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A new species of antipatharian coral (Cnidaria: Anthozoa: Antipatharia) from the southern California Bight

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Abstract

A new species of antipatharian coral (Anthozoa: Antipatharia) is described from the southern California Bight. The species, *Antipathes dendrochristos* **new species,** forms large, multi-branched, bushy colonies that can reach a height of 2 m or more. The species is characterized by having small branchlets arranged primarily bilaterally and alternately, but in varying degrees of regularity; by small conical spines less than 0.1 mm tall, and by small polyps usually less than 1.4 mm in transverse diameter. The species occurs in colors of white, orange/gold, pinkish-orange, pink, red, and red-brown.

Key words: Coelenterata, Cnidaria, Anthozoa, Antipatharia, Antipathidae, *Antipathes dendrochristos*, new species, eastern Pacific, United States

Introduction

In late 2002 during a series of submersible surveys of rock fish populations on offshore banks in the southern California Bight, scientists from the National Oceanic and Atmospheric Administration (NOAA Fisheries), and the Univerity of California at Santa Barbara discovered a population of large antipatharian colonies (Fig. 1A), many over 2 meters tall, growing at depths of 100–225 meters. After examining samples of several of the colonies and comparing them to type material of other nominal species, as well as to species descriptions in the literature, it was determined that the California specimens represented at least one, and possibly two, undescribed species. These newly discovered corals occur in various colors ranging from white to orange/gold, pinkish-orange, pink, red, and red-brown. In this paper the new species is described on the basis of colonies that were white in color when alive.

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ANTIPATHARIA
ANTIPATHIDAE Ehrenberg, 1834

The order Antipatharia has been the subject of an ongoing taxonomic revision (see Opresko 2001, 2002, 2003a, 2004). Several new families and subfamilies have been established, and one of the characters that is providing valuable insight into the taxonomic relationships within the order is the morphology of the living polyps, i.e., the size and proportional dimensions along the transverse and sagittal axes, as well as the size and shape of the tentacles. Information on these parameters has only rarely been available for earlier described species. Many species and genera were established solely on the basis of skeletal characters, and even in cases where polyps were present, because of contraction of the soft tissue, their appearance may have been altered after preservation. With the increased use of submersibles and remotely operated vehicles (ROVs) for collecting and filming, it has become more and more common for black corals to be observed *in situ* and also collected alive, thus providing valuable opportunites to record the morphology of the living polyps. As more information on living species is documented, the natural affinities within the order will hopefully become clearer.

As a result of the above mentioned revisions, many species and even several genera previously included within the family Antipathidae have now been re-assigned. Consequently, the family has, by default, undergone considerable modification and condensation. Further work is still needed to clearly define the limits of the family and to establish valid generic level taxa.

Antipathes Pallas, 1766

Diagnosis. Corallum sparsely to densely branched; bushy or flabellate; rarely monopodial. Branchlets of varying length; arranged irregularly, or bilaterally; rarely pinnulate. Spines usually triangular to conical in lateral view, smooth or papillose; often laterally compressed; sometimes with knobs or multiple forking at the apex. Polyps from about 1 to 3 mm in transverse diameter, sometimes longer along the sagittal axis than along the tranverse axis.

Type species. *Antipathes dichotoma* Pallas,1766.

Type material. A neotype has recently been established for *Antipathes dichotoma* (see Opresko 2003b). The type species is characterized by having relatively large polyps (up to 2 mm in transverse diameter), a rather sparsely and irregularly branched corallum, and large, smooth spines.

Remarks. Although many species formerly referred to *Antipathes* have now been reassigned to other genera in two newly established families (Myriopathidae and Aphanipathidae), the genus still contains species of very diverse morphology. It is likely that with further taxonomic revisions species in this genus will be recategorized, primarily on the

basis of the morphology of the polyps and on the growth form of the corallum, and, it is quite possible that some species now assigned to *Antipathes* may be removed from the family.

Antipathes dendrochristos new species

Holotype. USNM 1026793, in the southern California Bight, 33º57.914'N, 119º29.579'W, 96 m, Delta Dive 6147, 13 October 2003, coll. M. Love.

Other Material. Paratype (USNM 1026794), in the southern California Bight, 33º57.894'N, 119º29.343'W, 120 m, Delta Dive 6145, 13 October 2003, coll. M. Love; USNM 1070773, Pilgrim Bank, 33º42.33'N, 119º08.22'W, 200 m, Delta Dive 5848, 30 October 2002, coll. T. Laidig; USNM 1070774, Kidney Bank, 33º40.34'N, 119º11.17'W, 200 m, Delta Dive 5850, 31 October 2002, coll. M. Love; USNM 1070775 Anacapa Id., 33º57'N, 119º29'W, 110 m, Delta Dive 5877, 5 November 2002, coll. L. Wooninck.

Diagnosis. Multibranched, bushy colonies reaching a size of 2 m or more (Fig. 1A), with long plumose fronds. Branches and branchlets free and not anastomosing. Highest order branchlets usually less than 1 cm long and inclined distally; tending to be arranged bilaterally and alternately, five to six per centimeter, but not strictly uniform in orientation. A small number of additional branchlets coming off at various angles to the lateral branchlets. Spines small, conical, smooth, mostly 0.07–0.09 mm in height, with a rounded apex. Polyps usually 1 mm to 1.4 mm in transverse diameter (Fig. 1B), with relatively short, blunt tentacles. Color of living colonies white, gold/orange, pinkish-orange, pink, red, or reddish-brown.

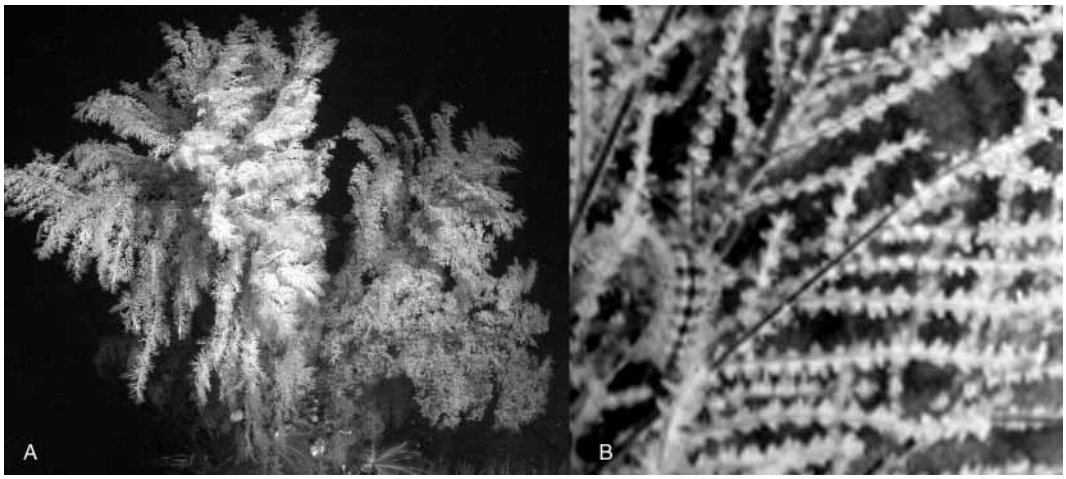

FIGURE 1. *Antipathes dendrochristos* n. sp.: A, *in situ* photo of white-colored variant, Delta Dive 5851, 122 m, southern California Bight; B, close-up view of polyps of pinkish-orange color form, Delta Dive 6145, 120 m.

Description of the holotype. The specimen selected as the holotype was white in color when alive. It is in two pieces (the larger part is shown in Fig. 2A), and the combined estimated height is 51 cm. The width is about 75 cm, and the diameter of the stem near its basal end is about 5.4 mm. The corallum is branched to the seventh order. Several main branches are 50 cm or more in length and about 4.8 mm in diameter at their basal end. Branches arise irregularly at various points along the stem and lower order branches, extend out on all sides, and are generally directed distally relative to the lower order branches from which they arise.

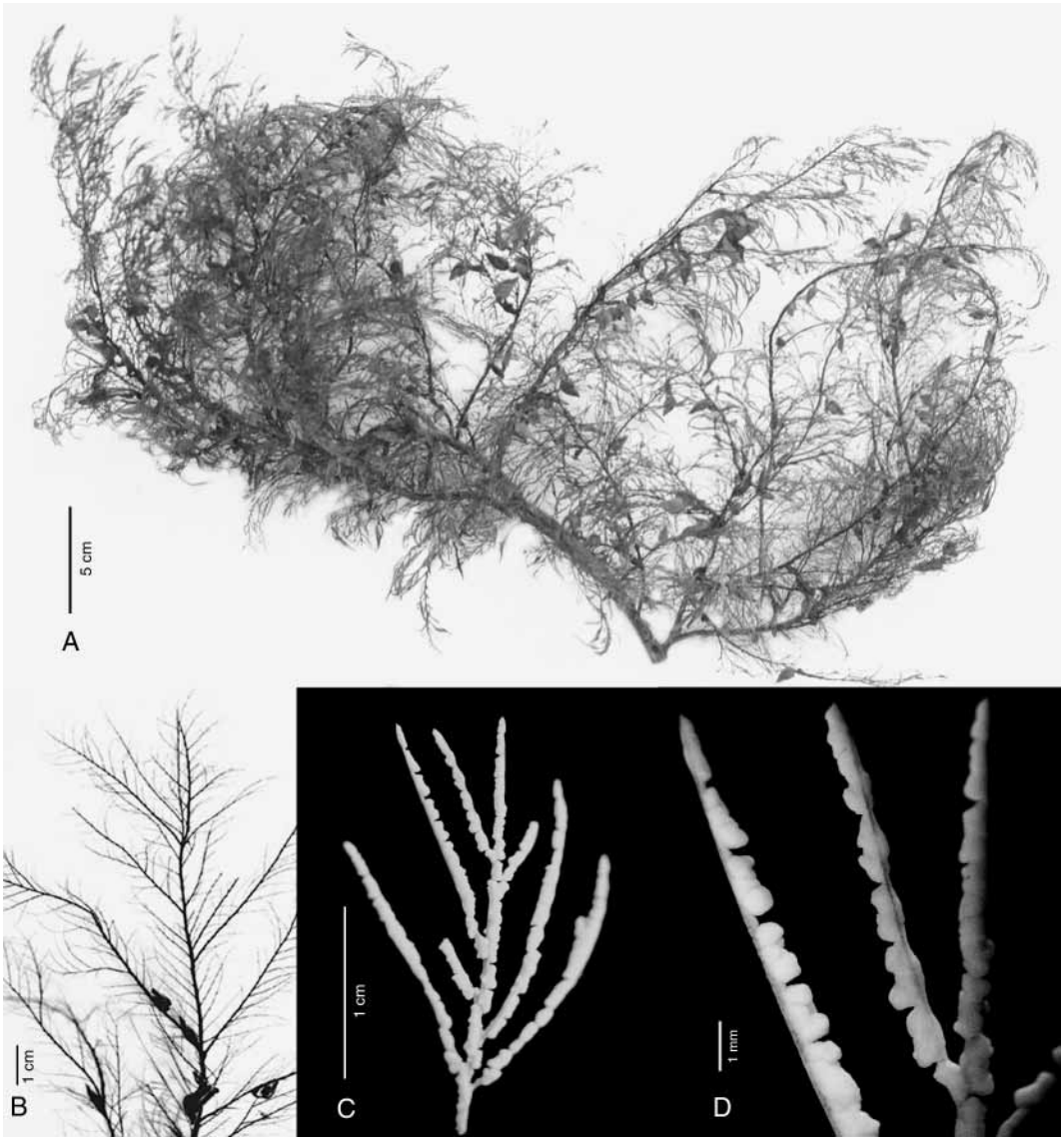

FIGURE 2. *Antipathes dendrochristos* n. sp., holotype (USNM 1026793): A, larger part of corallum; B, close-up view of branches with branchlets; C, branches with polyps; D close-up view of polyps.

Many of the terminal branchlets are arranged bilaterally and in an alternate pattern of varying regularity (Fig. 2B). Branchlets also occur randomly on the front and back sides of the branches. These additional branchlets develop at various positions relative to the lateral branchlets; in places, they are at right angles to the plane containing the two lateral rows and sometimes confined to only one side of the branch, thus giving the appearance of three rows of branchlets.

Terminal branchlets without sub-branches are mostly 0.5–0.7 cm in length; a few are up to about 1.5 cm long. Most branchlets greater than 1 cm usually have one or more sub-branchlets. The branchlets are directed distally, with the distal angle commonly about 45º. The interior angle formed by the two lateral rows is frequently near 180º, but varies from less than 90º to greater than 180º. The orientation of the plane containing the lateral branchlets can vary in position on different parts of the same branch, and from branch to branch. The lateral branchlets are 2–5 mm apart, with 3–4 branchlets per centimeter on each side and generally 5–6 per centimeter for both rows (up to 7–8 per centimeter in places where branchlets also are present on the front or back of the axis).

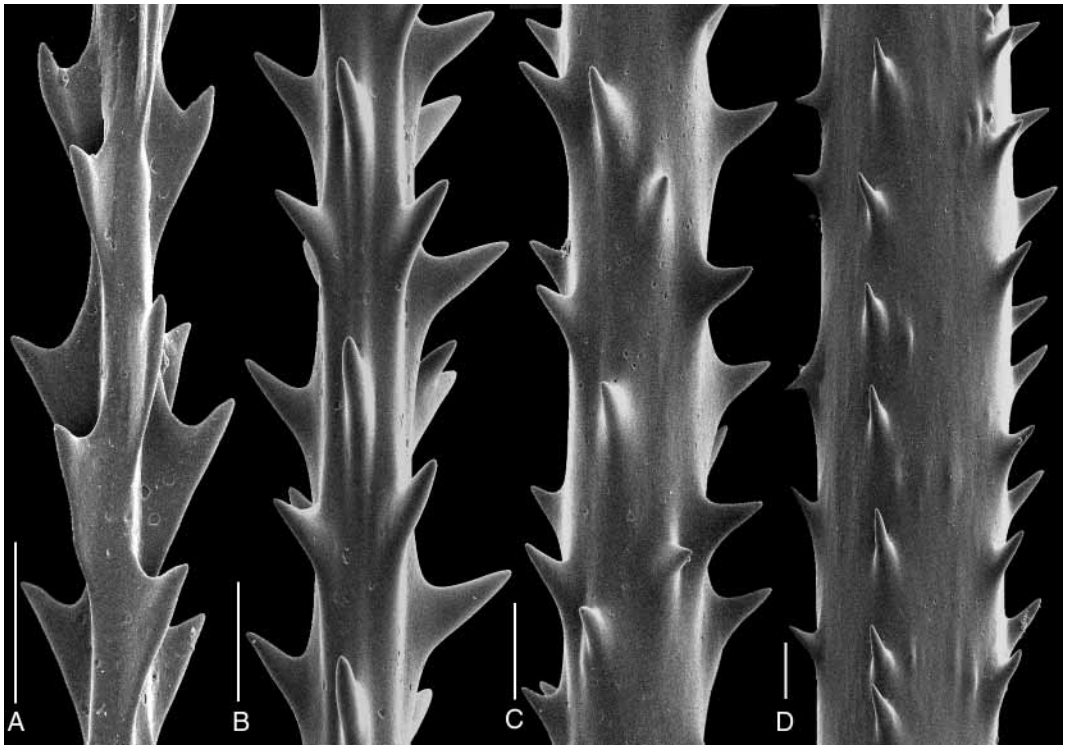

FIGURE 3. *Antipathes dendrochristos* n. sp., holotype (USNM 1026793): A–D, spines on branchlets and branches. Scale bars 0.1 mm.

The spines are conical, smooth, with a narrow, but slightly rounded apex (Figs 3A–D). They are usually inclined distally, but some individual spines may slant downward

towards the base of the branchlet. The spines range in size from about 0.07 mm to 0.09 mm (as measured from the tip to the center of the base). The polypar spines are slightly larger than the abpolypar spines, and they tend to be directed more horizontally than the abpolypar spines. Spines near the tips of the branchlets often have the appearance of being strongly inclined distally, with a flared base (Fig. 3A). Four to six rows of spines are visible in lateral view (excluding rows in which the spines are only partially visible), and within each row the spines are spaced mostly 0.21–0.27 mm apart (range 0.19–0.30 mm). The spines on the larger branches are similar in size and density to those on the smaller branchlets but appear more acicular (Fig. 3D). The spines on the stem are similar to those on the larger branches.

The polyps (Figs 2C–D) are 1–1.4 mm in transverse diameter. On the branchlets they are arranged uniserially, with seven to nine per centimeter along the axis. The polyps do not have the same orientation from branchlet to branchlet; therefore, the corallum, as a whole, does not have a polypar and abpolypar side. Small polyps are sometimes interspersed between the larger ones. In the preserved material the polyp tentacles are short and have a blunt, rounded apex. On the larger branches the polyps are not arranged as uniserially as those on the branchlets, and some occur on opposite sides of the axis.

Description of pinkish-orange color variant. As noted above, this species occurs in color forms other than white. A specimen (USNM 1026794) reported to have a pinkish-orange color when alive will be described here in detail for comparison with the white holotype. The corallum (Fig. 4A) is about 47 cm tall and about 35 cm wide. There are two holdfasts and two stems, both extending to the top of the corallum. Both stems have a basal diameter of about 3.7 mm. The corallum is branched to the fifth order. The largest branch is 30 cm long and about 2.0 mm in basal diameter. Branches tend to form pinnulated fronds 3–4 cm wide, but these may be up to 10 cm across in cases where the branchlets are developed into branches.

As in the white variety, the smallest branchlets of the paratype are arranged primarily bilaterally and alternately (Fig. 4B), the two lateral rows often nearly opposite each other (interior angle close to 180º). The terminal branchlets are up to about 1 cm long before becoming sub-branched. Branchlets that are 0.4–0.6 cm in length are 0.3–0.4 mm in thickness at the base (excluding the spines); those 1 cm long are about 0.8 mm thick, and those 1.6 cm long are about 1.3 mm thick. The branchlets are for the most part directed distally, with the distal angle usually 40-50º. The density of the terminal branchlets is very similar to that of the holotype, with 5–8 per centimeter.

The spines on the branchlets and branches (Figs 5A–D) are very similar in size and shape to those in the holotype; i.e., slightly unequal in size around the circumference of the axis, with those on one side more horizontally directed than those on the opposite side. The height of the spines ranges from about 0.08 mm to 0.11 mm. Four rows of spines are visible in lateral view, and within each row the spines are usually spaced 0.24–0.28 mm apart. The spines are not much larger or more densely arranged on the larger branches

(Fig. 5D). The polyps (Fig. 4C) are 0.9–1.1 mm in transverse diameter, with 9–10 per centimeter along the axis.

Overall, there are no substantial differences in morphology of the corallum, spines and polyps between this pinkish-orange form and the white holotype.

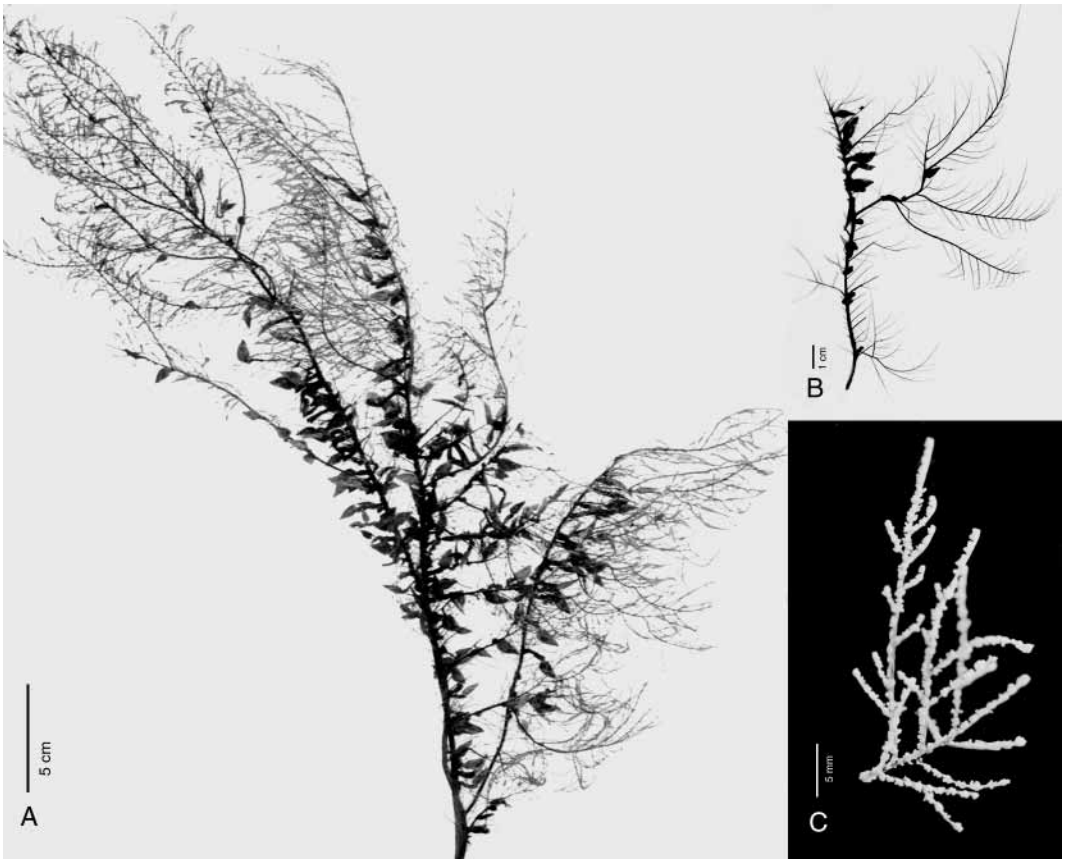

FIGURE 4. *Antipathes dendrochristos* n. sp., pinkish-orange form, paratype (USNM 1026794): A, entire corallum; B, close-up view of branches with branchlets; C, branchlets with polyps.

Remarks. Several other specimens were available for study; one white-colored specimen from Delta Dive 5850; one gold-colored specimen from Delta Dive 5871 and one of the pink variety from Delta Dive 5848. The white and gold specimens are similar to the holotype in the length, thickness, and density of the terminal branchlets, in the size of the spines (mostly 0.08–0.09 mm), and in the size and density of the polyps (about 1.2 mm in transverse diameter, with 8–10 per centimeter). The pink specimen from Delta Dive 5848 is also similar in the size and density of the terminal branchlets and in the size and the density of the spines; however, the polyps were found to be larger than those in the other specimens. The polyps are up to 1.7 mm in transverse diameter with only 6–7 polyps per

centimeter, whereas those in the pinkish-orange paratype from Delta Dive 6145 were no more than 1.1 mm in transverse diameter, with 9–10 polyps per centimeter. Although polyp size in antipatharians can vary somewhat even within a single colony, this character also has been used as a key indicator to differentiate closely related species. The significance of the difference observed here requires further study to determine if it is consistent and can be correlated with other morphological characters.

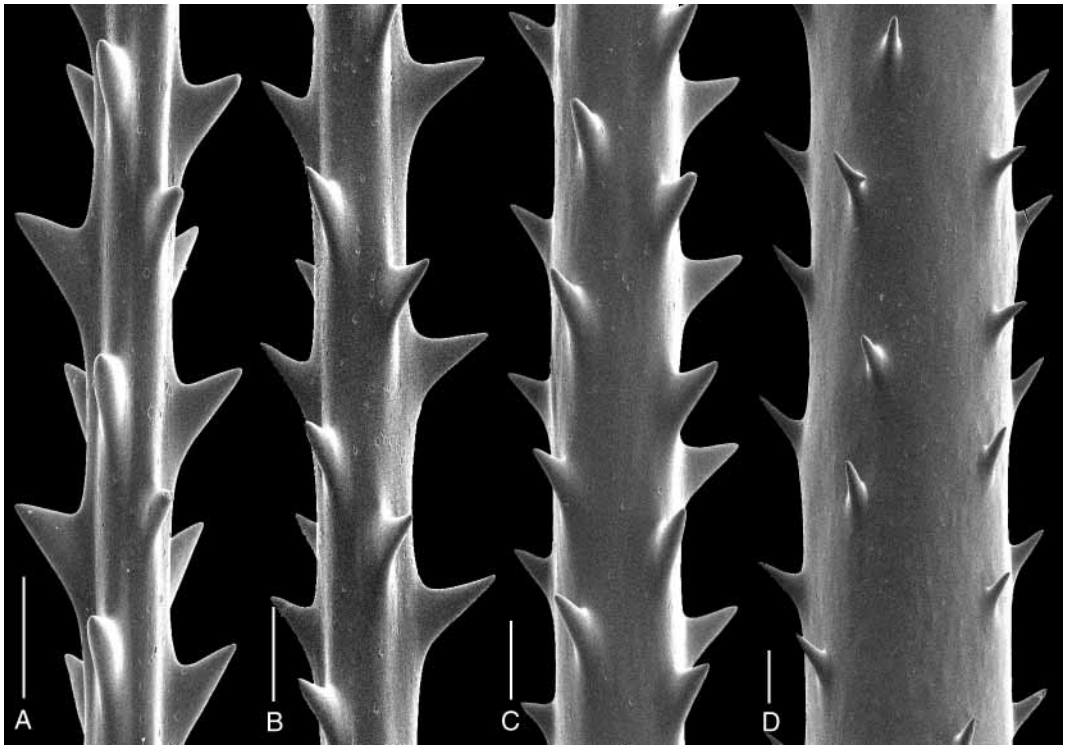

FIGURE 5. *Antipathes dendrochristos* n. sp., pinkish-orange form, paratype (USNM 1026794): A–D, spines on branchlets and branches. Scale bars 0.1 mm.

Comparisons to other species. Based on the general arrangement of the smallest branchlets, on the morphology of the spines and the size of the polyps, the new species resembles several species reported from off the southern tip of South America. These species, originally described by Brook (1889) as *Antipathella speciosa* and *A. minor*, differ, however, from the new species in having a corallum which is flabellate and reticulate with adjacent branchlets fused together to varying degrees. Brook (1889) reported that in *A. minor* the branches and branchlets form long narrow pinnate fronds "rarely more than 2 cm across the pinnae". Based on a reexamination of part of the type specimen, it was determined that the branchlet density in *A. minor* is 7–10 per centimeter, the spines are 0.05–0.1 mm tall, and the polyps are about 1 mm in transverse diameter, with 7–9 polyps per centimeter. In *A. speciosa* the density of the branchlets is 9–11 per centimeter, and the

spines are 0.08–0.1 mm tall. Polyps were not present on the type of *A. speciosa*. Thus, in the size of the spines and polyps these two species are very similar to *A. dendrochristos* n. sp. Differences exist mainly in the growth form of the corallum, and in the density of the terminal branchlets (Fig. 6). In *A. dendrochristos* there are usually no more than 5–6 lateral branchlets per centimeter (excluding the branchlets that sometimes occur on the front and back sides of the axis).

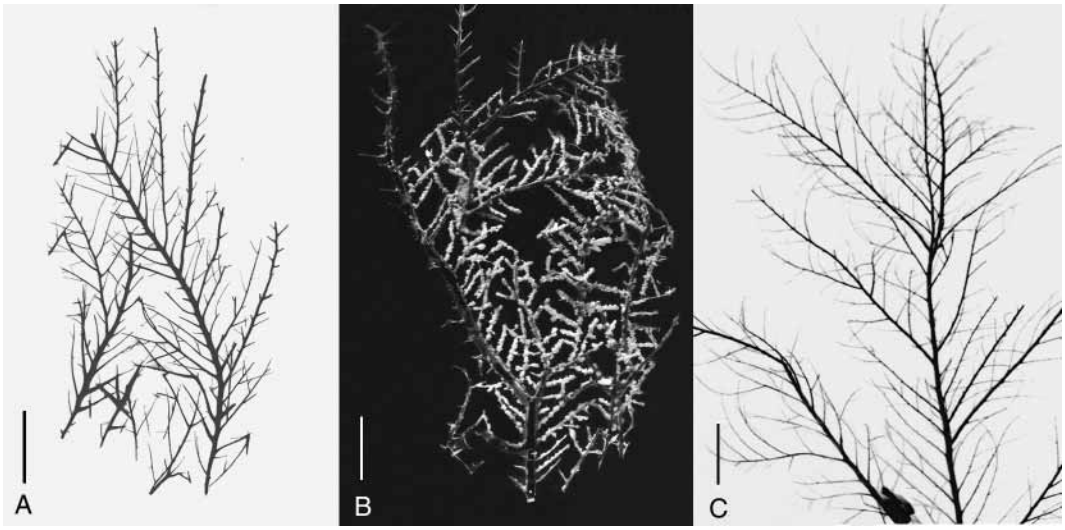

FIGURE 6. *Antipathes* spp.: A, *A. speciosa* Brook, branchlets from schizoholotype (USNM 100358); B, *A. minor* Brook, branches from schizoholotype (USNM 1000383); C, *A. dendrochristos* n. sp., branches from holotype (USNM 1026793). Scale bars 1 cm.

Affinities. Many species of the genus *Antipathes* are characterized by polyps which, when alive and fully expanded, have relatively long, pointed tentacles, often with the sagittal tentacles larger than the laterals and set lower on sides of the polyps. Sometimes this appearance is maintained in specimens preserved in alcohol; however, often the polyps and tentacles become strongly contracted. Photos of living polyps of *A. dendrochristos* (Fig. 1B) suggest that the polyp tentacles are typically short and blunt. The polyps of *A. minor*, although preserved in alcohol, have a similar appearance to those of *A. dendrochristos*. The spines of *A. dendrochristos*, as well as those of *A. speciosa* and *A. minor*, are generally conical whereas the more typical members of the genus *Antipathes* often have spines that are triangular in outline and laterally compressed. These differences are suggestive that *A. dendrochristos* and related species may be taxonomically distinct from the more typical species of the genus. This supposition will be further evaluated by means of molecular techniques in which DNA sequencing of specific genes will be compared across species. This analysis may also shed some light on the significance of the different color morphs of *A. dendrochristos*. Based solely on morphological characters, these color vari-

ants are difficult to distinguish in the laboratory; however, differences in the size of the polyps described above for the pink variant from Delta Dive 5848 may prove to be more than intraspecific variability.

Ethmology. An arbitary combination of letters; an allusion to the popular common name "Christmas tree coral"; used as a noun in apposition; gender feminine.

Distribution. Known only from the type locality and adjacent areas of the southern California Bight.

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