

BRIEF COMMUNICATIONS

A probable spawning aggregation of the leather bass *Dermatolepis dermatolepis* (Boulenger) in the Revillagigedo Archipelago, México

O. ABURTO-OROPEZA*†‡ AND P. M. HULL*

*Center for Marine Biodiversity and Conservation, Scripps Institution of Oceanography, 9500 Gilman Drive, La Jolla, CA 92093-0202, U.S.A. and †Departamento de Biología Marina, Universidad Autónoma de Baja California Sur, Carretera al sur km 5.5, La Paz, B.C.S. 23081, México

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Detailed life-history observations of *Dermatolepis dermatolepis* are given, including the location, size and timing of a probable spawning aggregation. These observations emphasize the general rarity of the species and the importance of no-take reserves in the management of offshore islands.

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The leather bass *Dermatolepis dermatolepis* (Boulenger, 1895) is a poorly known grouper living on coral and rocky reefs in the eastern Pacific Ocean. One of only three species in the genus *Dermatolepis* (family Serranidae, subfamily Epinephelinae), the leather bass distribution ranges from southern California to Ecuador, including the Gulf of California, the Galapagos Islands and other offshore islands (Heemstra & Randall, 1993) such as the Revillagigedo Archipelago. Juveniles settle among the spines of the long-spined sea urchin *Diadema mexicana*. Adults are predominantly solitary, although they frequently occur in association with schools of herbivores that facilitate leather bass predation on benthic fishes and crustaceans (Montgomery, 1975). Of the 122 reef fish species in Revillagigedo recorded on scuba dives in February 2006, the leather bass was the only large grouper (c. 1 m total length, L_T) and one of the main reef predators.

The Revillagigedo Archipelago lies c. 650 km south-west of Baja California and includes four volcanic islands: Socorro, San Benedicto, Roca Partida and Clarion (Fig. 1). The islands are separated from one another by as little as 53 km

‡Author to whom correspondence should be addressed. Tel.: +858 5349899; fax: +858 8221267; email: maburto@ucsd.edu

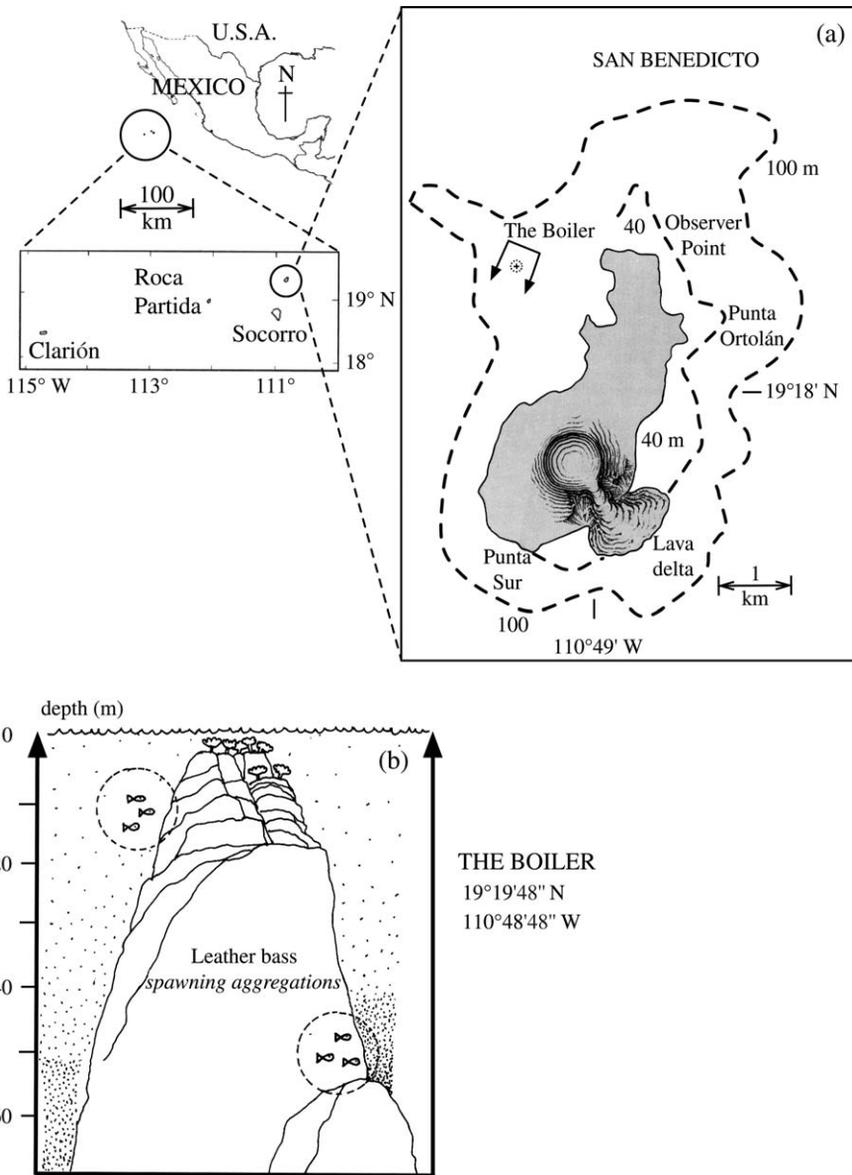


FIG. 1. Location of the leather bass aggregation. (a) San Benedicto is the northern-most island of the Revillagigedo Archipelago, located c. 400 km south-west of Baja California. The Boiler (the site of the aggregation) is a seamount c. 1 km north-west of San Benedicto. Bathymetry around San Benedicto corresponds to British Admiralty Chart No. 1936 (U.K. Hydrographic Office, Taunton, U.K.). (b) Sketch of the depth, bathymetry and locations of the *Dermatolepis dermatolepis* aggregations observed at The Boiler (direction of the observation noted with arrows on the map of San Benedicto).

(San Benedicto to Socorro) or as much as 283 km (Roca Partida to Clarion) with bottom depths between islands of c. 3100 m, with the exception of the numerous interspersed seamounts (Siebe *et al.*, 1995). These islands are subject

to the influence of the North Equatorial Current during the summer and the beginning of autumn, especially in October, and to the California Current in the winter and the beginning of spring, especially in April (León-Tejera *et al.*, 1996). Additional hydrographic influences come from the Gulf of California, the Costa Rica Coastal Current and the Equatorial Counter Current (Kessler, 2006). The winds are dominated by the North-east Trades and coastal winds (Ortega *et al.*, 1995). The highly variable winds and superficial current patterns cause the annual temperature of sea water to vary from 19.7 to 23.5° C (Llinas-Gutierrez *et al.*, 1993).

A marine expedition was led to Revillagigedo from 7 to 28 February 2006 to obtain baseline information on the ecosystem structure of the subtidal rocky reef communities. This included surveys of the diversity, abundance and size structure of the fish, macroinvertebrate and algal communities. The number and location of the sites surveyed were dictated by the scheduled stops of a tourism boat, the *Nautilus Explorer* (Table I). Underwater scuba surveys were carried out at all sites using six replicates of standard underwater visual belt transect survey methods (Harmelin-Vivien *et al.*, 1985). The transect was 50 m long and 5 m wide for the mobile large fishes and 2 m wide for the small territorial fishes. When high swell prevented the use of this method, timed 10 min swims (established to be *c.* 50 m in length) were substituted. Fish density was calculated as the abundance of a given species inside a transect divided by the total area surveyed.

On the day before the new moon in February 2006, a large aggregation of leather bass was observed at The Boiler (Fig. 1 and Table I), in which 54 individuals were congregated on the north-east side of this shallow seamount only 150 m in circumference. Averaged across all transects, the mean \pm s.e. density of leather bass at The Boiler was 3.60 ± 1.45 individuals 100 m^{-2} . Twenty days before there were only 0.40 ± 0.23 individuals 100 m^{-2} at The Boiler (Fig. 2). Recreational divers reported a second aggregation of *c.* 30 leather bass at 50 m depth on a deeper seamount. These aggregations are notable for several reasons. First, the leather bass is a rare species in Revillagigedo and was recorded in only 40% of the transect surveys. Furthermore, when they occurred, they were typically solitary and ranked 32nd out of 92 fishes for density (0.28 ± 0.05 individuals 100 m^{-2}). With the exception of the spawning aggregation, the density of leather bass in Revillagigedo is statistically similar to the density of leather bass in unfished locations in the Galapagos Islands (Ruttenberg, 2001). Adult leather bass were distributed throughout all four Revillagigedo Islands without significant differences between 5 and 25 m depth or between sites. This is notable, as sites varied widely in terms of habitat type, current and swell (Table I). As far as is known, there is no traditional knowledge pertaining to periodic aggregations of fish as at The Boiler. The Boiler, however, is known to attract giant manta rays *Manta birostris* (Walbaum) and sharks, *e.g.* *Triaenodon obesus* (Rüppell) and *Sphyrna lewini* (Griffin & Smith), possibly due to generally intense swell, waves and currents around the pinnacle.

The only reference in the literature of leather bass aggregations is a review paper that mentions leather bass spawning behaviour in aggregations of >50 individuals (Morris *et al.*, 2000), although the original source of this information is unclear. The aggregation of leather bass at The Boiler had a nine-fold

TABLE I. Environmental characteristics of reef sites in the Revillagigedo Archipelago, Mexico

Island*	Site	Code	Exposure†	Predominant habitat	Swell
San Benedicto (5.9 km ²)	The Boiler (19°19'48" N; 110°48'48" W)	SB-B	Exposed	Seamount	> 3 m
	El Canyon (19°18'25" N; 110°49'10" W)	SB-C	Exposed	Lava	< 1 m
	Cabo Pierce (18°47'09" N; 111°03'29" W)	S-CP	Exposed	Wall	< 1 m
Socorro (120 km ²)	Punta Norte (18°52'50" N; 110°59'29" W)	S-PN	Exposed	Lava	< 1 m
	Roca O'Neil (18°50'07" N; 111°04'12" W)	S-RO	Exposed	Seamount	< 1 m
	Pedro (18°45'08" N; 111°00'44" W)	S-P	Protected	Boulders	< 1 m
Roca Partida (0.01 km ²)	(19°00'32" N; 112°04'56" W)	RP	Exposed	Wall	> 3 m
Clarion (19 km ²)	Roca del Cuervo (18°21'14" N; 114°40'58" W)	C-RC	Protected	Boulders	< 1 m
	Roca Monumento (18°21'56" N; 114°45'54" W)	C-RM	Exposed	Boulders	< 1 m

*Island surface area is listed beside the island name (Ortega *et al.*, 1995).

†Exposed sites refer to offshore sites (< 200 m from the island) and, or deep. In most cases strong currents characterize these sites. Protected sites are located in bays or shallow areas of the island.

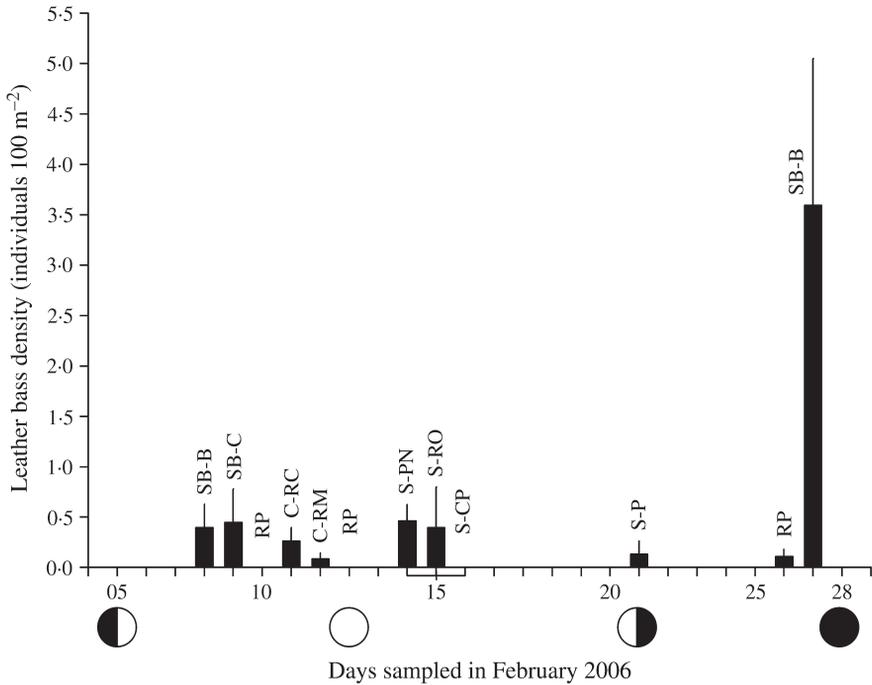


FIG. 2. Mean \pm s.e. density of leather bass in the Revillagigedo Archipelago for the sites at which leather bass were found in February 2006. Site codes, indicated above the density bars, are given in Table I. The phases of the moon in February 2006 are indicated with symbols below the corresponding date of occurrence.

increase in mean density of individuals over the site (and archipelago) average and was localized in the steepest part (from 10 to 30 m depth) in a small area of *c.* 500 m². Intraspecific leather bass interactions were notably higher within the aggregation. Although leather bass are known to alter their colouration between light and dark grey when joining intraspecific aggregations for feeding (Montgomery, 1975), the individuals of this conspecific aggregation had strongly enhanced yellow colouration on the margins of their fins, face and lips [Fig. 3(a)]. This colouration pattern is typical of young leather bass, but has not been reported in large leather bass (Thomson *et al.*, 2000) although Human & Deloach (2003) provide a picture with similar colour patterns. Furthermore, the individuals in this aggregation had greatly distended bellies [Fig. 3(b)]. Unfortunately, diving and permit restrictions prevented the potential observation of spawning, which typically occurs at dusk in groupers (Thresher, 1984), or the collection of females to check for hydrated eggs, which would unambiguously confirm a spawning aggregation (Domeier & Colin, 1997). The observations, however, suggest that the aggregation observed was a spawning aggregation because of leather bass density, behaviour, colouration and physical condition, with the distended abdomens of many individuals potentially indicating the presence of hydrated eggs. Spawning in the leather bass has been recorded in the popular film 'Secrets of the Ocean Realm: Creatures

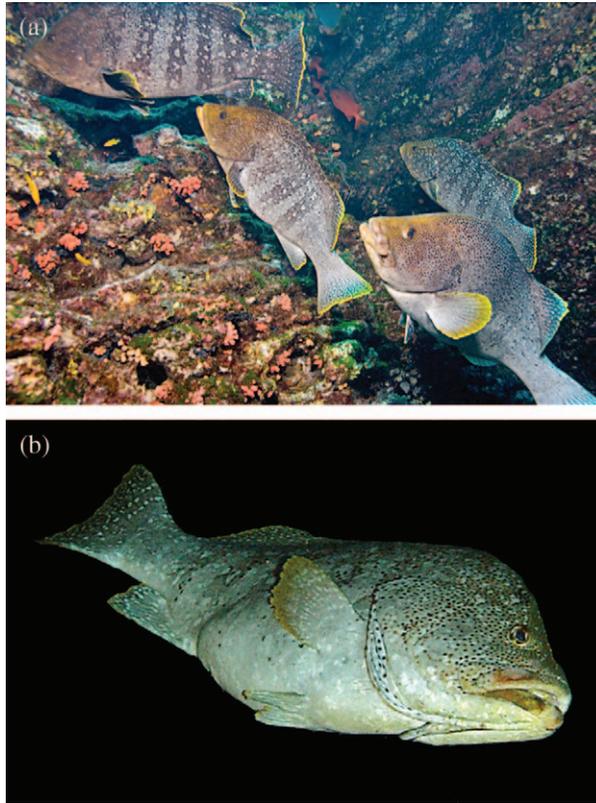


FIG. 3. Leather bass aggregating at 'The Boiler', San Benedicto on 27 February 2006. Individuals were typified by (a) brighter colour patterns (intensified yellow border on fins and head), increased densities, intraspecific interactions and (b) greatly distended bellies. Both pictures were taken at c. 15 m depth.

of Darkness' produced by Howard Hall Productions (©MMVII Questar, Inc., Chicago, IL, U.S.A.). On 22 July 1995 (4 days before the new moon) an aggregation of leather bass was filmed on the shallow side of Manuelita Island, a tiny island just north of Cocos Island, at c. 12 m depth. The Manuelita leather bass aggregation had a similar density to the aggregation encountered at The Boiler and was composed of individuals with distended bellies, exhibiting greatly increased intraspecific interactions. Just after dark, small groups of bleached leather bass were filmed as they separated from the main aggregation to spawn. Grouper spawning in small subgroups has been noted in the leopard grouper, *Mycteroperca rosacea* (Streets) (Erisman *et al.*, 2007) and the Pacific creolefish, *Paranthias colonus* (Valenciennes) (Sala *et al.*, 2003); in both cases the subgroup was composed of one female and several males. These similarities strongly suggest that the aggregation of groupers at The Boiler was a spawning aggregation. Additional information, such as duration, frequency and migration distance, is needed to determine if leather bass spawning aggregations are of a transient or resident type (Domeier & Colin, 1997).

Although the leather bass was assessed as a species of 'Least Concern' by the IUCN working group on wrasses and groupers (Sadovy, 2007) and 'Lower Risk: near threatened' in a compilation of information regarding minor fisheries (Morris *et al.*, 2000), a study in the Galapagos Islands found that leather bass abundance was zero in the presence of a fishery (Ruttenberg, 2001). Fishing spawning aggregations can have dramatic negative effects on reproduction and fish populations (Sala *et al.*, 2001; Sadovy & Domeier, 2005). Therefore, it is imperative that known leather bass spawning sites are fully protected. Additionally, large animals such as groupers often experience their highest mortality early in life (Coleman *et al.*, 2000); rarity of leather bass, even in protected areas, may be due to high juvenile mortality after recruitment. Although leather bass recruitment to long-spined sea urchins allows them to inhabit offshore islands lacking in shallow coastal habitats (*e.g.* mangroves and sea grasses), it ties their recruitment success to an organism that has a patchy distribution in time and space (Dumas *et al.*, 2007). These observations should be considered in fisheries regulations or conservation programmes to avoid population depletions like those noted in Galapagos Islands by Ruttenberg (2001). Furthermore, the results emphasize the importance of increased protection at The Boiler, a site now notable for hosting a probable leather bass spawning aggregation in addition to aggregations of giant mantas and sharks.

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