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common in collections, was found living on small rocks in the deeper tide-pools, collectable only at a minus tide. It bears a superficial resemblance to the young of *A. limatula*, but this latter species lives up at the mid-tide level.

Chiton collecting here was good; 26 species were found. The highlights were *Callistochiton connellyi* Willett, previously known only from the type locality near Ensenada, Lower California, and *Lepidochitona lowei* Pils.

Another interesting find was made a few miles south of Carmel. This was a large, heavy specimen of *Marcia kennerleyi* (Cpr.) Rve., dead, but the valves still held together by the ligament.

While collecting at Morro Bay several years ago we found *Cryptomya californica* Conr. which has very short siphons, living about 6 inches below the surface but adjacent to the numerous crab burrows into which it extended its siphons.

Regarding the West Coast mytilids: students here on the coast consider *Mytilus multiformis* Cpr. a good species, of the Mexican and Central American coasts. It is very small, seldom reaching  $\frac{1}{2}$  inch, and grows in large mats on the surface of rocks. The northern limit of its range is Cape San Lucas. *Mytilus adamsianus* Dunker is listed from Santa Barbara to Panama (Mr. H. N. Lowe listed it from San Juan del Sur, Nicaragua). At present California collectors are calling our local shell *M. adamsianus*, but it is possible that future study may show differences between our California shell and those from further south. In that case the name *stearnsi* Pils. & Raym. may be available for our California shell.

Along the coasts of Los Angeles and Orange counties large colonies of *Lasaea* live in crevices of the ledge rock. Sometimes, but by no means always, *M. adamsianus* lives in the edges of these same crevices with the end of the shell exposed to the light. *Septifer bifurcatus*, on the other hand, is usually well hidden from the light.

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## COLOR VARIATION IN OLIVELLA BIPLICATA IN VARIOUS LOCALITIES

BY D. S. AND E. W. GIFFORD

In THE NAUTILUS, volume 55, pages 10-12, we published an account of color variation in a series of 2757 specimens of *Olivella*

*biplicata* collected alive at Bolinas, Marin County, California. Subsequently, we have collected in other localities with the idea of determining if the percentages for the color variations were the same everywhere. There became apparent a considerable deviation in this regard at different localities.

The places at which we collected range from Port Orford, Oregon, in the north, to Ensenada, Baja California, in the south. Including the published Bolinas series, we have the following: Port Orford, Curry County, Oregon, 553 specimens; Crescent City, Del Norte County, California, 978; Trinidad, Humboldt County, California, 911; Tomales Bay, Marin County, California, 558; Bolinas, Marin County, California, 2757; Santa Cruz, Santa Cruz County, California, 1806; Monterey, Monterey County, California, 1199; Morro Bay, San Luis Obispo County, California, 514; Santa Barbara, Santa Barbara County, California, 695; Ensenada, Baja California, 4. This makes a grand total of 9975.

The xanthochroistic specimen found at Bolinas was not duplicated, so it remains unique in a series of 9975. It is the only specimen that lacks the characteristic purple coloring near the canal, which gives this species its common name of Purple Olive Shell.

In the following counts we shall distinguish two main categories: (a) shells with no trace of orange in aperture, (b) shells with orange in aperture. Within these two categories we shall separate "normal" colored shells from albinos. The so-called normal color range will be as defined in the preceding article (page 10, third paragraph). Lastly, (c) we shall record the total albino count.

Our table reveals Santa Cruz as the center of abundance (35%) of shells with trace or more of orange in the aperture. Then follows Monterey, across Monterey Bay from Santa Cruz, with 25%. Crescent City ranks third with 13%, Bolinas fourth with 11%. It is remarkable that Tomales Bay, north of Bolinas, runs only 2%, and Trinidad, south of Crescent City, runs less than 1%. Both lie between Crescent City and Bolinas. Port Orford, north of Crescent City, also yields less than 1% of shells with trace of orange. It is evident that somewhat different heredities mark the populations of different localities. For occurrence of orange in the aperture, there are with certainty two centers: (a) Crescent

COLOR VARIATION IN *OLIVELLA BIPLICATA* IN TEN LOCALITIES

Locality	Total	No Orange in Aperture	No Orange: Normal	No Orange: Albino	Orange in Aperture	Orange: Normal	Orange: Albino	Total Albino
Port Orford .....	553	550 (99%)	549	1	3 (1%)	3	0	1 (1%)
Crescent City .....	978	846 (87%)	837	9	132 (13%)	129	3	12 (1%)
Trinidad .....	911	910 (99%)	876	34	1 (1%)	1	0	34 (4%)
Tomales Bay .....	558	547 (98%)	490	57	11 (2%)	11	0	57 (10%)
Bolinas .....	2757	2458 (89%)	2280	177	299 (11%)	262	37	214 (8%)
Santa Cruz .....	1806	1182 (65%)	1042	140	624 (35%)	541	83	223 (12%)
Monterey .....	1199	898 (75%)	799	99	301 (25%)	261	40	139 (12%)
Morro Bay .....	514	511 (99%)	458	53	3 (1%)	3	0	53 (10%)
Santa Barbara .....	695	688 (99%)	652	36	7 (1%)	7	0	36 (5%)
Ensenada .....	4	4	3	1	0	0	0	1

City, (b) Bolinas-Santa Cruz. However, if collecting between Bolinas and Santa Cruz reveals somewhere a population with reduced occurrence of orange, we may then be justified in regarding Bolinas and Santa Cruz as separate centers. As it appears now, Santa Cruz is the center of high frequency (35%), diminishing at Monterey (25%) to the south and at Bolinas (11%) to the north. Perhaps the 2% of Tomales Bay represents a further northward tapering off from the Santa Cruz center of abundance. Morro Bay and Santa Barbara to the southward are in about the same category as Trinidad and Port Orford, with 1% or less. Whether the four Ensenada specimens are truly indicative of absence of orange, it is impossible to say with such a small series.

The table is also revealing as to albinism, which seems to have no certain correlation with the presence of orange in the aperture. Santa Cruz and Monterey head the list for frequency of albinism (12%). Tomales Bay and Morro Bay are second, with 10%. Then follows Bolinas with 8%, Santa Barbara with 5%, Trinidad with 4%, Crescent City with 1%, and Port Orford with less than 1%. Monterey Bay again appears as the center of abundance of albino specimens. From this center the abundance diminishes to the south and to the north. The greater abundance at Tomales Bay (10%), to the north of Bolinas (8%), may be merely due to the Tomales series being too small a sample.

Illustrating the fortuitous factor in collecting, yet at the same time reinforcing the validity of our percentages, is the case at Santa Cruz. Our total series of 1806 was collected on May 31st (876 specimens), and November 17th (930 specimens). On May 31st the percentages ran as follows: No orange in aperture, 68%; orange in aperture, 32%; albinos, 13%. On November 17th: No orange in aperture, 63%; orange in aperture, 37%; albinos, 12%. The figures presented in the table combine the results for the two days: No orange in aperture, 65%; orange in aperture, 35%; albinos, 12%.

Certain general impressions emerge from viewing large series of the normal colors. From Bolinas northward one gets the impression of drabness in the series, while from Santa Cruz southward the shells in general appear bluer and less drab and gray. Also to the southward the bishop purple appears more conspicu-

ously on the aperture portions of the shells. Southern shells on the whole average smaller than northern ones. The ravages of the parasitic sponge, *Cliona*, which mars shells at Bolinas, was observed nowhere else.

Some albinos at Bolinas have an ivory tone which is largely lacking from Monterey southward and replaced there by a veiled suffusion of purple, which seems to correlate with the greater abundance of this color in the normal colored shells. Indeed, some shells have a suffusion of purple in the parietal callus which is normally white, unless there is a trace of orange or yellow.

Many immature shells of normal color have very thin horn-colored lips (especially true in the north), which is evidently a continuation of the so-called wash of horn color mentioned in the Bolinas article. Another feature of many immature (half-grown or one-third grown) shells is the presence of a dark spot on the parietal wall projecting out slightly from under the upper edge of the lip. In the north (Port Orford to Tomales Bay), this spot is usually maroon, in the south (Bolinas to Santa Barbara) it is usually purple.

The months in which the specimens were collected are as follows: Port Orford, Crescent City, and Trinidad in July, 1941; Tomales Bay in April and August, 1941; Bolinas in November and December, 1940, and January, 1941; Santa Cruz in May and November, 1941; Monterey in May, 1942; Morro Bay in May, 1942; Santa Barbara in June, 1941, and January, 1942; Ensenada in June, 1941.

Very young shells were most abundant in January at Bolinas, in July at Port Orford and less so at Crescent City, but absent at Trinidad. This seems to imply either two breeding seasons, or else a summer breeding season in the north and a winter breeding season in the center (Bolinas) and south. Supporting the latter view was the absence of very young at Morro Bay and Monterey (one exception) in May, and at Tomales Bay in April and August. At Santa Barbara in January, however, five very small young were obtained, again suggesting a winter breeding season. At Santa Cruz we found no very young in either May or November. The very young shells collected at Port Orford were marked with longitudinal wavy brown lines on the ventral surface as at Bolinas (*op. cit.*, p. 12). A unique example of retention of this

infantile character is to be seen in a half-grown shell from Tomales Bay.

Tomales Bay also yielded another unusual specimen. It is an adult, quite brownish-gray in general cast of color. On the body whorl are two encircling parallel gray stripes, each varying from 1 to 2 mm. in width and 3 mm. apart.

At Santa Barbara dark gray shells were more abundant than elsewhere, but were usually only half grown, suggesting a possible fading with age. Two half-grown shells were unusual in possessing a sort of lemon-horn color on the body whorl. Wherever one collects a large series of this beautiful species, unusually colored individuals appear.

Although this paper deals with color variation, we cannot refrain from calling attention to the variation in form which is best expressed by the index derived from dividing maximum diameter by maximum length. We have selected by eye a few extreme examples. The bulk of the specimens lie between these extremes. A low index indicates slimness, a high index obesity. It will be observed that the range in our own random series of eight is from 44 to 60. The individual millimeter measurements and indices follow:

- Port Orford, normal color,  $27 \times 14$ , index 52.
- Port Orford, normal color,  $27 \times 12$ , index 44.
- Tomales Bay, albino,  $21 \times 12$ , index 57.
- Tomales Bay, albino,  $24.5 \times 12$ , index 49.
- Santa Cruz, orange trace,  $21 \times 11$ , index 52.
- Santa Cruz, orange trace,  $25 \times 15$ , index 60.
- Morro Bay, normal,  $18 \times 10.5$ , index 58.
- Morro Bay, normal,  $18.5 \times 9.5$ , index 51.

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## DESCRIPTION OF A HELICOID SNAIL FROM MADAGASCAR

BY H. A. PILSBRY

About half a century ago I figured a Madagascar shell under the name *Ampelita hemioxia*, in the Manual of Conchology (9: 155, pl. 41, figs. 31-33, July 27, 1894), intending to describe it in this journal. Evidently it passed out of mind. My friend Dr. Jos. Bequaert found the same species, which he identified