3 x 1.8 mm shell is ovate-oblong, solid, pale cream with a brown-orange basal band, and is rather glossy. It has 4 teleoconch whorls plus a blunt, domed protoconch. It is sculptured with prominent axial ribs overridden by spiral cords that become tubercular on the raised fasciole. There are about 8 ribs and 3 - 4 spiral cords on the penultimate whorl. The aperture is moderately narrow, and almost axial. The outer lip is variced and denticulate. The sinus is a deep U-shaped incision in the varix.

Species 188  Heterocythara zebuensis (Reeve, 1846)
The shell is 3.8 x 1.7 mm, solid, ovate-oblong and closely resembles H. rigorata but has a much broader body whorl and has about 1 fewer axial ribs on the penultimate whorl. The color is pink-white to yellow white. There are 3+ teleoconch whorls that are slightly convex with a stepped shoulder. The protoconch has 2 + whorls. It is sculptured with prominent ribs crossed by spiral threads with about 8 ribs and 3 spirals on the penultimate whorl. The aperture is narrow and vertical. The sinus is an U-shaped incision in the varix.

* 1373 Phelps Ave. #8, San Jose CA 95117

Email: chchang@mail.netzero.net
Small Turrids from Taiwan: *Clathurellinae* Continued

![Fig. 184 Glyphostoma evadue](image1)  
(Melvill, 1912)  
4 mm from Lutao

![Fig. 185 Heterocythara himerta](image2)  
(Melvill & Standen, 1895)  
3.7 mm from Lutao, Taiwan

![Fig. 186 Heterocythara rigorata](image3)  
Hedley, 1922  
3.6 mm from Lutao, Tai-

![Fig. 187 Heterocythara erismata](image4)  
Hedley, 1922  
4.3 mm from Lutao, Taiwan

![Fig. 188 Heterocythara zebuensis](image5)  
(Reeve, 1846)  
3.8 mm from Lutao
Species 189. *Heterocythara* sp. A.
This is a minute, solid, ovate shell, 3.8 x 2 mm. The color is creamy-white maculated with brown (or orange when faded) on the base and on alternate ribs above the periphery of the body whorl. It resembles *H. erismata* Hedley, but this species is stouter and has one less teleoconch whorl. Its spire whorls are less convex than *H. erismata* and the sutures areas are narrowly impressed while *H. eristoma* Hedley has convex whorls with concave sutures.

Species 190b. *Heterocythara* sp. B.
This 3.2 x 1.7 mm species is minute, ovate with a conical spire with about 5 teleoconch whorls. The shell is narrower and has a higher spire than the preceding species. The protoconch has 2+ flat-sided whorls. The shell color is creamy-white with alternate ribs light brown. The aperture is narrowed by the convex columella and the large projecting denticles on the lip posterior. The denticles on the inner margin of the lip appear to be aligned with the interstices of external spiral cords.
**Small Turrids from Taiwan: *Clathurellinae***

**Species 191  *Clathromangelia? coeuffa* Kuroda & Oyama, 1971**

This shell is 10 x 3.5 mm, ovate-fusiform and is yellow to tan-orange or cream in color. It has reticulate sculpture with about 18 convex axial ribs separated by about half their diameter and about 5 primary cords and 5 lower intermediate spiral threads on the penultimate whorl. The aperture is moderately wide and ovate with a short, curved canal. The outer lip is variced and lirate inside.

NOTE: Kuroda & Oyama (1971) treated this shell under *Clathromangelia?* due to a question about the type species of *Clathromangelia, Pleurotoma granum* Philippi which has much coarser sculpture and a truncated base (shown as in Fig 189b). I found no better genus for housing this shell. This shell and the next 3 species do not have the sutural sinus of genus *Philbertia*, and the sculpture of these shells does not have the broad, rounded, axial ribs of the type species of *Clathurella, (Clavatula rava* Hinds). Hence this paper temporarily follows Kuroda & Oyama’s example using Clathromangelia? to group species 189 to 192. I think it would be better in the future to have a new genus name for these shells.

**Species 192  *Clathromangelia? boholensis* (Reeve, 1843)**

This shell is 9 x 3 mm, elongate, semitransparent, and white to pale lavender in color and is rather indistinctly stained with orange blotches. It has 5 or 6 teleoconch whorls and a protoconch of 1+ smooth, convex whorls. It has closely-spaced, flat-topped axial ribs reticulated by spiral threads forming rectangular nodes of the ribs. The columella is sinuous [concave centrally and convex on the parietal wall and canal. The canal is very short and a little recurved. The outer lip is variced and smooth within.

**Species 193  *Clathromangelia? aegrota* (Reeve, 1845)**

The shell is 10 x 3.8 mm, oblong-ovate, and is a little ventricose. It has deep sutures on the spire and is decussate throughout with somewhat curved, longitudinal ribs separated by their diameter and transverse cords also separated by their diameter leaving deep, parallelogram to square interstices. The aperture is quite wide and rather elongate. The outer lip is serrate. The shell color is uniformly buff.

**Species 194  *Clathromangelia? sp. A***

The shell is 10 x 3.2 mm, ovate with a slender spire, and is chocolate to brown-orange in color. It has reticulate sculpture, with about 19 axial ribs and 7 - 8 spiral cords on the penultimate whorl. The aperture is moderately wide and ovate. It has a very short, truncated canal. The outer lip is weakly variced and lirate inside similar to external spiral cords. It is found off Homei, North Taiwan.

**Species 195  *Paraclathurella gracilenta* (Reeve, 1843)**

This shell is 9 x 3 mm, slender-fusiform and has 5 convex teleoconch whorls and a protoconch of 3 whorls. Its color is yellow with darker bands on the sutural and body whorl. It is densely sculptured with longitudinally ribs and spiral threads forming a fine reticulation. There is a strong columellar callus. The aperture is moderately narrow and long without columellar folds. The outer lip is variced and raised from the inner surface with the inner edge dentate. The sinus is a U-shaped incision in the heavy varix.
Small Turrids from Taiwan: *Clathurellinae*

**Fig. 191** *Clathromangelia? coeffea*  
Kuroda & Oyama, 1971  
10 mm from Homei, N. Taiwan

**Fig. 191b** *Clathromangelia? granum* (Philippi)  
type species of Clathromangelia

**Fig. 192** *Clathromangelia? boholensis* (Reeve, 1843)  
9 mm from Lutao, Taiwan

**Fig. 193** *Clathromangelia? aegrota*  
(Reeve, 1845)  
10 mm from Homei, N. Taiwan

**Fig. 194** *Clathromangelia? sp. A*  
10 mm from N. Taiwan

**Fig. 195** *Paraclathurella gracilenta*  
(Reeve, 1843)  
9 mm from N. Taiwan
Species 196  *Paraclathurella contracta*  
(Reeve, 1843)

The shell is 8.8 x 3 mm, elongate-ovate, and has slightly turreted whorls that are almost flat below the periphery and have a sloping shoulder. It is delicately reticulate having about 20 longitudinal ribs and 7 spiral cords on the penultimate whorl. There are 5 body whorls and a low paucispiral protoconch. It has a slightly raised columella callus. The aperture is moderately narrow and ovate. The sinus is broad and the anterior canal is short and flaring at the tip.

Powell (1966 p.109) places this species as a synonym of *P. gracilenta* (Reeve) but the two species are different in aperture, color and protoconch. *P. contracta* (Reeve) has a depressed protoconch of 1 + whorls while *P. gracilenta* (Reeve) has a rather tall protoconch of 3 convex whorls.

Species 197  *Paraclathurella koweitensis*  
(Melvill, 1904)

This 4 x 1.4 mm shell is ovate, whitish looks like *P. contracta* (Reeve) on the body whorl and aperture but this species is more narrow, has one fewer teleoconch whorls, has about half the number of spiral cords per whorl, and has fewer axial ribs. There are 11 axial ribs and 3 spiral cords on the penultimate whorl while *P. contracta* (Reeve) has 15-16 ribs and 5-6 cords. The protoconch has about one smooth, low, domed whorl.
Small Turrids from Taiwan: *Clathurellinae*

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<thead>
<tr>
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Shellers in the News: Dr. E. Alison Kay

Long-time Science Adviser for the HSN, Dr. E. Alison Kay will be retiring from the University of Hawaii this summer after 43 years as a professor in the departments of General Science and of Zoology.

Alison is well known to HMS members for her programs given at least annually at HMS meetings that keep us up to date on research on Cypraeidae and on historical backgrounds of malacologists from Hawaii. Of course, her work is well known world-wide. Especially in Cypraeidae. Ask for an expert in that field and E. Alison Kay will be in the lead on anyone’s list.

But probably the major contact with Alison for most people interested in identifying a shell is that thick, red book that is never far from reach at our desks, “Hawaiian Marine Shells” published by Bishop Museum Press in 1979. That book is one of the great examples of what a “shell book” should be. The book includes about 1000 species found in Hawaii from the shallow reef to dredging depths. The descriptions are quite detailed and furnish an example for other authors to emulate. The book will be fairly well timeless, though shell names do change. It is of use to any Indo-Pacific collector of small shells that are omitted from most popular shell books. Unfortunately, the book is out of print. Can we expect a revised version with color photos now that time will be hanging heavily on Alison’s hands in retirement? All we retired people are well aware of how difficult it is to find something to do during retirement.

Also of importance to the more biologically inclined is “An Atlas of Cowrie Radulae” by Hugh Bradner and E. Alison Kay published as a supplement to The Festivus, Volume XXVIII, December 27, 1996 that groups Cypraea into revised new genera of Cypraeidae of the Schilders.

Dr. Kay has published many articles and participated jointly in many publications such as “Mollusca: The Southern Synthesis” published by CSIRO in Australia that is the new standard of Molluscan biology and taxonomy. But, perhaps, the most important products of Alison are her Ph.D. graduates, who will continue to contribute to malacology in the future.

In lieu of a gala retirement party and gift, Dr. Kay has suggested the establishment of a scholarship fund to support students studying Hawaiian Natural History. Such a fund is being established in her name at the university, and your donations to that fund are requested. Please make out your checks to:

University of Hawaii Foundation, E. Alison Kay Scholarship Fund.

Mail to:
University of Hawaii
Department of Zoology
2538 The Mall, Edmondson 152
Honolulu HI 96822

Best Wishes to Dr. Kay From All Past and Present Members of The Hawaiian Malacological Society
Museum of Comparative Zoology
Harvard University
Cambridge, Massachusetts

With great regret, I inform you of the death of Ruth Dixon Turner, Professor of Biology and Curator in Malacology, Emerita, which occurred on 30 April, 2000, in the 85th year of her age.

Your obedient servant,
Kenneth Jay Boss

The following obituary was written by George Buckley and posted by Gary Rosenberg

Ruth Dixon Turner died on Sunday, April 30. She held the Alexander Agassiz Professorship at Harvard University and was a Curator of Malacology in the University's Museum of Comparative Zoology where she also served as co-editor of the scientific journal "Johnsonia". She graduated from Bridgewater State College, earned a Masters degree at Cornell University and a Ph.D. at Harvard/Radcliffe under the direction of Dr. William J. Clench who brought her to Harvard from the Clapp Labs in Duxbury.

Turner, who had begun her scientific and teaching career in a one room schoolhouse in Vermont, went on to become the world's expert on Teredos, bivalved-mollusks called shipworms. These marine borers cause widespread destruction by eating wood in the ocean environment, destroying piers, docks and wooden boats. She became known affectionately as "Lady Wormwood" for her work in this field. It was she who explained why there was little wood left on the sunken liner Titanic when it was discovered by fellow scientist Robert Ballard.

During her career, which spanned some five decades, Dr. Turner kept laboratories in La Parguera in cooperation with the University of Puerto Rico, Northeastern University's Marine Sciences Institute at Nahant, the Marine biological Laboratory at Woods Hole and at Harvard. Her work led to collaboration with the United Nations Food and Agriculture Organization, U.S. Navy Office of Oceanography which funded much of her research and the Woods Hole Oceanographic Institution where she became the first woman scientist to utilize the Deep Submergence Research Vehicle ALVIN to study the deep sea.

Over some two decades, she participated in several dozen oceanographic expeditions. The Oceanographic Institution later named Turner a "Women Pioneer in Oceanography". She received many other honors including a number of honorary degrees. The venerable Boston Sea Rovers, an ocean education group of which she became an esteemed member, named her "Diver of the Year" in recognition of her accomplishments. The U.S. Navy dedicated their book on "Biodegradation in the Sea" to Professor Turner. Other book dedications noted that she was a "Biologist par Excellence" and quoted her often-repeated motto "know your animals". Dr. Turner's last major project was as a member of the scientific team that investigated the wreck of the "Central America", a sunken steamer that contained millions in lost gold. It has been called the mostscientifically studied shipwreck ever by a Federal judge.

A past President and beloved member of the Boston Malacological Club and the American Malacological Union, Dr. Turner provided leadership to these organizations and guidance to their members...
who study seashells and other mollusks. She was a Director of the Marine Ecology Project and a consultant to many organizations including the National Geographic Society and its programs on deep sea vent systems. Lecturing widely, she shared her knowledge and love of the sea and its life. A dedicated teacher and skilled dissectionist and illustrator, Turner was a mentor to hundreds of students around the world. She trained people, opened doors for them and watched proudly as they started out on their own careers.

Dr. Turner leaves her sisters Winifred Garrity and Lina MacNeil. She is predeceased by her parents and her brothers Henry and Arthur and sisters Jessie, Mary and Frances. Contributions are being accepted to a Memorial Fund that has been established in her name at the Woods Hole Oceanographic Institution. A wake will be held on Thursday from 4-8 PM at Long Funeral Home in Porter Square, Cambridge with services on Friday at 11 AM.

[George adds the following personal comments :]

As a teenager I began working for Ruth Turner and Bill Clench in the Mollusk Dept. at Harvard University's Museum of Comparative Zoology. Being the person with a car I became the "designated driver" so to say and ended up being in charge of field expeditions in the local area. This led to many enjoyable afternoons and very early morning "Minus tides" - the better to collect marine specimens as well as leading to muddy feet and a very messy car as all sorts of marine fauna and flora were brought back to Harvard. Ruth provided sage council on my winning high school science fair projects on "Radula the teeth of snails" and was duly proud of my achievements. The job grew in importance as I had the prime responsibility on many occasions of getting Ruth "to the sub on time" at Woods Hole.

As I entered college, the collecting went further afield with trips to the Everglades, the Altamaha River and Puerto Rico. Ruth was always there to provide guidance, support, and training in dissections-- whatever was needed. I particularly enjoyed going to conferences and seminars with Ruth and observing the great good will shown towards her. She truly loved what she did and greatly enjoyed interacting with people and people loved her. I taught a course on Ocean Environments with her for many years at the Harvard University Extension School and even after she retired and I kept teaching the course she would accompany us on our field trips - - "Cape Cod Expeditions", as they are known -- well into her eighties much to the benefit and enjoyment of my students. Ruth will be missed by legions of students.
Ellis Cross, editor of HSN for many years died on the morning of May 8, 2000. His wife, Diana, informed us that his death followed several weeks in the hospital. Ellis had requested that in lieu of flowers, contributions be made in his name to:

Diving Historical Association
P.O. Box 1267
Port Angeles, WA 98062-0234

Ellis was editor or co-editor of the HSN from 1962 to 1965 and then settled in as “The Editor” from 1967 to 1975. During this period he did a number of research projects reported in HSN articles. During his editorship, the HSN increased its readership greatly due to his ability to attract articles from a variety of people on subjects that were of interesting to most people involved with shellimg.

Those of us associated with the production of the HSN know of Ellis’ ability to get out a monthly magazine of quality with few of the facilities we enjoy today. Articles were retyped on a mechanical typewriter, and material was assembled by a very small group at one or two monthly meetings. Imagine working without a computer, no spell checkers, no photo scanners that we all take for granted today.

Ellis was also president of the HMS for 3 years between 1962 and 1966, and assisted whenever help was needed. Local members also were given a number of opportunities to hear his programs at HMS meetings on any number of subjects.

Ellis was first and foremost a diver with interest in about everything found in the sea. Originally, Ellis went through the U.S. Navy Deep Sea Diving School and after World War II, he trained divers in the Seattle area in hard hat diving. In 1990 he was inducted into the Diving Equipment Manufacturer’s Hall of fame. Probably most serious divers have read his articles placed in Skin Diver Magazine’s “Technifacts” column over many years. Ellis won many awards for his writing about diving and diving safety. He was still active in this area in the last month.

In Hawaii, Cross operated a company that furnished diving services to organizations such as the Oil refineries. He was an active contributor to the organization of state plans to react to oil pollution and other marine disasters.

Ellis was generous to HMS and others in both time and money. Over the years, he provided storage and work space to refinish the many shell cabinets that HMS owned for Shell Show use. He was also the primary worker on that project. He established a fund to support the efforts of youngsters who were interested in Malacology. That fund provided prize money for many annual Hawaii Science and Engineering Fairs, and at HMS shell shows. He also donated many shells over the years for HMS Auctions that funded HMS scholarship grants.

After many years in Hawaii, Cross retired to Port Angeles, Washington in 1986. He became an avid historian of Indian affairs in that area and contributed to that knowledge. Although he was frequently ill, he remained as active as possible in all his interest areas, particularly diving.

Comments by HMS members include:

An Email from Bob Dayle (Makua Bob)
I met Ellis Cross only a few times while an active member of the Hawaiian Malacological Society on Oahu. I know him much better through his articles and editorial comments in so many issues of the HAWAIIAN SHELL NEWS.
Ellis Cross

His pragmatic and experience-laden views were not shared by all in the Society but he always seemed to work for the sheller and shell collecting. He was one of several outstanding individuals in a dynamic period when the HAWAIIAN SHELL NEWS was pretty much the world's SHELL NEWS.

We must hope -- and expect -- that others will carry on with the enthusiasm his poured into shell-ing and sharing the news.

Mahalo and Aloha, Ellis.
Bob Dayle
Octopus bimaculoides Temperament and Behavior
By David Sinn*

*Portland State University
P.O. Box 751
Portland, OR 97207-0751
Email: psuocito@yahoo.com

During my research on molluscan behavior fulfilling a masters thesis at Portland State University in Portland, OR, I applied for and was granted student aid money from the Hawaiian Malacological Society. Their grant helped allow me to study the behavior of one of the more flamboyant members of the molluscs, the octopuses. Octopus bimaculoides (Fig. 1), the California mud-flat octopus, was the specific animal that I chose to study. For purposes of brevity here, I have excluded my methodology, and have included only general background and results. I hope that I have not sacrificed clarity. I am more than happy to forward to any interested readers a more thorough written copy of this work.

First of all, what do we know about octopus behavior? Surprisingly little, actually. There is, of course, a surplus of anecdotal evidence surrounding the behavioral capabilities of these creatures, but in the scientific literature the number of studies actually documenting such feats is small. That is not to say that these studies do not document an amazing complexity of behavior for these organisms, this is hardly the case. Studies have contributed pieces of the how of behavior in this group, as well as speculating on the why of these same acts. The overall picture that we are gaining from our continued studies is that octopuses possess a startling array and complexity of behaviors, and that these behaviors are indicators of a very different life from that of the vertebrates.

The particular aspect of octopus behavior that fascinated me as I began to study the scientific literature at Portland State was that cephalopod researchers have commented on the consistent, high variability in individual octopus responses for over 30 years. What I mean by this is that these researchers have been noticing that the organisms they study act very differently from one another, in ways that are stable within individuals but consistently different from one another. Essentially, these researchers provided the first notice of the individuality of octopuses, an aspect of behavior normally accorded for primates and other vertebrates.

In 1993, two researchers set about to define how octopuses differ from one another, individually. What Jennifer Mather and Roland Anderson discovered was that adult octopuses (their model was Octopus rubescens (Fig. 2)) differ from one another along three dimensions of behavior, which they termed Activity, Reactivity, and Avoidance.

With this knowledge, I attempted to contribute to two little known aspects of behavior in these animals: 1) the development of behavior through systematic documentation of their behavior across...
Octopus Temperament and Behavior     Continued

their early life, and 2) the how and why of behavior in these animals. I did this by examining their psychological trait temperament. I was interested in knowing if very young octopuses display behaviors that reflect underlying dimensions of “temperament”, and if so, how these temperamental dimensions develop. In all aspects of research I was interested in contributing to our overall knowledge of the life history of these animals.

Temperament was chosen as the model that best represented these early individual differences in behavior. In humans, temperamental traits are behavioral styles that an individual is born with. These are influenced by and influence the environment, and result in the adult personality. A discrete response to a stimulus is not a temperamental trait, but rather is a combination of certain responses that an individual shows consistently over time that defines the behavioral style of a particular individual. It is these styles that represent expressions of temperament. Temperament dimensions, therefore, can be used to define how very young individuals differ.

Why would researchers be interested in temperament? Over the past few years behaviorists have shown increased interest in the study of individual differences in their subject organisms, as the importance of these traits have been documented. Temperament traits have major heritable components, based in the physiology of the organism, and it is these heritable components that allow these traits to act as evolutionarily selectable material, much like any physical trait. Temperament, or stable individual differences, provide a basis for the development of behavior in a group of animals across evolutionary time through furnishing material for selection.

The study of temperament also allows us to make inferences about the behavioral substrate an individual is born with, and how levels of this substrate differ among individuals. How then, do individual O. bimaculoides differ? Do they display behaviors that can be considered individual temperament? The answer is yes.

With octopuses three weeks old, I was able to identify at least four dimensions of temperament, termed Active Engagement, Arousal/Readiness, Aggression, and Avoidance/Distinterest. These dimensional names represent trait continuums along which young octopuses can be rated relative to one another. Furthermore, the data indicated that related octopuses were more similar in these dimensions at three weeks of age than were octopuses that were unrelated. While this makes sense intuitively, in behavioral research simple relationships such as “genes make traits” do not exist, and it is extremely difficult to pinpoint the biological basis for behaviors. Showing that this relationship exists for these traits in octopuses is a first step towards learning about the evolution of these behaviors. Furthermore, scientists that study individual differences have hypothesized that these heritable components in the expression of temperamental traits exist. Very few studies across differing taxa have been able to actually demonstrate this rela-

Fig. 2 - Octopus rubescens
Photo by Dr. F.G. Hochberg
What were the particular octopuses like in my study? One brood of octopuses, for example, scored in the median range for Active Engagement, with high Arousal/Readiness scores, high Aggression scores, and high Avoidance/Disinterest scores. This group of octopuses was extremely Reactive, Aroused, and Aggressive, but were not particularly Active or Interested in seeking out contexts in which to be reactive.

This was in contrast to another group of octopuses, who were highly Actively Engaged, not at all Aroused or Ready, highly Aggressive, and not very Avoidant or Disinterested. This second brood at a very early age was particularly Active in Engaging with their environment, acting Aggressively, choosing to act towards or approach stimulus as opposed to assessing situations from afar, or Avoiding them altogether. How each of these strategies might be evolutionarily stable strategies for these organisms was the subject of much of my thesis work.

My study was also longitudinal in nature, and tested these individuals on their four dimensions of temperament throughout the first five months of life. For my master’s thesis only the first 9 weeks have been analyzed. Longitudinal results show that from week 3 to week 6 there are major changes in an octopus’s approach to its environment. In this period, they become less Actively Engaged, less Aggressive, and more highly Aroused and Ready. Weeks 6 to 9 are a period of more stability, when major changes are not observed along any of the temperament dimensions.

I have hypothesized that the major changes observed from week 3 to week 6 represent two major life history changes. The first change is the dispersal behaviors of these organisms, and is marked by the significant decrease in Active Engagement and Aggressive behaviors. The second change is indicated by these two dimensional changes along with a significant increase in Arousal/Readiness tendencies and is a transition from a life controlled by innately programmed behaviors to one of greater plasticity of response. Arousal mechanisms provide the basis for behaviors expressed in choice mediated contexts.

No studies have been performed on O. bimaculoides in the wild with regards to this development. Unfortunately, with the octopuses, what we have are mostly laboratory studies from which we are able to derive information. But by hypothesizing how these dimensions might be important in the early life of these organisms, both at week 3 and across the first nine weeks of life, documenting temperament trait development allows an ecological view of the basis for behavior in these marine invertebrates.

Octopus provide an excellent behavioral model for these types of studies, and also a relatively little known model from the standpoint of the development of behavior. In addition to this, working with this marine mollusc allows us to assess these types of traits in an organism that is very different from the vertebrates in its approach to its environment and its life, and yet probably no less intelligent in its endeavors to adapt. I hope that I am fortunate enough to continue my work with cephalopods. I plan to study them for many years to come, and I hope to continue working with organizations such as the HMS in order to do so.

Note: David Sinn was a 1999 winner of an HMS Scholarship grant covering this subject.
Molluscs and Background of 
TOKELAU – CENTRAL PACIFIC ATOLLS
By Peter McQuarrie *

Email: petermcq@clear.net.nz

Introduction
Tokelau is a group of three coral atolls, situated approximately 300 miles north of Samoa in the
Central Pacific Ocean. I recently spent two years in the group and as I have been unable to find any
published references to the shells of Tokelau, I have prepared this report on my shelling experience
there.

General area around Tokelau

The Atolls
Tokelau is a dependent territory of New Zealand and has a population of approximately 1500 with a
further 5000 Tokelauans living in New Zealand and Australia. The atolls are small and low-lying, not
much more than ten or twelve miles across and composed largely of a central lagoon, with only a
ribbon of coral islets around the perimeter. The maximum elevation of any land is only 12 or 15
feet above sea level. There are no airfields in Tokelau so to get there, one must make a 30 hour ship
voyage from Apia in Samoa on the monthly sailing of the cargo/passenger vessel which services the
atolls.
The People & Shells

The Tokelauans are a Polynesian people related to those of the larger islands of Tonga and Samoa to the south and Hawaii to the north east. They are very close ethnically to the people of Tuvalu, formerly known as the Ellice Islands. As Polynesians, Tokelauans traditionally eat a lot of fish, the main source of protein in their diet. Some species of shellfish are also collected for food, the most significant of which is the giant clam (*Tridacna maxima*) which is common on the shallow reefs within the lagoons. Only a few other species of shells are occasionally gathered for food: the large Thorny Oyster (*Spondylus aurantius*), some species of *Murex* and smallstrombs (*Strombus luhanus*).

At Nukunonu, the central atoll of the three, *Lambis lambis* is more common than at the other two atolls and is occasionally eaten. Some use is made of Mother-of Pearl shell (Black-lipped Pearl Oyster, *Pinctada margaritifera*) in traditional fishing lures for bonito fishing and in handicrafts where it is used as inlay in woodcarving. A more modern use is for carved jewellery. This shell may have once been common in Tokelau but it is now rare. A number of live *Pinctada margaritifera* were introduced to Fakaofo in 1999 from Fiji and from Manihiki in the Northern Cook Islands, in an effort to re-establish stocks for pearl farming. Live *Trochus* shells (*Trochus niloticus*) were also introduced to Tokelau's reefs from Fiji in 1986 in an attempt to increase the amount of shell available for decorative use and commercial harvesting for the shell button industry. Very little interest is shown in other shells and Tokelauans are not particularly knowledgeable about shell habitats and which species are to be found on their atolls.
Shell Environment

Coral atolls offer a very limited range of habitats for molluscs as their shells are composed almost entirely of materials found in coral. The reefs are made up of a mixture of living and dead corals and the sand is also derived from dead coral skeletons. This coral reef environment is usually considered to be a good habitat for cones and cowries, and Terebra are common in the sand floor of the lagoons. Some Pacific atolls have extensive mangrove swamps which provide the mud which is favoured by some molluscs but in Tokelau there are no mangrove or similar trees to create this type of habitat. There are few species of seaweed and the soft corals are also poorly represented. Another factor against there being a wide range of genera and species of shells in Tokelau is the isolation of the atolls in the Central Pacific, which means that many species have simply not arrived there as part of a natural dispersion by ocean currents. Yet another environmental factor which works against molluscs is that none of the Tokelau atolls have deep-water passages into their lagoons. The flow of fresh seawater from ocean to lagoon is restricted to that which can flow over the reefs at high tides. This, and shallow depth, results in lagoon water temperatures which are higher than that of the ocean, perhaps higher than the optimum temperature for shell life and there seems to be indications that this is also having an effect on corals within the lagoons.

Collecting

During my two years in Tokelau, I collected several hundred shell specimens from the three atolls and was constantly on the lookout for new species to add to my collection. My collecting methods were to walk the ocean reefs at low tides, both during the day and at night, turning over coral slabs to look beneath. I also snorkelled in the lagoons and collected beach specimens in an effort to learn which species were present, even if I could not find a living shell of every species.

The results were disappointing when compared to shell finds in the Tuvalu atolls which are at the same latitude but 600 miles to the west of Tokelau. There were fewer species present and specimens of all species were more difficult to find. I found shells, which are mostly common in other areas of the Pacific. My list includes 29 species of Cypraea, 17 Conus and a few Pectens, Mitres, Murex, Lambis and Strombus. Giant clams and Thorny oysters were common in the lagoons as were the Terabras on the lagoon floor. No Olives were found and this is not surprising as only one species of Olive has been reported from Tuvalu and two or three from nearby Samoa. There are some large colonies of Strombus luhuanus in the lagoons. Tritons and Lambis are rare in Tokelau and found mostly on Nukunonu, the largest of the three atolls.

Tiger cowries are common throughout the Pacific and are one of the few cowries seen out and
about in the daytime. This is probably because they are large and have strong shells and do not have many predators. In Tokelau they are exceptionally common. Other cowries that were found to be very common were *C. moneta*, *depressa* and *caputserpentis*. *C. Ventriculus* and *poraria* also appeared to be quite common. Two cowries which are common on other islands, *C. mauritania* and *arabica*, are much rarer in Tokelau. I was particularly gratified to discover *C. goodalli* in Tokelau as the distribution of this cowry is restricted to only the Central Pacific. Amongst the cones, the smaller *C. ebraeus*, *eburneus* and *flavidus* were plentiful and of the more collectible cones the most commonly found was *C. tulipa*. A few specimens of the rare *C. adamsonii* were seen on Nukunonu and had been found there by the school Principal, Luciano Perez.

Dead specimens of the Chambered Nautilus (*Nautilus pompilius*) are found washed up on the exposed ocean reefs of the atolls. These shells may not have originated in Tokelau and could have drifted from far away. The introduced *Trochus niloticus* has survived in small colonies but has not multiplied to the extent that would allow harvesting in any quantity.

### Conclusion

It was interesting to search for shells and to record for the first time the shells of Tokelau and there was always the air of expectation of not knowing what was waiting to be discovered. However, the results were rather disappointing when compared with other islands and atolls in the Pacific.

### List of Shells found in Tokelau

<table>
<thead>
<tr>
<th>CERITHIIDAE</th>
<th>CARDIIDAE</th>
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<tr>
<td><em>Cassis cornuta</em></td>
<td><em>Laevicardium elongatum</em></td>
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<td><em>Cassis tuberosa</em></td>
<td><em>flavidus</em></td>
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<td><em>Cerithium echinatum</em></td>
<td><em>litteratus</em></td>
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<td><em>adamsonii</em></td>
<td><em>lividus</em></td>
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<td><em>auricomus</em></td>
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<td><em>catus</em></td>
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<td><em>vitulinus</em></td>
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<td><em>bistrinotata</em></td>
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caputdraconis
caputserpentis
carneola
chinensis
depressa
erosa
goodalli
helvola
isabella
labrolineata
lynx
margarita
mariae
mauritiana
microdon
moneta
nucleus
poraria
scurra
talpa
teres
testudinaria
tigris
ventriculus
vitellus

MITRIDAE
Mitra mitra
Mitra stictica

MURICIDAE
Thais armigera
Drupella cornus
Drupella rugosa

OVULIDAE
Ovula ovum

PECTINIDAE
Chlamys coruscans coruscans
Laevichlamys irregularis
Miraepecten rastellum

PTERIIDAE
Isognomon perna

RANELLIDAE
Charonia tritonis
Cymatium gemmatum

Acknowledgements
I would like to express my thanks to the following people who helped me with shell identification.

Walter O. Cernohorsky, retired Curator of Molluscs, Auckland Museum.

Henk H. Dijkstra, Zoological Museum, University of Amsterdam

Reference
Outline of Introduction to Tropical Indo-Pacific Marine Faunal Injuries
by Keven Reed, O.D.*

[Editor’s Note: This is an outline of a talk given by Dr. Reed to people who were likely to treat patients with problems arising from marine injuries. Many medical abbreviations are used that will not be known to non-medical people, but you will still find some interesting facts here. When the outline is used in talks such as to HMS the substance and words in this outline were tailored to the specific audience. Medical words and abbreviations were not eliminated as they will be of use to some readers. “CSL” used frequently refers to Commonwealth Serum Laboratories of Australia. Many Japanese names are used as the talks were originally given in Okinawa.]

These abstracted notes apply mostly to animals found near coral reefs between the latitudes 30°N & 30°S, or sea water warmer than 20°C (68°F). Notable exceptions are the colder Humboldt Current along the western coast of South America, and Bermuda at 32°N which is warmed by the Gulf Stream. Hermatypic corals use symbiotic dinoflagellates (zooxanthellae) to carry on photosynthesis and allow the stony corals (order Scleractinia) to calcify/grow at a rate greater than the bioerosion rates caused by the ocean and coral predators.

VENOMS versus "POISONS = ORAL BIOTOXINS

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<tr>
<td>Protein</td>
<td>Non-protein</td>
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<td>high raw</td>
<td>low m.w.</td>
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<tr>
<td>cone shells</td>
<td>mushrooms</td>
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<tr>
<td>Snakes</td>
<td>puffer fish, hugu or fugu</td>
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<tr>
<td>jellyfish, kurage</td>
<td>PSP (bivalves or pelecypods)</td>
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Clostridial exotoxins curare & strychnine (plants)

SEAFOOD SITUATIONS:

1. Toxic dinoflagellates: "red" tides, paralytic shellfish poisoning (PSP/saxitoxin), and ciguatera fish poisoning (tropical reef fish). PSP occurs in temperate oceans in the summer and early fall. Death rate from respiratory failure can approach 25% in first twelve hours. Public Health Service monitors commercial clam beds in United States. First U.S. death from PSP in a 14-year period occurred in Alaska in 1990 (MMWR)

Of over 1,000 free-living dinoflagellate species only about 20 sp. are toxic. Fifteen species are known to be toxic to various animals in U.S. waters, and at least four species cause human poisoning; ie, Gambierdiscus toxicus & Ostreopsis lenticularis.

What are dinoflagellates? They are algae with flagellae, chromatophores, & amoeboid ingestion!; second only to diatoms in sheer numbers of plankton organisms. They may be commensals or symbionts with fish, corals, molluscs, etc..

Ciguatoxin is fat soluble and concentrates as it goes up the food chain. Fatality rate is 0.1 to 12.0% and is higher in turtles and eels than other reef fish. NOTE: when fish are ciguateric, they usually do not look or taste differently than normal. Also, cooking does not affect these toxins.

Ciguatera fish poisoning is a major public health problem in the tropics. Virtually any species of salt-water near-shore/reef fish may suddenly become ciguatoxic. However, most commonly implicated fish was grouper in 60% of Miami, FL cases reviewed in a 1980 JAMA article. Most ciguateric cases in U.S. come from...
Marine Faunal Injuries  Continued.

Hawaii or FL.

Signs & Symptoms (Ciguatera)
looks like food poisoning at first, myalgia of legs (86%) pruritis without a rash, symptoms may be bizarre, diarrhea, vomiting, numbness, sensory reversal (hot &cold drinks) in convalescent period. Onset usually within a couple hours of eating.

Saxitoxin (PSP) is water soluble & inhibits sodium channels. Ciguatoxin is lipid soluble and stimulates sodium channels.

Treatment: Symptomatic. If patient is alert and not having any difficulty swallowing or breathing, may induce vomiting if emesis hasn't already occurred. Freeze a piece of the fish for analysis. Death by respiratory paralysis. Think oxygen & mechanical ventilation.

Though the mechanism hasn't been elucidated, American physicians working in the South Pacific have had amazing results using IV mannitol on severe cases of ciguateric poisoning (JAMA 259:2740-2742, 1988). 20% sol IV @ rate of I g per kg of body weight over 30-45 minutes. It is now recommended to give 20% mannitol IV to patients within a week of their ciguateric poisoning (Thomas & Scott, 1997). Patients must be rehydrated before the mannitol treatment if they are dehydrated.

To relieve itching in mild cases, use 25-50 mg diphenhydramine (Benadryl) qid in adults. Note: Whereas IV atropine (0.5 mg up to 2.0 mg) has been very effective in treating hypotension and bradycardia associated with ciguateric fish poisoning, it is CONTRAINDICATED in PSP victims.

Don't eat barracuda or moray eels (unless you want to experience ciguatera). There are an estimated 3 0,000 ciguateric poisonings per year in Puerto Rico and the U.S. Virgin Islands alone. Fortunately, not a major problem in Okinawa. About eighty cases per year are reported in Hawaiian islands.

TIPS that toxic dinoflagellates may be present in large numbers: 'red tides/bioluminescence; respiratory distress from ocean spray; Obey PHS bans on eating local bivalves (shellfish).

2. Scombroid fish poisoning. preventable with timely refrigeration of fish to prevent bacterial decomposition. Occurs in scombroid family of fishes (tuna, mackerel, bonito, albacore & wahoo). Also, Coryphaena hippurus (called "mahi mahi" in Hawaii, "dorado" in Calif & Mexico, and "dolphin fish" in Florida) accounts for over half the Hawaiian cases.

Bacterial action on histidine in fish flesh produces saurine (fish histamine). CDC reported na deaths in over 1,000 cases reported to them in the U.S. from 1973 -1986.

Victims frequently note a sharp, peppery taste. Onset of Sx's in 30-60 minutes. TREATMENT: may want to empty stomach, but supportive therapy should suffice. Manage as an allergic reaction; 25-50 mg diphenhydramine (Benadryl) qid for adults I mg/kg for children. For SEVERE CASES: 300 mg IV cimetidine or 50 mg IV ranitidine.

May send home on these H2 blockers~ 300 mg Tagamet (cimetidine) tid po, or Zantac (ranitidine) 150 mg bid po

3. Puffer Fish, Fugu (Japanese gourmet sashimi), Tetradotoxin: Note puffer fish are circumtropical and common. May be smooth skinned puffer (Tetradontidae) or spiny porcupinefish (Diodontidae)-.heat stable neurotoxin: cooking won't prevent: The poison's presence in the animal is intermittent.

Death by respiratory paralysis; no antidote; 470 Japanese deaths recorded in one year (1947); commercial sale requires licensed chef.

Treatment is supportive; Numbness & tingling may oc-
cur in ten minutes; later nausea & vomiting often quite severe. Death usually occurs within 6 hours. Induce vomiting if ate toxic fish within last 3 hours; A paralyzed victim may be fully conscious.

4. Many cartilaginous fish (Chondrichthyes) are biotoxic - most biotoxic part of shark to eat is its liver: no antidote.

Some sharks eat rays and skates.

If patient become symptomatic within 30-60 minutes of eating any fish's liver, induce vomiting (only if alert & not having trouble breathing).

5. Vibrio vulnificus: This organism is a free-living, ubiquitous, Gram negative bacterium in the marine environment. It is not a pollutant. However, 125 infections in Florida alone from 1981-1992 with a 35% fatality rate (NEWWR 04 June 1993). In another CDC series of 302 V. vulnificus infections from the Gulf Coast states between 1988 through 1995, 47% were associated with eating seafood and 42% with wound infections. V. vulnificus primary septicemia cases from seafood: 81% to 96% had eaten raw oysters the week before onset of illness. Characteristic large hemorrhagic bullae of skin.

Raw oysters + pre-existing liver disease = 200 times greater fatality rate than adults who ate raw oysters with healthy livers

PREVENTION: Cook shellfish. Boil at least ten minutes.
TREATMENT: Tetracyclines; or double-strength trimethoprim-sulfamethoxazole bid; or a fluorinated quinolone (ciprofloxacin or levofloxacin)

6. Gastropoda, part of phylum Mollusca: Beware of Imogai, genus Conus: Though there are cone shells in the Atlantic basin, all the human fatalities from cone stings have been in the Indo-Pacific. Cone species that are vermivorous are less toxic than molluscivorous species like the textile cone. The most dangerous cone shells are piscivorous (fish eating).

Conus geographus= Amboina (Japanese) =Hamanakaa (Okinawan): This cone shell has the most human kills to its credit: 18 fatal cases by 1982 from throughout the Indo-Pacific and 8 confirmed deaths in Ryukyu Is alone (southern Japan) by 1996. Death ranges from approximately 40 minutes to 5 hours depending on body size. Venom has neuromuscular blocking action; death from respiratory failure; no antidote. Crude fatality rate for geographus is 67% worldwide and 55% in Japan. This animal does not live in Hawaii

First aid: hot water soak (46'C/I 150F) & ligation/constricting band, as there's no local necrosis (June 1984, Nippon Eiseigaku Zasshi 39(2), two articles by Yoshiba, S. at Jikei U. School of Medicine, Tokyo) Treatment: assisted ventilation.

7. Family Scorpaenidae is a large family of benthic (bottom dwelling), near shore, carnivorous fish, with venomous spines. There are over ninety species in Japan from this family and at least 27 species occur in the Okinawa Prefecture. However, only a few of these fish are truly lethal. First aid for a sting: Hot water soak for 30-90 minutes.

Subfamily Pteroinae--Minokasago=Turkeyfish/Lionfish: pain lasts for hours. Venom is in rays of pelvic, anal, and dorsal fins (not the pectoral rays).

Subfamily Synanceiinae (includes genus Synaegaqia)=koza=Stonefish These are the infamous ones. Eight species of Synanceiinae in Okinawa (Masuda H., et al. WESPAC U.S. Naval Hospitals keep the tropical stonefish antivenin from CSL on board. Administer as slow IV.

Pain management: Meperidine doesn’t work: [Halstead & HM3 Bolinеau patients] May try nerve block or ketorolac tromethamine (Toradol) IM or IV.

8. Ei=Stingrays: Annually in U.S. there are more stingray injuries than scorpionfish & marine catfish injuries. In the 1950's approximately 750 Americans stung by
Marine Faunal Injuries  Continued.

rays per year; by 1990, 1,800 U.S. stingray injuries per year. Seldom fatal, though a large ray stinging a child in the chest can cause death. 1945-1989 seven deaths reported in the English literature from Australia, New Zealand, and U.S..

TREATMENT: Hot water soak (45-46°C/113-115°F) for 30-90 minutes; surgical exploration, irrigation, X-ray, analgesic; don’t suture wound closed; antibiotics if puncture is deep or signs of infection already present. If the integumentary sheath on the serrated barb doesn’t break, or breaks prior to penetration, one may not be envenomated. Some fish have multiple barbs. The giant (23 feet/7 meter) manta ray is a harmless filter feeder and has no stinger. However, other large rays, such as the ten foot Mobula iapodm, have a stinger.

Venomous catfish injuries are treated like stingray wounds. The venom is in the pectoral & dorsal rays. A stinging marine catfish frequently seen in WESPAC tidepools/coral reefs is Gonsui, Molosus fineatus. They usually appear as a ball/school of juveniles slowly moving through the shallow water.

9. Sea urchins=uni: The roe are eaten at sushi bars. Some species have venomous pedicellariae; some have venomous spines; some inject dye (tattoo). A puncture wound without venom is still a problem. Hot water soak (45-46°C/113-115°F) for 30-90 minutes. After gently removing spines or shaving pedicellariae from skin with foam & a razor, soak in vinegar (5% acetic acid). Frequently need antibiotics for secondary infection.

10. Nudibranchs (Phylum Mollusca) and colorful free-living Turbellarian marine flatworms (Phylum Platyhelminthes) include species which can eat jellyfish and hydroids, then pass the undischarged nematocysts (stinging organelle) from their digestive tract to their body’s surface to use for self-defense.

11. Phylum Cnidaria (older term, Coelenterata) includes jellyfish, corals, hydrozoans (ie, Millepora fire coral and Portuguese-Man-O-War, (katsuonoeboshi) colonial siphonophores), and sea anemones.

Over four times as many human fatalities occurred from jellyfish stings at Brisbane, Australia as from shark bites over 25 years! Crude fatality rate for all types of jellyfish during 124 years at North Queensland (tropical), Australia- 9%.

Cubomedusae=Sea Wasps=Box Jellies: These are cubozoans (box jellyfish) and are the most dangerous species; ie, Australian box jelly, Chironex fleckeri (identified in 1955 by Dr. Hugo Flecker) and the Philippine/Okinawan box jelly, Chiropsalmus quadrigatus, habukurage. CSL, recommends only vinegar for First Aid treatment of C. fleckeri stings. Caveat for meat tenderizer. CPR.

Box jellyfish antivenin (Chironex) prevents necrosis of wound as well as decreasing mortality. CSL sheep’s blood product administered IV or IM. Kept in WESPAC U.S. Naval Hospitals.

Vessication of wound characteristic of cubomedusae (sea wasps/box jellies). Discoloration of skin may be permanent. Cold packs can help manage pain, but do NOT let ice (water) touch the wound or the tentacles. Freshwater can stimulate the microscopic nematocysts to discharge.

May use antihistamines. May apply topical hydrocortisone if no infection present. Scotch tape may retrieve microscopic, species specific barbs from wound to send to museum curator for positive id. May need epinephrine (bee sting kit) for anaphylaxis to species normally not dangerous. 2-4 year follow-up of five patients stung on their corneas by sea nettles, Chrysaora quinquecirrha, in Chesapeake Bay: all developed significant intraocular pressure increases and prolonged iritis, but made full visual acuity recoveries with conventional treatment (Glasser, et al, Sep 92 Ophthalmology)

12. Echinoderms: sea urchins (see #9), starfish, sea cucumbers, crinoids, & sand dollars
Marine Faunal Injuries   Continued.


Sea cucumbers=namako=beche-de-mer=trepang: **Glands/Tubules of Cuvier** (eject from anal pore of animal when it feels threatened) have *holothurin/saponin poison* which may cause blindness from topical contact. Holothurin is a blistering agent.

13. **Elapids are sea snakes**, cobras, kraits, taipan, & American "coral" snakes

Over fifty described species: **31 species occur in Northern Australian waters and nine occur in Okinawa**. There are no sea snakes in the Atlantic and only one species occurs in Hawai'i (infrequently) and by the western coast of Central America, the yellow-bellied pelagic sea snake.

British researcher, Reid: 1956 Malaysia survey: only 1/4 of all sea snake bites had envenomation.

FIRST AID: Pressure immobilization technique; do not incise wound. Unlike pit vipers (hibu & rattle-snakes), there is usually no pain at the site of the wound. If no evidence of poisoning within **6 hours**, then no envenomation or not a sea snake bite.

**Myoglobinuria** becomes evident about 3 to 6 hours after envenomation. Principal pathological lesion in man is alternating skeletal muscle necrosis. However, may have neurological sign of envenomation; ie, an *aptnosis* (drooping eyelid) without myoglobinuria. Usually ascending flaccid paralysis; if survive first week, full recovery predicted. Number of days myoglobin grossly visible in urine indicates approximately how many weeks for recovery.

Tx: polyvalent- sea snake antivenin from CSL: minimum one ampule for an adult: may need three to ten ampules intravenously.

14. **Octopuses**: generally harmless; strong hard beaks and venom (which can be released without biting) to paralyze prey. There are no giant octopuses in tropics. The giants live near British Columbia. All cephalopods can rapidly change color to camouflage.

**Hyomondako=Hapalochlaena maculosa** or *H. lunulata* or *H. fasciata* Only one type of octopus ever caused human fatalities: the "Blue Ringer". Clyde Roper, cephalopod curator, stated there's at least five species of blue-ringed octopuses, though usually only one or two are listed in current texts. This small octopus does not attack, but bites defensively. The venom contains tetrodotoxin (see #3) and it **blocks the phrenic nerve supply to the diaphragm, so death is from asphyxia**. The *bite* from a blue-ringer is painless. Treatment is supportive. Assisted ventilation.

FIRST AID: Pressure immobilization technique (venom sequestration). Do NOT incise. If no paralysis or respiratory symptoms within 15 minutes of removing octopus, then you're not fatally envenomated. The blue-ringed octopus in the James Bond movie 'Octopussy' was probably a fake (too large), as *H. maculosa* averages a 5" (12 cm) arm spread.

15. **Secondary infections to marine (saltwater) environment accidents--target is a marine *Vibrio* sp.: Septra or Bactrim double-strength tab's po **twice a day** for a week to ten days if not allergic to 'sulfa drugs'; or, **doxycycline 100 mg po bid; or TCN 500 mg po qid (adult); or, ciprofloxacin HCl: Typical adult dose: 500 mg or 750 mg tab po bid (q 12 hrs); or levofloxacin po once a day (250 & 500 mg tab's).**

Infected wounds should be vigorously scrubbed with soap & water each day, and then a clean, dry bandage applied. May want to apply an antiseptic ointment such as bacitracin.

NOTES: CSL = Commonwealth Serum Laboratories
of Australia Names of animals in Itahcs are common Japanese names.

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Skin and Soft-Tissue Infections after Injury in the Ocean: Culture Methods and Antibiotic Therapy for Marine Bacteria by Reed KC, et al, Military Medicine,
While still in Perth waiting for our expedition to get underway, I visited the Western Australian Museum in the company of Barry Wilson who kindly showed me the museum's shell collection. In one cabinet drawer filled with volutes were four unidentified hermit crab shells which had been collected near Freemantle. I had with me at the time a paper by D. N. H. Ludbrook on the "Systematic Revision of the Volutid Genus Amoria", in which was a description and photograph of a similar shell, *Amoria (Amoria) reevei* (Sowerby), identical in every respect to the four shells in question. Sowerby had described and named this species from a unique specimen with only the vague locality data of Australia as its type locality.

Our discovery of these four specimens of *A. reevei* was important for two reasons. Before this discovery, Dr. Ludbrook had expressed an opinion that the unique holotype of *A. reevei* might be a freak gerontic (old adult) example of *A damoni*. These four shells prove this hypothesis incorrect for it is improbable that all five shells are freak and gerontic specimens. Secondly, the type locality is now established as within a 50 mile radius of Freemantle.

Although closely allied to *A. damoni*, *A. reevei* is a larger and broader shell with a short spire and flaring aperture. There are four plaits on the columella the anterior two being more pronounced and less oblique. The body whorl is cream colored, finely reticulated with a golden brown network of triangles which are intensified in two broad encircled bands. The dimensions of the shell figured in

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*Fig. 1 and 2. Amoria (Amoria) reevei* (Sowerby, 1864) Dead beach shell collected near Freemantle, S.W.A. length 103.6 mm, diameter 52.5 mm. Syn.: *Voluta reticulata* Reeve, 1843, not Linne, 1767. See Cotton, 1957, “Aus. Rec. Text, Sped. Mol. Fam. Volute.”
Cliff Weaver Volute Expedition to Australia  Continued

I want to take this opportunity to congratulate Barry Wilson for recognizing these shells as possibly new to the South Western Australian molluscan fauna, thus making the rediscovery of *A. reevei* possible.

On May 8th we left Freemantle aboard the ‘Davina’ and headed north to begin our marine shell dredging expedition along the Western Australian coast.

My diary begins:

May 9th - We thought it was rough yesterday but you should see the ocean today. Our captain, Arthur Cooper, said that if he could have seen how high the waves were last night he would have turned around and headed back to Freemantle. Fifteen and twenty foot crests are still all around us. We eat on the floor where things don't have to fall so far.

May 10th - We arrived inside the sanctuary of Geraldton's stone breakwater where we went ashore and inspected the crayfish plant. At the restaurants we ate delicious undersized crayfish which are supposed to be illegal to sell. All the restaurants sell them so no wonder the crayfish are getting scarce. Dr. Ray George, who once made a government survey of the crayfish population, muttered about these depredations between mouthfuls. In the mean time, aboard the "Davina", broken deck planking caused by the storm was being repaired.

Fig. 3 & 4. *Amoria (Amoria) damoni* Gray, 1844. Taken by author on sand bar, Dolphin Island, Dampier Archipelago, W.A.: Length 94 mm, diameter 38 mm. Sometimes erroneously called *A. reticulata*; see Ludbrook, 1952, “Rev. Genus Amoria”, “Proc. Mal. Soc. Lon.” Dec 31, 1953, parts 3 & 4, pp. 133-134, pl. 14, Fig. 1 & 2.

Fig. 5 & 6. *Amoria (Amoria) damoni* Gray, 1844. Collected by the author on a sand bar, Thevanard Island, 15 miles N.E. of Onslow, W.A.. Length 79.6 mm, diameter 36 mm. This shell was thought to be an ecotype of *A. damoni* and may prove, after further study to be a diminutive, northern, warm water form of *A. reevei*. 

this article are; height 102.6 mm; diameter 52.5 mm.
May 11th - Off at 10:00 a.m. for the Houtman Abrolhos Islands, west of Geraldton. These are a group of low lying coral and sand islands covered with brush about 40 miles off the coast. We made two dredging stations but no shells. Spent the night leeward of South Island. Weather much better. Over the ship's radio we heard we had been on the edge of a hurricane while coming north.

May 12th - We headed west of Zeewyk Channel looking for deep water on the edge of the continental shelf. At 10:00 a.m. we dropped our dredge in 80 fathoms and brought up a fine subadult *Aulica irvinae* and a very dead species of *Notovoluta* which we believe to be *N. kreuslerae*. Our second dredge haul in 85 fathoms produced a beautiful live specimen resembling *Nannamoria guntheri* but with finer and more numerous longitudinal lines and a somewhat different spire and protoconch. (Subsequently this shell proved to be a new species and is being worked on by Dr. McMichael at the Australian Museum in Sydney).

Arrived at east side of East Wallaby Island at 3:00 p.m. Tom Richert and I swam ashore from the “Davina” and saw our first coral formations. Hundreds of large *Trochus* and *Turbo* shells covered the reef shelf. Just off the reef in a sand depression in 151 of water I spotted the largest univalve I ever saw. I yelled for the dinghy and for Tom and between us we hoisted an 18” *Melo miltonis* aboard. The shell had been resting in an oval depression on the flat sandy bottom and looked like a large grey pillow from above. When we removed the animal it weighed over nine pounds. (Whether this is a size record or not I don't know but this shell is much larger than any I looked at during my stay in Western Australia. Joyce Allan, in her book "Australian Shells", says that a *M. miltonis* grows to about 7”).

A half hour after finding this large shell, Tom found a smaller but more beautiful *M. miltonis* and several dead ones to give us a good series. Tom also found a fine *Conus pontificalis* on the reef.

We both learned that you can remove the animal from a Melo shell by using your hands and a sharp knife. You amputate the foot and work the liver loose with your fingers. In this manner, the complete animal is worked out and the shell is ready for the cabinet.

May 13th - We were up at 6:00 and in the cold water looking for another large *M. miltonis* but no luck. Tom and George then donned their aqua lungs and proceeded to fill two gunny sacks with crayfish they took from ledges in 2’ of water. While the cook was preparing crayfish over a fire on the beach, I walked across East Wallaby Island and flushed about a dozen wallabies (small kangaroos), from their day time hiding places, they are a nocturnal animal. Some females would go bounding off with little feet dangling sideways from pouches. The largest wallaby I saw was only two feet high. There is no fresh water on these Islands but the wallabies seem to be able to assimilate small quantities of brackish water from tide pools. The vegetation is sparse and low consising mostly of scrubby bushes under which the wallabies hide and sleep.

After returning to the beach we ate the crayfish and departed for Sharks Bay making one more dredge haul before leaving the Abrolhos. In this haul, in 80 fathoms, we took a beautiful salmon-pink, cone about 2” in length which in all probability, is a new species. Mariel was very happy with this shell, cones being her favorite family.

In the next issue I'll relate how Tom and I collected some large *Melo Amphorus* in Sharks Bay and how we were both surprised by the 12’ shovel nosed sharks that give the Bay its name.

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Mrs. King returned to Honolulu, June 22, 1960. The expedition broke up at the northern end of their operations, more than 1000 miles from Perth, in order to allow the boat time to get back to Perth before the expiration of the charter period, June 30th. Dr. Richert and Dr. Burgess, the other Honolulu members of the party, flew to Fiji (Golden Cowry country) but the weather was bad and collecting poor so they flew to Tahiti, thence to Bora Bora. Maybe they will settle the argument as to whether *Cyprae granulata* is endemic to Hawaii on this trip. They are expected to return to Honolulu between the first and fourth of July.
Error in article on Nucella
May, 2000 Issue of IHSN, Features Section, page 16
By Russell Webb

Wed, 3 May 2000 00:00:53 -0700
From: "RUSSELL WEBB" <russwebb@earthlink.net>

It looks like one of the pictures I sent got misplaced. The *Nucella* in the picture titled Nucella lamellosa are all but that species. They are *N. emarginata*, *N. canaliculata* and *N. lima*. Attached is the picture that should go in that spot.

You might also mention Hardy’s home page which first had my photo of *Nucella lamellosa* variation. This home page has many species illustrated with the references that Hardy had available for the species. Many people will find this a good source of information.

Russ

From Editor:

The link to Hardy’s home page is: http://www.gastropods.com/shell_pages/index.html
Hardy's Internet Guide to Marine Gastropods. “A partly illustrated catalogue of Gastropods with references to books in my small library and some guidelines on how I have put this home page together plus an update history.” Email: jzhhardy@xs4all.nl

**Below are photos with correct titles. Thanks to Russ.**

![Fig. 2. *Nucella lamellosa* Gmelin, 1791 Variability Correct illustration for this species.](image1)

![Top row *N. emarginata* Deshayes, 1839, Center row: *N. Lima* Gmelin, 1791 Lowest row: *N. canaliculata*, Duclos, 1832 Mislabeled Fig 2 of IHSN, May, 2000, page 16 With corrected species names above.](image2)