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New records of the deep-sea anemone *Phelliactis callicyclus* Riemann-Zurneck, 1973 (Cnidaria, Actiniaria, Hormathiidae) from the Gulf of California, Mexico

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Abstract

Specimens of a deep-sea anemone were observed in photographs and video footage taken with the Remotely Operated Vehicle JASON (WHOI Deep Submergence Laboratory) in the Gulf of California, Mexico, in May 2008. Comparison of our material with photographs and description of this species available in literature indicate that the sea anemones filmed during the JASON survey are most likely to represent *Phelliactis callicyclus* Riemann-Zurneck, 1973. This species has previously been reported from a locality in the Gulf of California near the present record. During the JASON survey, 28 specimens of *P. callicyclus* were spotted in 27 locations during six dives. The specimens occurred on angular rock outcrops along the escarpments of the transform faults of the Gulf of California, between depths of 993–2543 m and at temperatures ranging from 2.3 to 4.5°C. Based on these new records, *Phelliactis callicyclus* appears to be widely spread in the Gulf of California.

Key words: Deep-sea survey, ROV Jason, *Phelliactis*, eastern Pacific

Introduction

Direct observation of deep-water invertebrate communities has become more frequent using Remotely Operated Vehicles (ROV). Photographs, video footage, and occasional samples collected *in situ* have helped to characterize in detail the habitats at great depths and the communities associated to these habitats (Freiwald *et al.* 2008, Ishibashi *et al.* 2008). When specimens are not available for direct study in the laboratory, the shape, size, and colors of the organisms observed in videos and photographs are sometimes sufficient to provide a positive identification. Identification is further facilitated by the fact that ROV footage is available for unlimited re-examination (Gage & Tyler 1992, Beuchell *et al.* 2010). Correct identification based on video footage or photographs, however, will depend on the skill of the taxonomists involved and on the general knowledge they have of the local fauna.

The genus *Phelliactis* Simon, 1892 is represented by 20 species worldwide (Fautin 2015, 2016). Of these, two have been recorded in the eastern Pacific: *Phelliactis callicyclus* Riemann-Zurneck, 1973, and *P. hydrothermala* Sanamyan & Sanamyan, 2007 (Sanamyan & Sanamyan 2007, Zelnio *et al.* 2009). The former was recently discovered in the Guaymas Bassin during the R/V "Keldish" cruise in the Gulf of California in 2003. On that occasion, photographs were taken and specimens were collected using the MIR-I and MIR-II Russian submersibles (Sanamyan & Sanamyan 2007). In this note we report on a series of additional records of this species for the Gulf of California.

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Material and methods

The project "Caracterización del Fondo Marino en las Cuencas Abisales y Escarpes de Fallas Transformes en el Golfo de California" ["Sea Floor Characterization on the Abyssal Basins and Transform Fault Escarpments of the Gulf of California"] was initiated by CICESE research centre (Ensenada, Mexico) in 2008. This project aimed to take advantage of video footage and still photographs taken by ROV during exploratory dives throughout the Gulf of California, Mexico, at 380–3747 m depths (Hinojosa-Corona 2014). The expedition aimed to explore the boundary of the North American and Pacific tectonic plates in the Gulf of California, to survey and collect rock sample from the deep basins and transform faults connecting them.

Footage was taken by the ROV JASON (see Robert *et al.* 2010), operated from the R/V "Atlantis" during a survey cruise organized by Scripps Institution of Oceanography (SIO) in May 2008. Three video cameras were run continuously and simultaneously during each dive, providing a total of ca 400 hours per camera and 1512 photos (Hinojosa-Corona 2014). Size of the observed specimens was estimated using a scale provided by a pair of collimated laser beams 10 cm apart projected on the background during the dives.

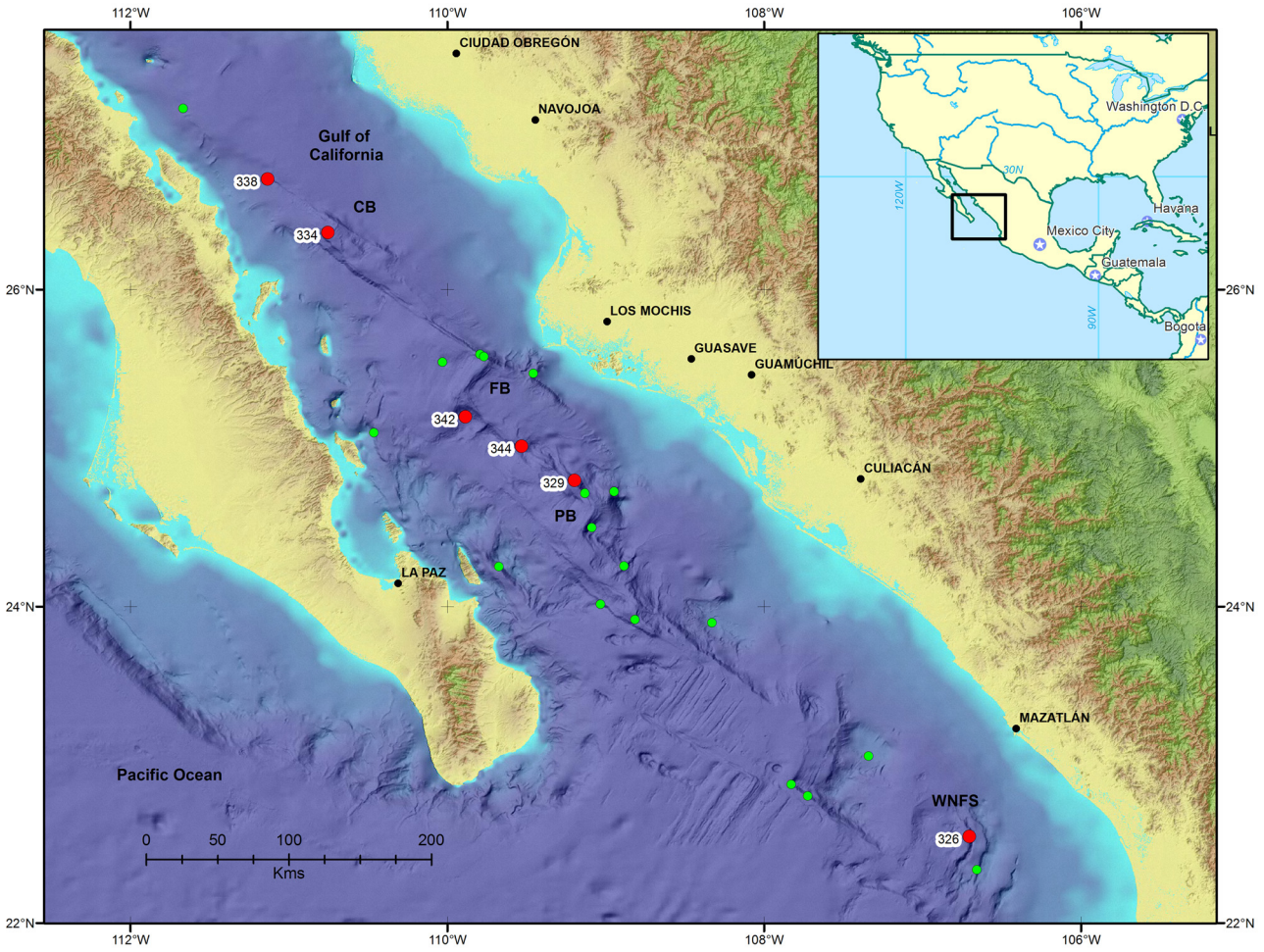

FIGURE 1. Sites (a total of six) in the Gulf of California (red dots) where specimens of *Phelliactis callicyclus* Riemann-Zurneck, 1973, were captured in video or photographs during the ROV JASON dives in May 2008. Green dots correspond to sites where no specimens were detected. PB = Pescadero Basin; FB = Farallon Bassin; CB = Carmen Basin; WNFS, West Nayarit Fault Scarp.

Results

Material examined. Specimens referred herein to *Phelliactis callicyclus* were spotted during six different dives in the central and southern Gulf of California (Figure 1, Table 1). At 26 of the 27 sites, only one specimen was observed; at one site, two specimens were spotted in the same scene (dive J2-326) (Figure 2D). Photographs taken by JASON were compared to the photograph provided by Sanamyan & Sanamyan (2007: figure 4 A) which is reproduced here (see Figure 2 A). Although none of the specimens filmed by JASON were collected, the similarity in shape and color-pattern is striking, as is the relative proximity of the sites where *P. callicyclus* was observed (MIR-I and II: Guaymas Basin, 27°00'N; 111°24'W, at 2000 m depth; JASON: roughly between 22°30'N; 106°40'W and 25°N; 109°30'W, at 993–2544 m depth; see Table 1).

TABLE 1. List of transect-site numbers, positions, depth of dives and water temperatures registered during the JASON ROV survey corresponding to *Phelliactis callicyclus* Riemann-Zurneck, 1973 observations on video sequences in the Gulf of California. Chronological order of observations with UTC time is provided. * Source material is digital photo.

Dive Transect	Latitude	Longitude	Depth	Temp ˚C	UTC Date Time	Specimens	DVD
J2-326-3	22.53646	-106.70491	1225.7	3.9	2008-05-02 09:22:29	1	6
J2-326-3	22.53649	-106.70472	1210.7	3.9	2008-05-02 09:32:59	1	6
J2-326-3	22.53648	-106.70392	1156.6	4.0	2008-05-02 09:54:03	1	6
J2-326-3	22.53649	-106.70384	1150.4	4.0	2008-05-02 09:57:39	1	6
J2-326-3	22.53647	-106.70361	1129.4	4.2	2008-05-02 10:03:40	1	6
J2-326-3	22.53646	-106.70316	1080.1	4.4	2008-05-02 10:37:03	1	6
J2-326-3	22.53646	-106.70310	1074.9	4.4	2008-05-02 10:38:50	2	6
J2-326-3	22.53646	-106.70308	1071.7	4.5	2008-05-02 10:39:57	1	6
J2-326-3	22.53645	-106.70303	1067.2	4.5	2008-05-02 10:40:08	1	6
J2-326-3	22.53643	-106.70292	1061.2	4.5	2008-05-02 11:00:38	1	7
J2-329-1	24.79756	-109.19727	2044.1	2.3	2008-05-05 03:09:25	1	21
J2-334-4	26.31970	-110.77115	2543.4	2.6	2008-05-10 12:18:22	1	60
J2-334-4	26.31876	-110.77202	2526.4	2.6	2008-05-10 12:54:26	1	60
J2-338-1	26.71614	-111.14084	1498.2	3.2	2008-05-14 23:03:44	1	86
J2-338-3	26.66824	-111.11608	1152.4	4.1	2008-05-15 12:13:51	1	92
J2-342-1	25.18855	-109.89625	1028.7	4.5	2008-05-19 00:06:09	1	115*
J2-342-1	25.18869	-109.89623	1022.3	4.5	2008-05-19 00:11:56	1	115*
J2-342-1	25.18903	-109.89640	1005.1	4.5	2008-05-19 00:20:12	1	115*
J2-342-1	25.18983	-109.89650	993.4	4.5	2008-05-19 00:45:27	1	116
J2-342-1	25.19022	-109.89468	1007.5	4.5	2008-05-19 01:06:57	1	116*
J2-342-1	25.19024	-109.89451	1005.6	4.5	2008-05-19 01:08:28	1	116
J2-342-1	25.19067	-109.89250	1025.3	4.4	2008-05-19 01:24:12	1	116
J2-342-1	25.19075	-109.89189	1035.5	4.3	2008-05-19 01:28:32	1	116
J2-342-1	25.19043	-109.87808	1009.4	4.5	2008-05-19 04:05:33	1	117
J2-342-1	25.19093	-109.87781	1004.9	4.5	2008-05-19 04:19:35	1	117*
J2-342-1	25.19111	-109.87769	1007.2	4.5	2008-05-19 04:21:36	1	117*
J2-344-1	25.00704	-109.54107	2179.7	2.3	2008-05-21 02:12:28	1	130

Distinctive external characters for *P. callicyclus* are as follows (adapted from Sanamyan & Sanamyan, 2007): large specimens (oral disk up to 134 mm wide) with cylindrical column of more or less of same diameter throughout its length; oral disk very wide, developed as two unequal lobes; distal part expanded; scapulus short (about 0.2 column length); scapus covered with relatively small, crowed hemispherical tubercles, tubercles smaller and flattened in column proximal half, absent near limbus; cuticular covering of scapus dark (paler on tubercles); scapulus with numerous ridges, each with 1–3 distinct tubercles; tentacles peripheral, thickened at base, about 186, arranged in several cycles.

External morphology and size of the observed specimens agree well with the characters provided above taken from the description provided by Sanamyan & Sanamyan (2007): specimens are large, up to about 180 mm high and 128 mm wide (greatest diameter measured distally), similar in size of the unique specimen recorded by Sanamyan & Sanamyan (2007) (i.e., 186 mm high; 134 mm wide), with a similar proportion between height and width; the column is more or less of the same diameter throughout its length, with at most small tubercles on the column, the distal part is significantly and abruptly expanded; the oral disk is folded into two unequal lobes; position and shape of the tentacles on the oral disk also coincide. Color pattern is also very similar.

The presence of tentacles at periphery of disk distinguish *P. callicyclus* from the other species of *Phelliactis* reported from the eastern Pacific, *P. hydrothermala*. In the latter, tentacles are at outer third of the oral disk. Tentacles in *P. hydrothermala* are almost uniformly cylindrical, vs. thicker at base in *P. callicyclus*. The scapus in *P. hydrothermala* is also rougher, with larger pyramidal tubercles than in *P. callicyclus*; these tubercles are particularly large in the distal portion of the scapus (up to 10% of the specimen larger diameter) (Sanamyan & Sanamyan 2007). Photographs obtained from the JASON dives clearly shows tentacles in a peripheral position (Figure 2 B, E, F), thicker at base (Figure 2 B), and there is no sign of large, pyramidal tubercles on the scapus (Figure 2 D, E).

Habitat. The only specimen previously collected in the Gulf of California was taken at the foot of a hydrothermal construct (Sanamyan & Sanamyan 2007). The specimens observed during the JASON dives (Table 1) occurred at 993–2543 m at 2.3–4.5°C. Specimens were always isolated from other anemones, fixed to rocks which size vary from a few centimeters to several meters. The habitat could be described as steep slopes of angular rocky outcrops. We spotted 27 different sites with observations of which 78% occurred in only two dive locations (Table 1, Figure 1). The dive with most observations was in the Farrallon Basin (FB) (J2-342) with 11 sites, following the West Nayarit fault scarp (WNFS) (J2-326) with 10 sites. On the other four dives, at most two sites per dive were registered.

Observations during dive J2-342 occurred on the first and longest transect (3248 m long), traversing the ridge of two promontory domes at Farallon central seamount, between depths of 1000 and 1042 m and temperatures of 4.3 and 4.5 ˚C. This is a volcanic construct in the middle Gulf of California between the Farallon (FB) and north Pescadero basins (PB) (see Figure 1), a transition between the continental and the oceanic crust. Rock samples collected were sedimentary and volcanic type (Hinojosa-Corona *et al.* 2014). On dive J2-326 observations occurred during the third transect, ascending along the fault scarp in depths of 1061 to 1225 m and temperatures of 3.9–4.5°C. Rock samples collected during this transect were plutonic felsic, mainly granodiorite and granite.

Remarks. *Phelliactis callicyclus* was described by Riemann-Zurneck (1973) from material collected in the SW Atlantic, at 800 and 1220 m depth. While comparing the Guaymas Basin material with the holotype description, Sanamyan & Sanmayan (2007) were not able to find any characters that could separate their specimen from the Atlantic *P. callicyclus*. Although they did not re-examined the type material, they provided a series of characters of internal (e.g., mesenteries) and external (e.g., scapus and scapulus) structures, including the size and distribution of cnidae, and illustrations of the Pacific material.

Distribution. Southwestern Atlantic, 800–1220 m depth; Guaymas Basin (27°N; 111°24’W), Gulf of California, Mexico, 2000 m depth (Sanamyan & Sanamyan 2007). Records of *P. callicyclus* obtained from the JASON dives are from the central and southern Gulf of Californian, between ca 22°30'N (north of Carmen Island) and ca 26°42'N (SW of Mazatlán), in depths of 993–2543 m, thus extending its known distribution to the SE by ca 690 km. Because the bottom water temperature at 2000 m in the Guaymas Basin area is close to 2.5°C (unp. data), the temperature range for *P. callicyclus* in the Gulf of California is 2.3–4.5°C.

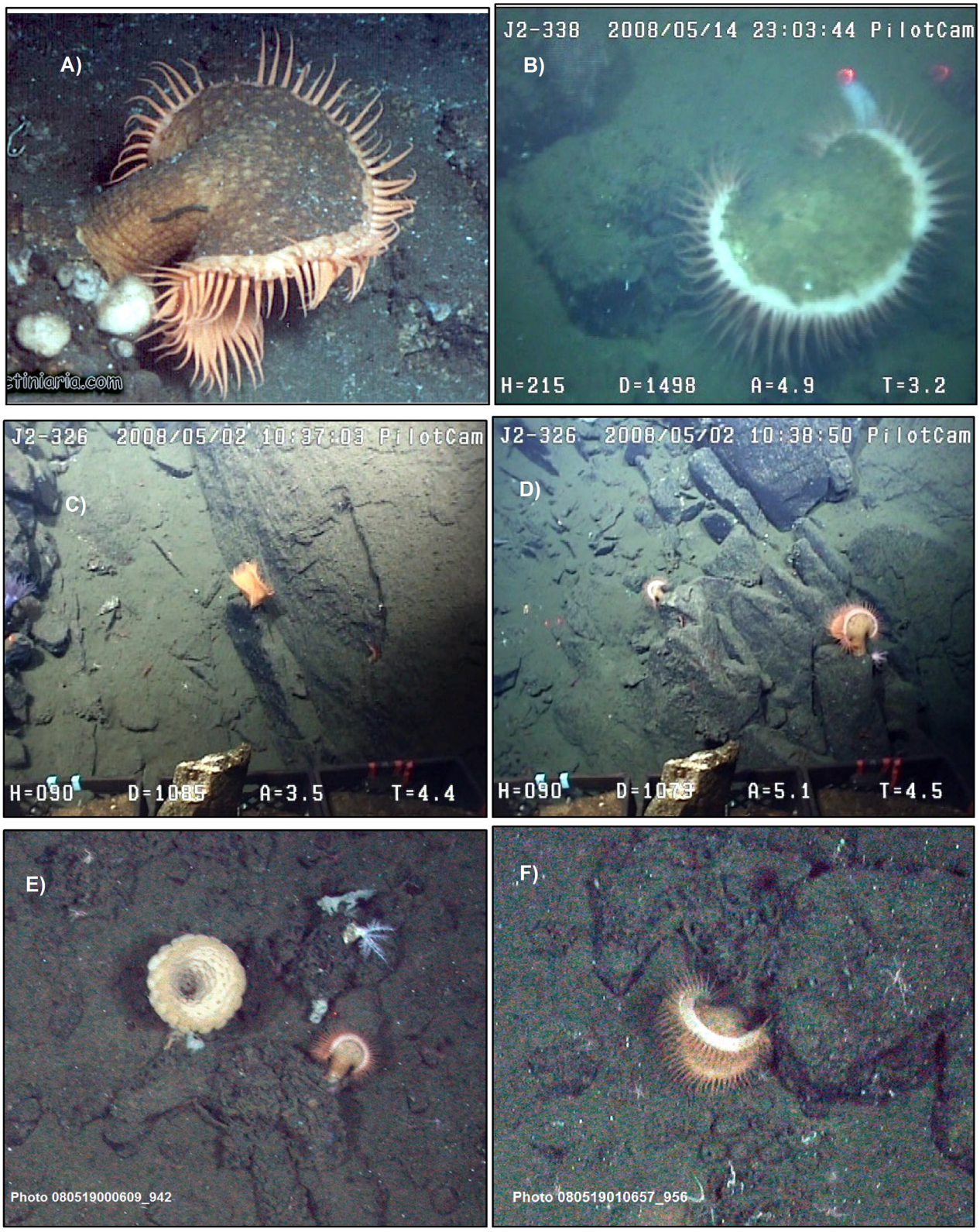

FIGURE 2. Photographs of *Phelliactis callicyclus* Riemann-Zurneck, 1973. A) From the MIR submarines dives in the Guaymas Basin (from Sanamyan & Sanamyan 2007). B–F) From the JASON ROV dives at different dive locations, May 2008 cruise; note the two specimens in figure D.

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