

## *Oliva spicata* (Röding, 1798)

### PART ONE

#### Iconography of adjacent populations in the Cortezan Subprovince, intraspecific variability and recent taxonomic history.

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#### **Key-words**

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#### **Abstract**

In Tropical West America, *Oliva spicata* (Röding, 1798) is found in a series of small, adjacent, morphologically recognizable populations that will be considered here as geographic forms. Eighteen of these forms, coming from the same number of localities, are illustrated. Furthermore, in order to evaluate the intraspecific variability of *Oliva spicata*, two populations found about 500 km. distant from each other are morphologically compared.

#### **Note**

- The almost total lack of knowledge concerning the ecology and ethology of *Oliva spicata* has created some difficulty in using a term to indicate the single populations with which the species is presented in its area of distribution. Since A) *Oliva spicata*'s reproductive modality, B) the influence of the environment on its morphology, and C) what the connection is between the populations that occupy the single patches, are, in fact, yet unknown, it seems incorrect to use any of the terms presently available (see below). In their place, the general term "geographic form" will be used here.

Geographic variation. The differences between spatially segregated populations of a species; population differences in the space dimension. (Mayr, 1963)

Metapopulation. Set of local populations within some larger area, where typically migrations from one local population to at least some other patches is possible. (Hanski & Gilpin, 1997)

Ecomorphism. Phenomenon in which ecological factors cause more-or-less important morphological changes in organisms.

- All of the specimens shown here have a certain place of origin. Since this is essential to the iconography presented in this article, specimens bought commercially, or those whose place of origin can't be verified, haven't been taken into consideration. Many of these specimens have been collected by the author; still others were given to him by those who actually found them and were able to provide data concerning their finding. Lastly, since every geographic form presents a certain variability, the choice was made to present those specimens which best show the characteristics of the geographic form considered.

- In the chapter "Recent Taxonomic History", the classifications faithfully reflect the original works, both in sequence and orthographically.



Fig.1 *Oliva spicata* (Röding, 1798). Live specimen at Conception Bay, Baja California, Mexico. By M.A.Perini, October 1999.

## **Introduction**

In this article, discussion as to whether or not the many names attributed to the geographic forms of *Oliva spicata* are valid as species has intentionally been avoided. There are two reasons for this: first, because it isn't considered possible to do so with only a morphological analysis of the shell; second, because the various forms of *Oliva spicata* are allopatric, in other words, they occupy different localities, which leads us to suppose that every single population is a geographic form of the species we are dealing with. While awaiting further studies, it was preferable to deal with the subject based on that which is known. Unfortunately, the knowledge we have of this species hasn't changed since Myra Keen's first edition of "Sea Shells of Tropical West America" came out back in 1958. The contribution of this present article is essentially iconographic, with the addition of data indicating where the specimens shown were found. This allows us to have a vision of the connection that exists between the intraspecific variability and the distribution of the single geographic forms in the wider area of distribution of *Oliva spicata*.

Many of the specimens shown here were found by the author and by Ernest E. Staley along the coasts of Baja California between 1995 and 2000. For this purpose, the eastern coasts of Baja California, from San Felipe to the south of La Paz were explored, whereas the Pacific coast was explored from Bahía Magdalena to Cabo San Lucas. Specimens of *Oliva spicata* were found also on Coronado Island and Espíritu Santo Island in the Gulf of California. In 1997, Hurricane "Nora" washed ashore many specimens in Bahía de Santa Inés and in the area of Punta Chivato. Among these, the best were chosen to be added to our collections.

In our search, we made use of the collaboration both of local fishermen and normal inhabitants of the place, who helped by showing us, and sometimes giving us, that which they had gathered over time. Visits to small, private collections and public exhibits, like that of the Natural Sciences in Bahía de Los Angeles, were also interesting. Exploring a great number of places along the coasts of Baja California, yet another important element was drawn to our attention.

With the exclusion of the estuary of the Colorado River, north of San Felipe, it was observed that the coasts of the peninsula, like those of many islands, are made up of an alternation of beaches and cliffs. The latter keep the habitats occupied by *Oliva spicata* separated, and cause a fragmentary distribution. It was exactly this isolation of the single populations that has contributed to the development of the many forms in which the species is found today.

Studying the collection of *Oliva spicata* kept at the Museum of Natural History of Los Angeles (NHMLA), thanks to the kindness of Dr. James McLean, at the time Curator of Invertebrate Zoology, was important. Although the collection needs to be reorganized, two elements emerged: first, the allopatric distribution of the different forms was confirmed; second, that adjacent populations have a similar morphology.

## **Recent taxonomic history**

To put in evidence the great difficulty that authors have always had dealing with *Oliva spicata*, the following shows some of the classifications from 1969 to the present.

### **1969, R.F.Zeigler & H.C.Porreca**

Species: *Oliva spicata* (Röding, 1798)

Subgenus: *Oliva* Bruguiere, 1798

Synonyms: *Oliva arachnoidea* Röding, 1798; *Oliva litterata* Röding, 1798 non Lamarck, 1810; *Oliva araneosa* Lamarck, 1811; *Oliva oriola* Duclos, 1835; *Oliva melchersi* Menke, 1851; *Oliva intertincta* Carpenter, 1857; *Oliva oblongata* Marrat, 1870.

Forms: *cumingi* Reeve, 1850; *fuscata* Marrat, 1871 (synonyms: ? *ustulata* Lamarck, 1811; ? *oniska* Duclos, 1844; *perfecta* Johnson, 1911); *hemphilli* Johnson, 1911; *obesina* Duclos, 1835; *pindarina* Duclos, 1835; *subangulata* Philippi, 1848; *venulata* Lamarck, 1811 (synonym: *punctata* Marrat, 1870); *violacea* Marrat, 1867 (synonym: *rejecta* Burch & Burch, 1962).

Note: It is interesting to note the presence of synonyms among the forms.

### **1971, A. Myra Keen**

Species: *Oliva spicata* (Röding, 1798)

Subgenus: *Oliva* Bruguiere, 1798

Synonyms: *Porphirya arachnoidea* and *litterata* Röding, 1798; *Oliva araneosa* and *venulata* Lamarck, 1811; *Oliva obesina*, *oriola* [not Lamarck, 1811] and *pindarina* Duclos, 1835; *Oliva subangulata* Philippi, 1848; *Oliva cumingii* Reeve, 1850; *Oliva melchersi* Menke, 1851; *Oliva intertincta* Carpenter, 1857; *Oliva fuscata*, *oblonga*, *punctata* and *violacea* Marrat in Sowerby, 1870; *Oliva hemphilli* and *perfecta* Johnson, 1911; *Oliva rejecta* Burch & Burch, 1962; *Oliva ionopsis* Berry, 1969.

### **1986, E.J.Petuch & D.M.Sargent**

Species: *Oliva spicata* (Röding, 1798)

Subgenus: *Strephona* Mörch, 1852

Synonyms: *litterata* Röding, 1798 not *litterata* Lamarck, 1811; *arachnoidea* Röding, 1798; *oblongata* Marrat, 1870.

Forms: *araneosa* Lamarck, 1811; *fuscata* Marrat, 1871; *intertincta* Carpenter, 1857.

Subspecies: *deynzeræ* Petuch & Sargent, 1986.

Note: 1) As you can see, few names are present in "synonyms" and "forms" because the Authors consider many more taxa as valid species. 2) The Subgenus has changed from *Oliva* to *Strephona*. 3) A new subspecies from Cocos Is. (Costa Rica) is named: *Oliva spicata deynzeræ*.

**1996, G.Terzer**

Species: *Oliva spicata* (Röding, 1798)

Subgenus: *Strephona* Mörch, 1852

Synonyms: *arachnoidea* (Röding, 1798); *litterata* (Röding, 1798) *non* Lamarck, 1811; *oblongata* Marrat, 1870.

Forms: *araneosa* Lamarck, 1811; *fuscata* Marrat, 1871; *intertincta* Carpenter, 1857.

Subspecies: *deynzeræ* Petuch & Sargent, 1986; *ionopsis* Berry, 1969; *melchersi* Menkes, 1851

**1998, B.Tursch, D.Greifeneder & D.Huart**

Species: *Oliva spicata* (Röding, 1798)

Subgenus: omitted.

Synonyms: *Porphirya spicata* Röding, 1798; *Porphirya arachnoidea* (Röding, 1798); *Oliva araneosa* Lamarck, 1811; *Oliva venulata* Lamarck, 1811; *Oliva oniska* Duclos, 1845; *Oliva pindarina* Duclos, 1840; *Oliva timoria* Duclos, 1840; *Oliva subangulata* Philippi, 1848; *Oliva cumingii* Reeve, 1850; *Oliva ligneola* Reeve, 1850; *Oliva melchersi* Menke, 1851; *Oliva intertincta* Carpenter, 1857; *Oliva violacea* Marrat, 1867; *Oliva brunnea* Marrat, 1870; *Oliva punctata* Marrat, 1870; *Oliva fuscata* Marrat, 1870; *Oliva spicata* var. *hemphilli* Ford in Johnson, 1911; *Oliva spicata* var. *perfecta* Johnson, 1911; *Oliva rejecta* Burch & Burch, 1962; *Oliva ionopsis* Berry, 1969; *Oliva (Strephona) radix* Petuch & Sargent, 1986; *Oliva subangulata cortezana* Petuch & Sargent, 1986.

Subspecies: *deynzeræ* Petuch & Sargent, 1986.

**2009, C.Hunon, A.Hoarau & A.Robin**

Species: *Oliva spicata* (Röding, 1798)

Subgenus: *Strephona* Mörch, 1852

Synonyms: *arachnoidea* (Röding, 1798); *araneosa* Lamarck, 1811; *brunnea* Marrat, 1870; *fuscata* Marrat, 1870; *melchersi* Menke, 1851; *oniska* Duclos, 1845.

Subspecies: *deynzeræ* Petuch & Sargent, 1986.

Synonym: *perfecta* Johnson, 1911

Observing the number of taxa in the “synonyms”, the alternation of opinions among the various authors is evident. The single taxon changes status, going from valid species to subspecies, synonym or simple form, according to the authors. Nevertheless, apart from the single classifications, the fact that some authors have placed many taxa in synonymy shows the morphological resemblance between them - so much so to be indistinguishable, if considered an integral part of the intraspecific variability of one single species.

**Intraspecific variability**

To put in evidence the intraspecific variability of *Oliva spicata* the choice was made to compare the specimens belonging to two populations present on the eastern coast of Baja California (plates 1 and 2). The two populations are separated from each other both by distance from San Francisquito to Bahia de La Ventana, about 500 km and by the orography of the coast. As with many other populations of *Oliva spicata* present in the Cortezan Subprovince, the morphological difference between them would be sufficient to consider them two distinct species. Based exclusively on morphology, the nineteen synonyms cited by Myra Keen don't seem so many, since every suitable locality presents a different form. It's certainly possible that a population is no longer able to interbreed fertily with other populations, and constitutes a different species. Nevertheless, at the present, we lack sure studies to affirm this, and so, field observations lead us to consider such populations as geographic forms of one single species.

The images of the two populations taken into consideration show twenty specimens: juveniles, subadults and adults. This way, it's possible to see not only how the shell changes during growth, but also how the difference between the two populations is already present in specimens not yet completely formed. Furthermore, to put in evidence the differences between the two populations, charts (figs. 2 and 3) and two comparative plates have been used (plates 3 and 4).





Plate 1. *Oliva spicata* (Röding, 1798). Population n.1. Locality: off San Francisquito, Baja California, Mexico (28°24'49.7" N, 112°51'19.1" W). Juveniles, subadults and adults from 22.80mm to 49.90mm (20 items out of a batch of 48) collected at 8-10 meters depth on gray sand by G.Lawson in May 1995.



Plate 2. *Oliva spicata* (Röding, 1798). Population n.2. Locality: off Punta Arena de La Ventana, Bahía de La Ventana, Baja California Sur, Mexico (24°3'40.6" N, 109°49'43.0" W). Juveniles, subadults and adults from 22.38mm to 45.78mm collected at 6-8 meters depth in white sand by G.Lawson in April 1987.

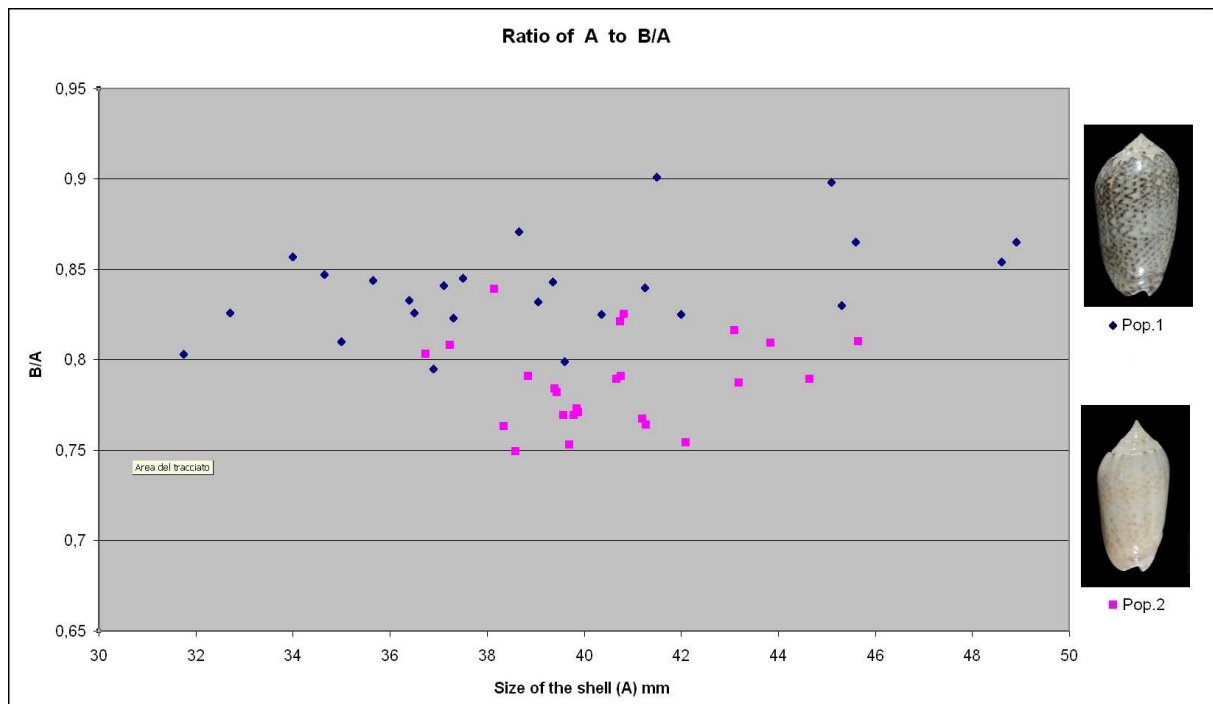
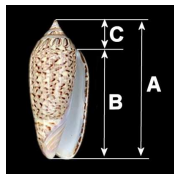


Fig.2 *Oliva spicata* (Röding, 1798). Ratio of A to B/A, read below.



In these two charts, 25 adult specimens of each of the two populations, chosen between the minimum and maximum dimensions available, are compared. Figure 2 shows the connection that exists between the total length of the shell (A) and the ratio B/A. The chart puts in evidence that for Pop. 1, the ratio B/A is between 0.8 and 0.9, whereas for Pop. 2, between 0.75 and 0.85. In both populations the space is 0.1. The average value of B/A is equal to 0.840 for Pop. 1, while it is 0.787 for Pop. 2. In fig. 3 you can see that in Pop. 2, the average trend of C/A is horizontal. It extrapolates that, apart from the obvious Gaussian fluctuations of the average value, the trend corresponds to C/A=uniform, that is to say, the development of the shell is strictly isometric. Instead, in Pop. 1, the trend is initially almost horizontal (up to about 38 mm.), then begins to slope down. The average value of C/A is almost uniform in the smaller specimens, but is no longer so in the larger ones. This means that the development of Pop. 1 goes through a first phase which is isometric, after which another non-isometric phase takes over and prevails.

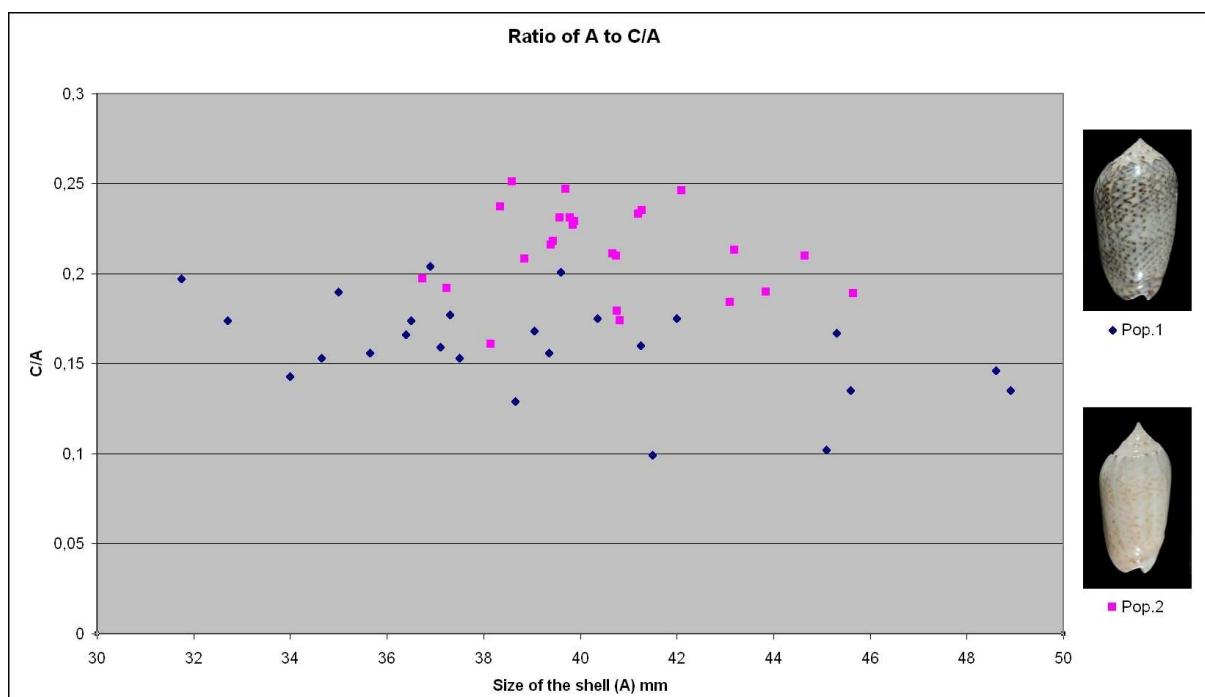


Fig.3 *Oliva spicata* (Röding, 1798). Ratio of A to C/A, read above.



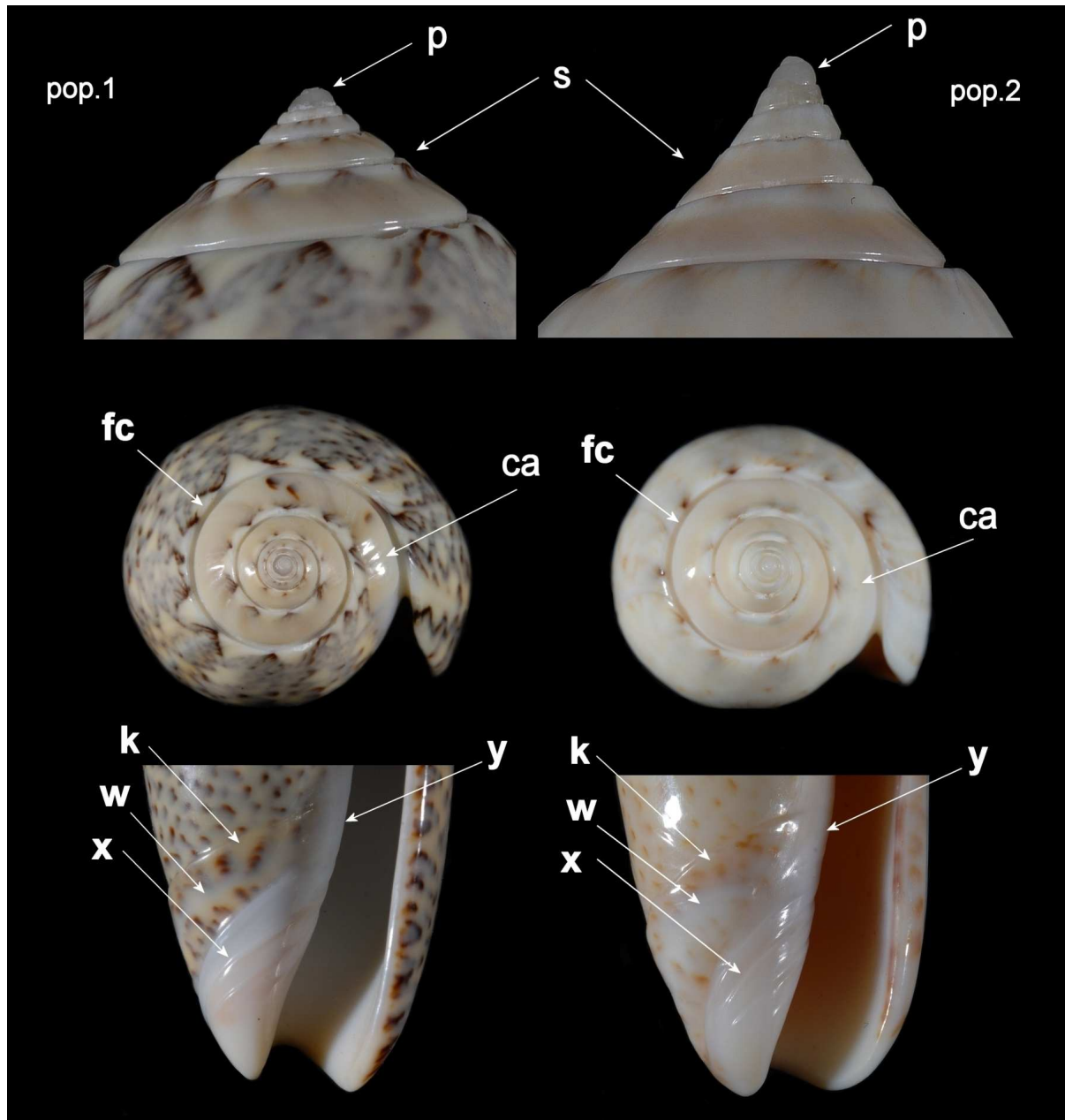


Plate 3. *Oliva spicata* (Röding, 1798). Comparative plate, see text below.

In plate 3 we can see that the greatest difference between the two populations is the vertical development of the spire “s” and the height of the protoconch “p”. This latter is visibly more raised in Pop. 2, reaching 1.45 mm. whereas in Pop.1, it's only 1.05 mm. Nevertheless, in both populations, the protoconch has an average of 2.55 whorls and it is 1.75 mm. wide. The spire “s” is very different in the two populations: in Pop. 1, it is low conical; in Pop. 2 it is high concave. Completely similar in the two populations are both the filament channel (fc), open all of its length, and the callus. This latter is of a light color and weakly developed, occupying about two thirds of each whorl on the spire. The callus doesn't exceed the aperture of the posterior channel. Also, the fasciole (K) shows the same characteristics in both populations. In fact, it has the same design of the body whorl, but in a more marked way, with a blotch (w) without pattern in its central part. Both populations have a columella (x) with three columellar plications, rarely four, of a light color. The inner lip (y) is smooth, without parietal plications in both of these populations.

In plate 4 a juvenile specimen (J) of about 25 mm. and an adult of over 45 mm. are compared for the purpose of observing how the shell changes during growth. We can particularly take note that: 1) During growth the posterior notch (pn) turns back more in Pop.1. 2) The form of the anterior notch (an) is different in the two populations, but in both it doesn't change during growth. 3) In Pop. 2, growth is isometric.



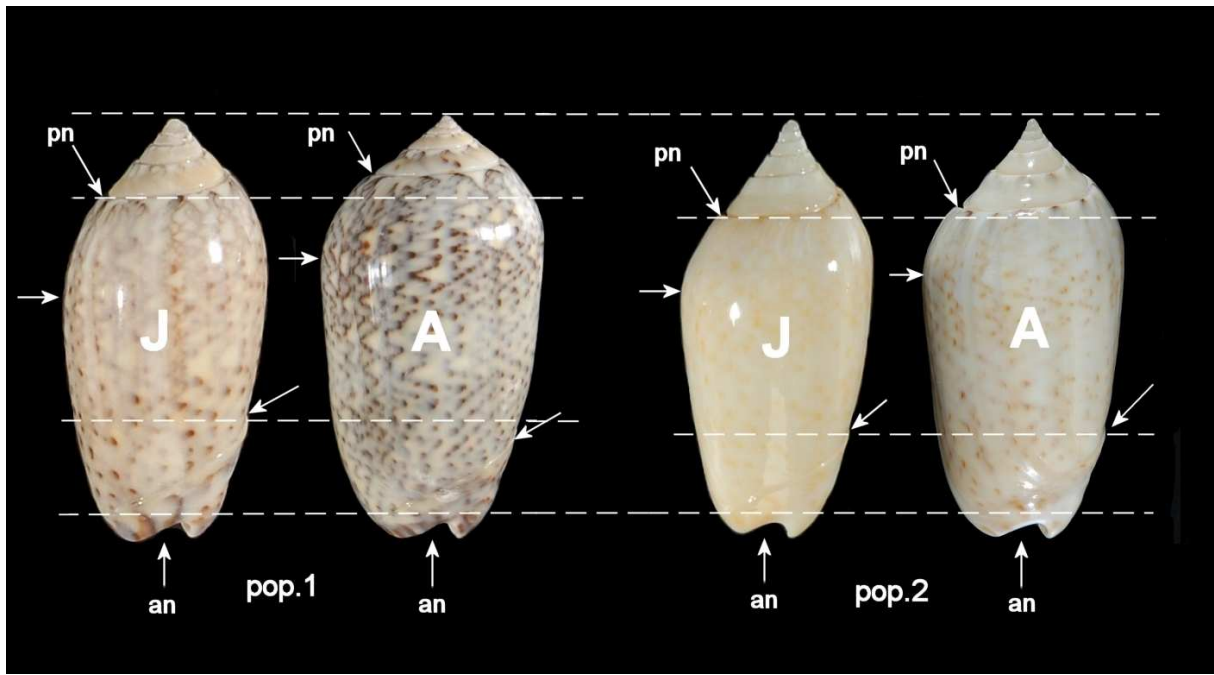


Plate 4. *Oliva spicata* (Röding, 1798). Comparative plate, “J” juvenile specimen, “A” adult specimen, “an” anterior notch, “pn” posterior notch.

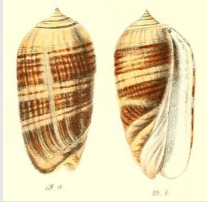
### **Iconography**

In the following plates some specimens of *Oliva spicata* coming from the 18 different stations of the Cortezan Subprovince are shown. The synoptic plate (plate 6) gives us an immediate idea of the distribution of the various forms, that is to say, the intraspecific variability of this species. It's also interesting to note that some adjacent populations show a striking resemblance, like those of Punta Chivato, Bahia de Santa Ines, Bahia Concepcion and Isla Coronado.



Fig.4 The beach and Isla El Requeson are connected by a thin strip of sand. Bahia Concepcion, Baja California Sur, Mexico.

The *violacea*, *venulata* and *rejecta* forms form true populations, while the *cumingii* form is an exception. The drawn back shoulder and particularly low spire, as well as some darker transversal bands, are elements that appear in single individuals within each population. When all three of these characteristics are present in an individual, especially if it has a light background, we have the *cumingii* form. In other words, populations in which all the individuals present the typical morphology and coloring of the *cumingii* form don't exist.



*Oliva cumingii* Reeve, 1850: Pl. 11 figs. 19a-b. Original description:  
 "Shell cylindrically oblong, swollen posteriorly, rounded, spire short, apex rather exerted, sharp, columellar plaits flattened, almost concealed, columella swollen at the base; orange-saffron colour, variously banded with unspotted chestnut and blackish-brown, base of the columella faintly tinged with livid-purple, interior of the aperture bluish-white." Recent. Gulf of California.

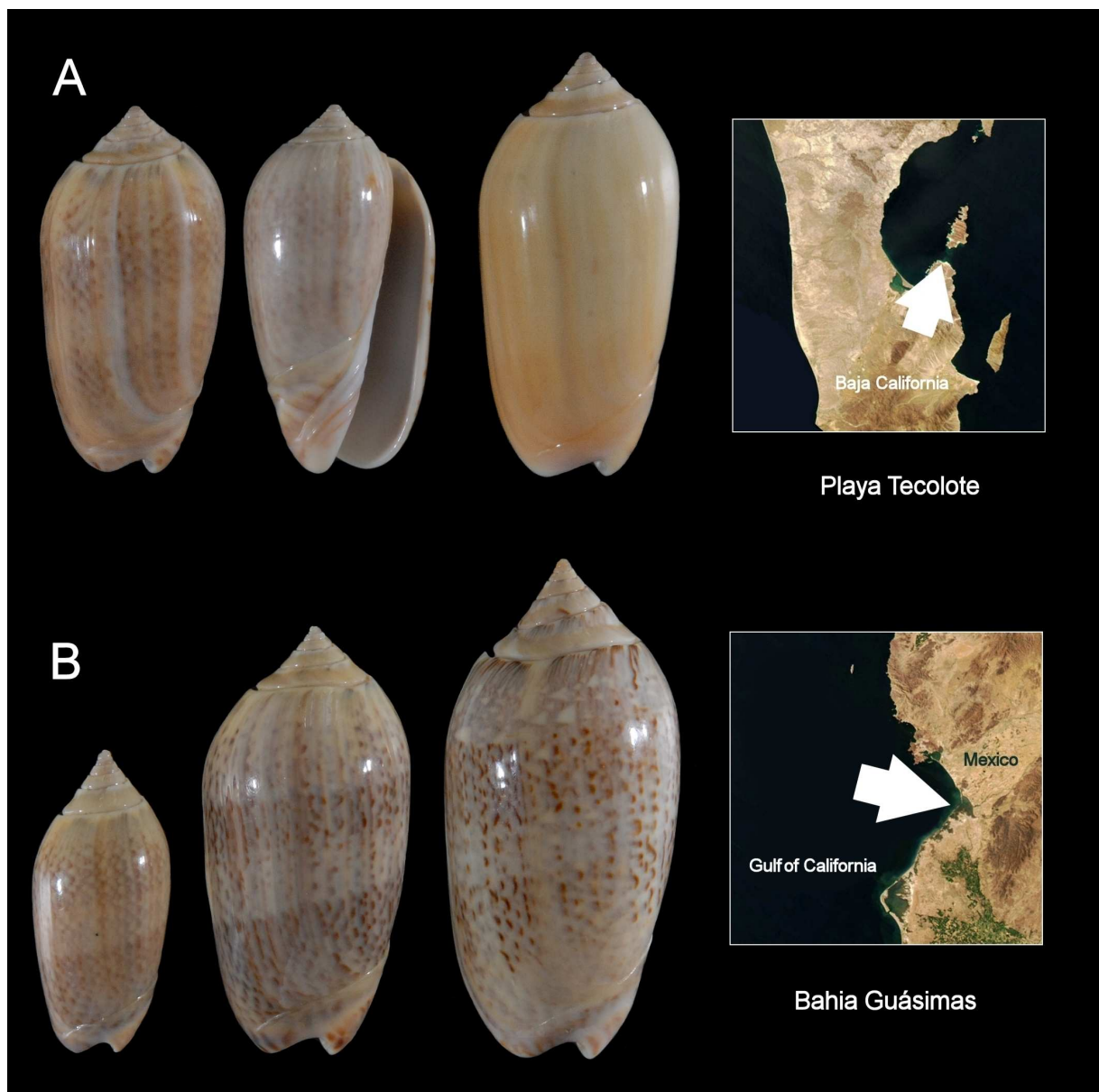


Plate 5. *Oliva spicata* (Röding, 1798). A) Size 37.40mm and 43.60mm collected by Perini & Staley in October 2000 at Playa Tecolote, Canal de San Lorenzo. B) Size 31.20mm, 43.70mm and 51.00 collected by G.Lawson in May 1985 at Bahia Guásimas, South Guaymas.



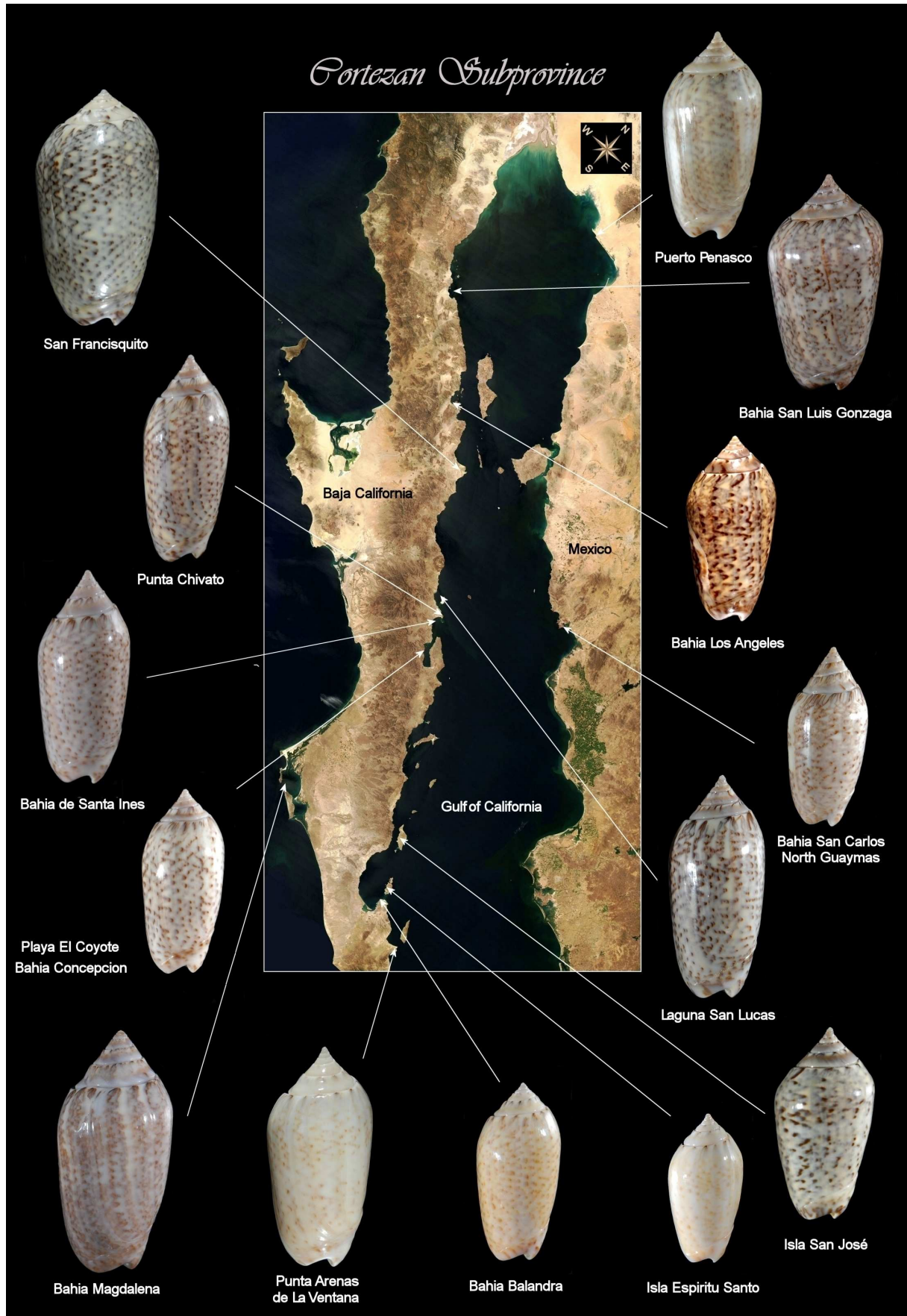


Plate 6. *Oliva spicata* (Röding, 1798). Synoptic plate showing some geographic forms in the Cortezan Subprovince.



**Plate 7.**

On this map are marked the 18 investigated places in the Cortezan Subprovince. The specimens of *Oliva spicata* showed in the plates 5 and 8-13 were found in following localities:

**Plate 5**

- A) Playa Tecolote, Canal de San Lorenzo
- B) Bahía Guásimas, South Guaymas

**Plate 8**

- 1) Puerto Penasco
- 2) Punta Arena
- 3) Bahía San Luis Gonzaga

**Plate 9**

- 4) Bahía de Los Angeles
- 5) San Francisquito
- 6) Bahía San Carlos, North Guaymas

**Plate 10**

- 7) Laguna San Lucas
- 8) Punta Chivato
- 9) Bahía de Santa Ines

**Plate 11**

- 10) Playa El Coyote, Bahía Concepcion
- 11) Isla El Requeson, Bahía Concepcion
- 12) Playa de Loreto

**Plate 12**

- 13) Isla Coronado
- 14) Isla San José
- 15) Bahía Magdalena

**Plate 13**

- 16) Isla Espiritu Santo
- 17) Bahía Balandra
- 18) Punta Arenas de La Ventana



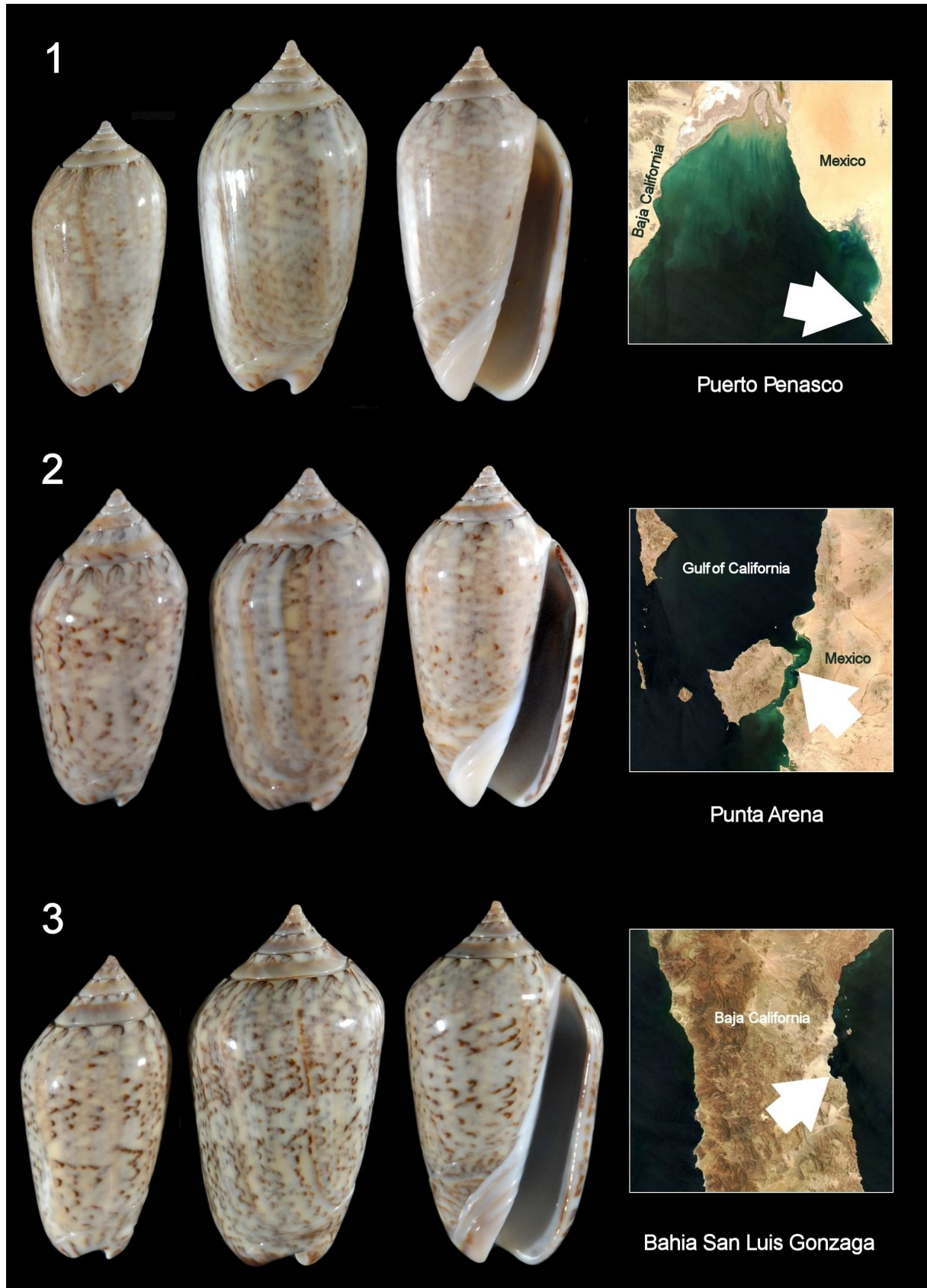


Plate 8. *Oliva spicata* (Röding, 1798). 1) Size 33.70mm and 43.15mm, collected by C.Brown in June 1999 at Choya Bay, Puerto Penasco. 2) Size 38.60mm and 41.80mm, collected by G.Lawson in May 1985 at Punta Arena, sonora. 3) Size 37.45mm and 44.50mm, collected by J.Jackson in June 1988, at South-East of the bay of Bahia San Luis Gonzaga.

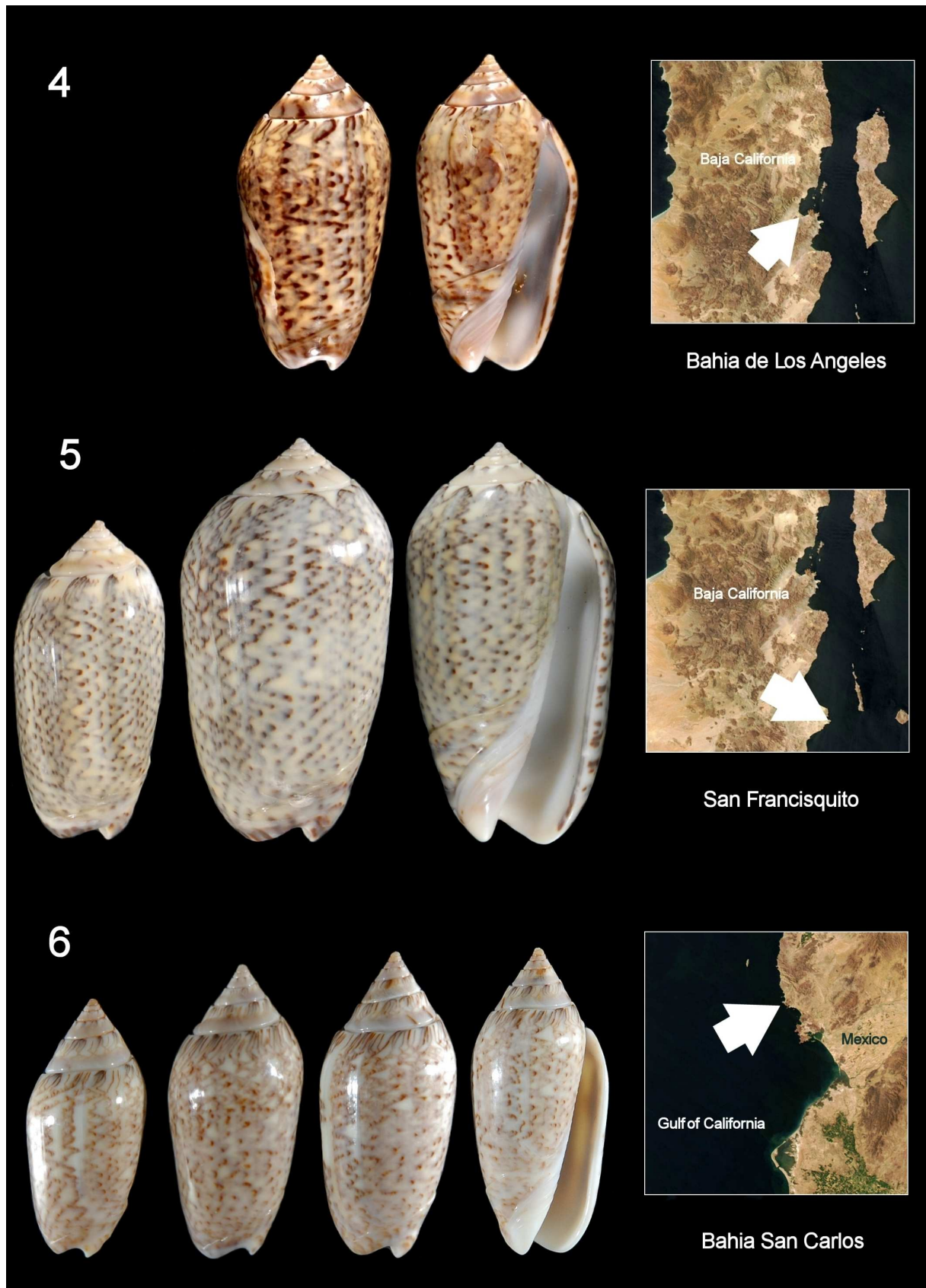


Plate 9. *Oliva spicata* (Röding, 1798). 4) Size 39.16mm, collected by A.Staley in March 2001, off Bahia de Los Angeles. 5) Size 37.25mm and 49.90mm, collected by G.Lawson in May 1995, off San Francisquito beach. 6) Size 31.85mm, 36.40mm and 37.35mm collected by Jim Cordy in June 1972 at Bahia San Carlos, North Guaymas.



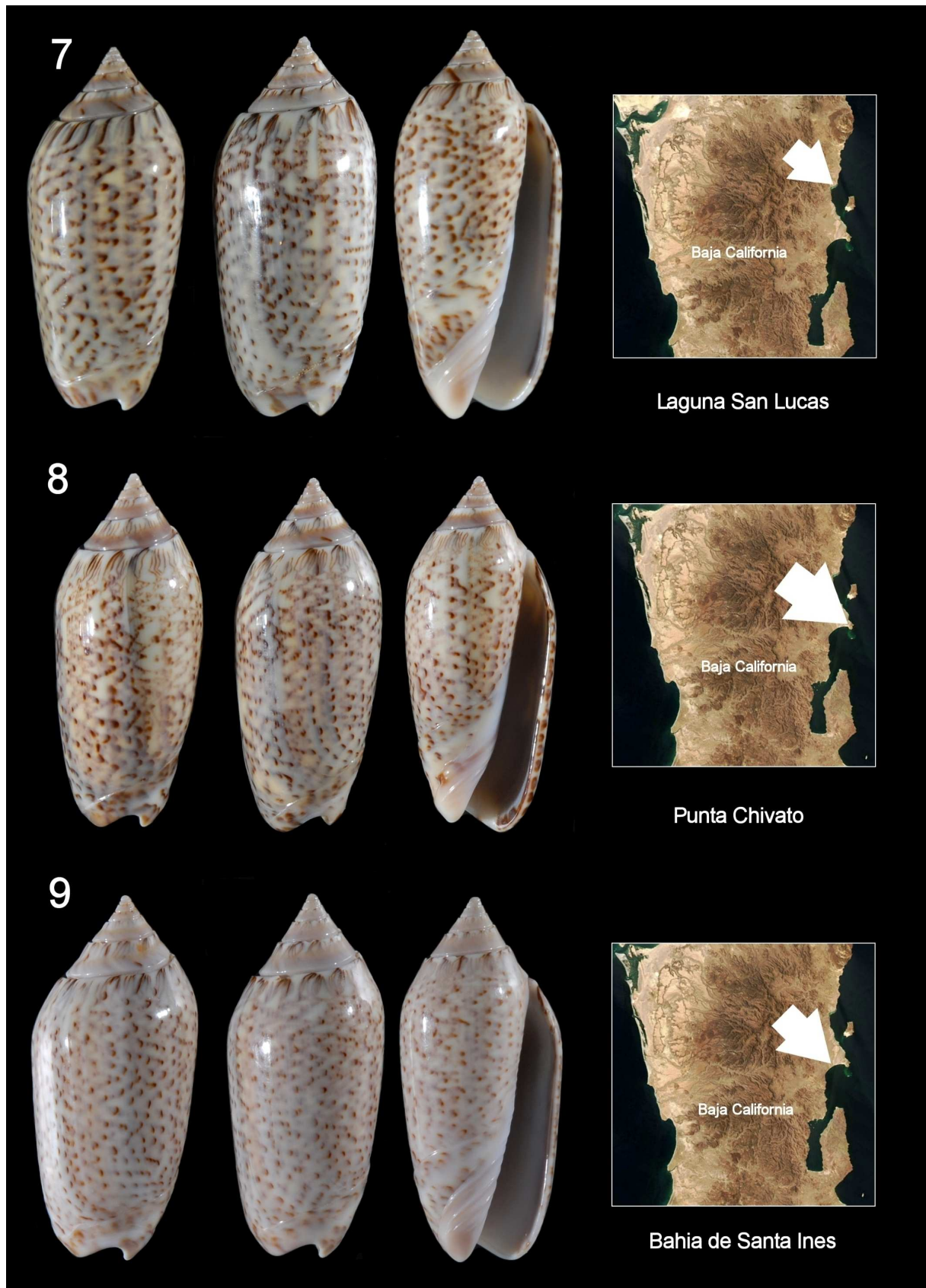


Plate 10. *Oliva spicata* (Röding, 1798). 7) Size 44.50mm and 47.00mm, collected by R. Rupert in 1997 and 1998 inside the Laguna San Lucas. 8) Size 43.70mm and 41.20mm, collected by J.Jackson in November 1989 off Punta Chivato. 9) Size 45.95mm and 46.10mm, collected by Perini & Staley in October 1998 in the southern part of Bahia de Santa Ines.

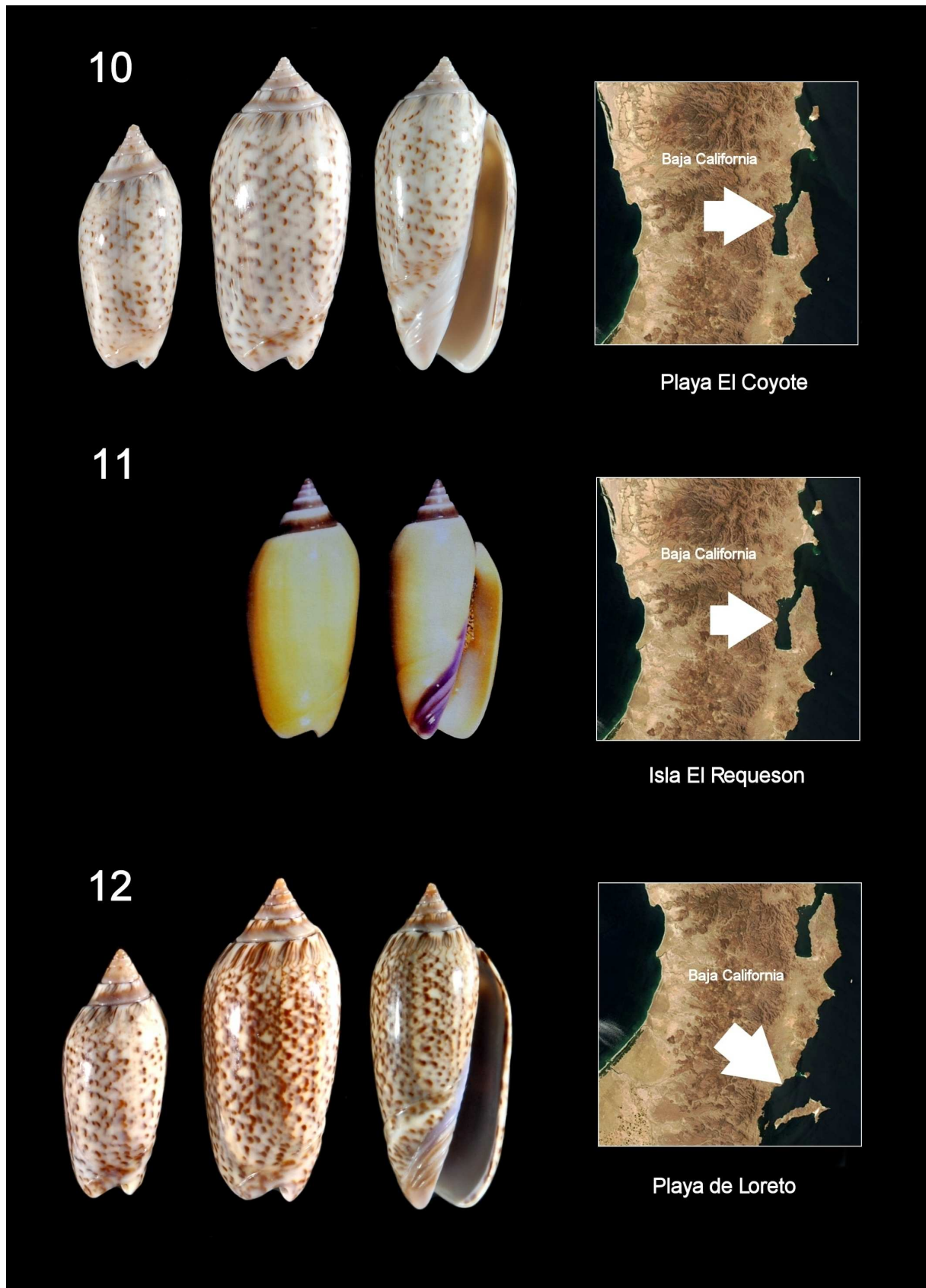


Plate 11. *Oliva spicata* (Röding, 1798). 10) Size 30.00mm and 38.65mm collected by Perini & Staley in October 1997 at Playa El Coyote, Bahía Concepción. 11) This is the one and only known specimen showing this coloration. Size 33.50mm, collected by J.Jackson in October 1989 near Isla El Requeson, Bahía Concepción (Courtesy **THE FESTIVUS**, 1991. Vol.XXIII, No.4, figs. 3-4). 12) Size 30.70mm, 40.00mm and 39.70mm, collected by Perini & Staley in October 1997 at Playa de Loreto.



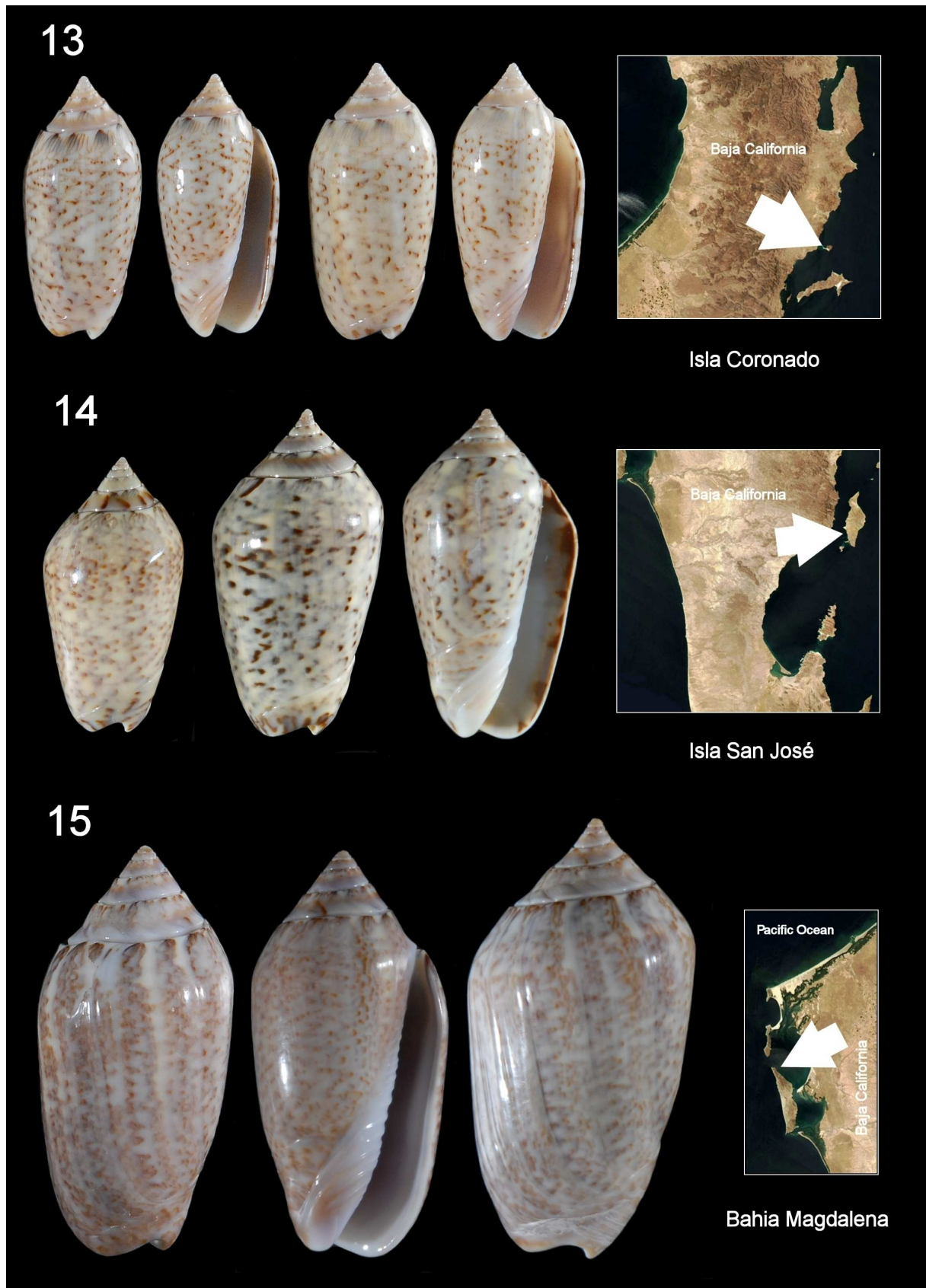


Plate 12. *Oliva spicata* (Röding, 1798). 13) Size 31.75mm and 33.80mm, collected by Perini & Staley in October 1998 at Isla Coronado, North Loreto. 14) Size 29.33mm and 39.90mm, collected by J.Jackson in June 1976 on South-West tip of Isla San José. 15) Size 49.20mm and 53.30mm collected by J.Jackson in December 1997 inside the main entrance of the Bahia Magdalena.

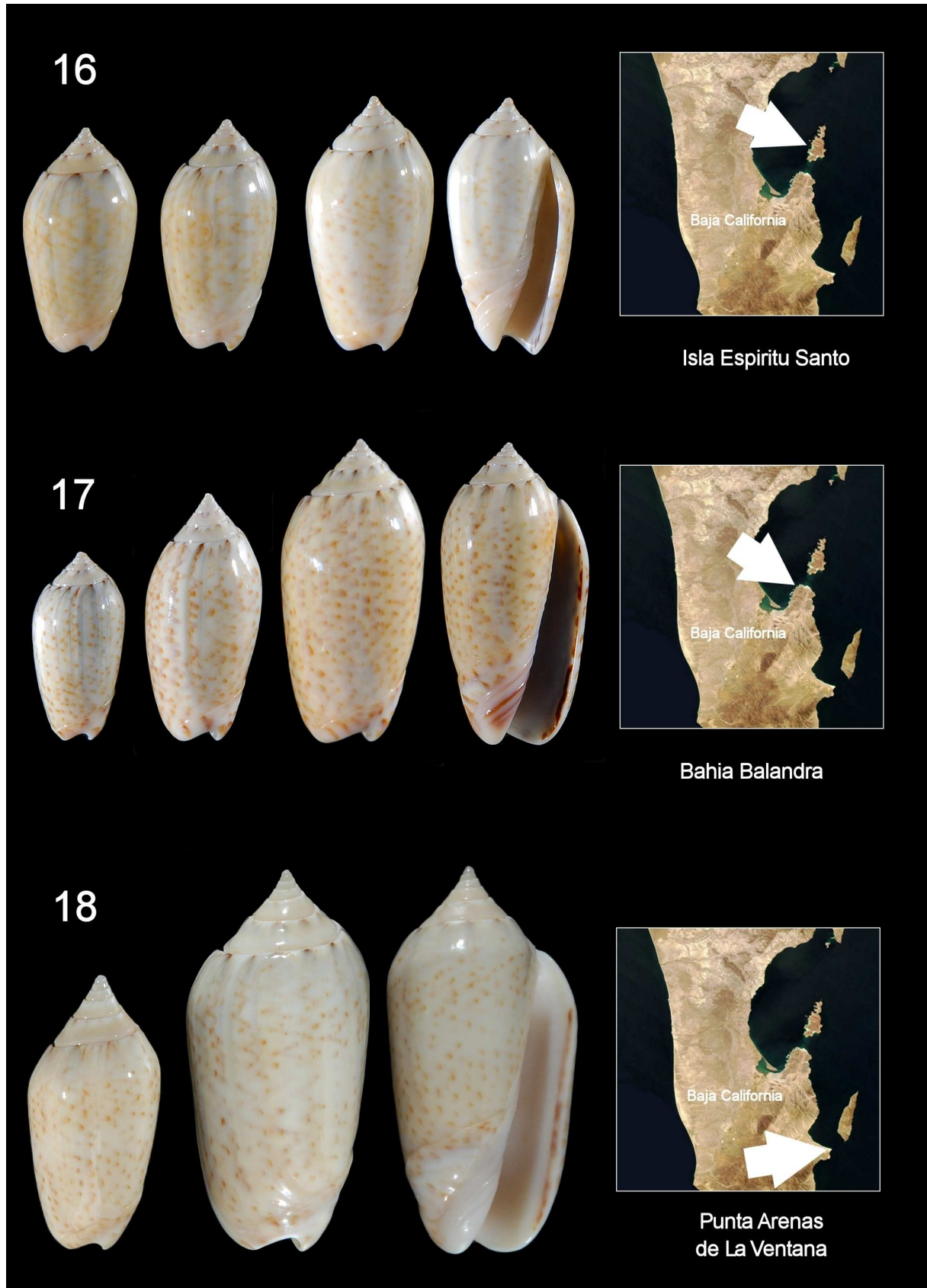


Plate 13. *Oliva spicata* (Röding, 1798). 16) Size 26.60mm, 27.85mm and 29.30mm, collected by Perini & Staley in October 1998 at Bahia San Gabriel, Isla Espiritu Santo. 17) Size 22.80mm, 26.25mm and 30.50mm, collected by Perini & Staley in October 1998 at Bahia Balandra, North-East of La Paz. 18) Size 31.55mm and 45.78mm collected by G.Lawson in April 1987 off Punta Arenas de La Ventana, South of Bahia de La Ventana.

**Habitat and Remarks**

In the localities explored, *Oliva spicata* has shown to prefer bottoms made up of low grit sand and without rocks and seagrass. No specimens were found on muddy bottoms or those of coral sand, even though it must be said that in the Gulf of California, this type of bottom is rather rare. The color of the shell seems to be in relation to the color of the substratum. In the bays that are particularly protected, *Oliva spicata* is present in the intertidal zone, whereas in more exposed localities it's been found in the subtidal zone up to 10 meters deep. It's not rare to see their habitat shared with other species of olives, as found in Bahia Santa Ines. There, besides *Oliva spicata*, also *Oliva incrassata* (Lightfoot in Solander, 1786), *Oliva polpasta* (Duclos, 1833) and *Oliva porphyria* (Linnaeus, 1758) were present. Lastly, it's worth notice that the bigger specimens were found at greater depths. Whether this depends on over-collecting in the intertidal zones, or on biological reasons, is unknown.

In the following chart the data relating to the collection of specimens:

	<b>1. Puerto Penasco.</b> Live specimens buried in light sand on exposed tidal flats in low intertidal zone.		<b>10. Bahia Concepcion.</b> Collected alive by snorkeling at 1-3 meters depth in light sand. Off Playa El Coyote.
	<b>2. Punta Arena.</b> Active specimens in day time found in sand at about 1 meter depth.		<b>11. Bahia Concepcion.</b> Collected alive near the shore in white sand, in the morning. Area Isla El Requeson.
	<b>3. Bahia San Luis Gonzaga.</b> Collected at low tide in sand at South-East end of bay.		<b>12. Playa de Loreto.</b> Collected alive by snorkeling at 1-3 meters depth in grey sand.
	<b>4. Bahia de Los Angeles.</b> Collected alive and active (day light) in sand, off North side of the bay.		<b>13. Isla Coronado.</b> Collected alive by snorkeling at 1-3 meters depth in almost white sand.
	<b>5. San Francisquito.</b> Collected by diving at 8-10 meters depth on grey sand		<b>14. Isla San José.</b> Intertidal zone, in sand on flats. Near mouth of lagoon channel on South-West tip of Isla.
	<b>6. Bahia de San Carlos.</b> Live taken on light sand bars at low tide.		<b>15. Bahia Magdalena.</b> Collected at 10 meters depth on gray sand. Inside main entrance of the bay.
	<b>7. Laguna San Lucas.</b> Collected by snorkeling at 2-3 meters in light sand. Active after sunset.		<b>16. Isla Espiritu Santo, Bahia San Gabriel.</b> Specimens collected in the morning at 1-2 meters depth buried in white sand.
	<b>8. Punta Chivato.</b> Collected at 7 meters depth in light sand. Off beach, 1/2 mile West of Point.		<b>17. Bahia Balandra.</b> Active specimens collected in the late afternoon in low water on light sand.
	<b>9. Bahia de Santa Ines.</b> By snorkeling at 2-3 meters depth, in clear and light sand. Active after the sunset.		<b>18. Punta Arenas de La Ventana.</b> By diving at 6-8 meters depth in white sand. Mostly specimens were active, some buried. Off the beach.

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