

## NORTHERN OCCURRENCE OF TWO ESTUARINE CRABS: THE FIDDLER CRAB, *UCA CRENULATA*, AND THE BURROWING CRAB, *MALACOPLAX CALIFORNIENSIS*

A male fiddler crab, *Uca crenulata*, was found in Goleta Slough, approximately 2 km E of the University of California, Santa Barbara campus (lat 34° 25' N, long 119° 50' W) (Figure 1), on 17 July 1986. The fiddler crab (16.5 mm carapace width (cw)) was found in the upper intertidal zone of the small estuary, in a muddy area vegetated with pickleweed, *Salicornia* sp.

Fiddler crabs typically occur on intertidal shores in protected locations in tropical, sub-tropical and warm temperate locations. *U. crenulata* is the only species of fiddler crab reported from California (Crane 1975). *U. crenulata* has previously been reported as far north as Playa del Rey, Los Angeles County (lat 33° 58' N, long 118° 27' W) (Garth and Abbott 1980). Johnson and Snook (1927) reported a male *U. crenulata* specimen measuring 19.7 mm cw and Allen (1980) reported males approaching 30 mm cw.

One male burrowing crab, *Malacoplax californiensis*, was collected on the Morro Bay mud flat during an early morning minus tide, several hundred meters S of the Morro Bay State Park (lat 35° 20' N, long 120° 50' W) (Figure 1) on 20 July 1986. The crab was collected in shallow water (ca. 0.5 m below MLLW) in a muddy area with patches of eelgrass, *Zostera* sp., and ghost shrimp, *Callinassa californiensis*, burrows. This specimen measured 31.3 mm cw.

*M. californiensis* is an intertidal to subtidal inhabitant of bays and protected waters in southern California and Baja California (Garth and Abbott 1980). *M. californiensis* was previously reported as far north as Mugu Lagoon, Ventura County (lat 34° 06' N, long 119° 05' W) (MacGinitie and MacGinitie 1969).

The northern extensions of these species may be the result of larval transport and recruitment associated with nearshore currents during the El Niño events of 1982 and 1983. The distances between the previously reported northernmost occurrences and those reported here are about 130 km for *U. crenulata* and 230 km for *M. californiensis*. Durations of the planktonic larval stages of *U. crenulata* and *M. californiensis* are unknown, but the span of planktonic life for several *Uca* species ranges from 17 to 28 d (Rabalais and Gore 1985).

The estimated velocity of northward nearshore currents in February and March of 1983 was 0.72 km/hr in the region of Point Conception (Figure 1) (Lynn 1983). Simpson (1984) reported the development of an anomalously strong inshore California Countercurrent which appeared earlier in the season (June–July) than in normal years (late summer) in association with the 1982–83 El Niño event. At an average ocean current velocity of 0.72 km/hr the transport of planktonic larvae from established colonies of either species could have occurred in less than 14 d. Northern range extensions of other southern invertebrate species have been reported during the 82–83 El Niño episode: the pelagic red crab, *Pleuroncodes planipes* (McGowan 1984), the euphausiid, *Nyctiphanes simplex* (Brodeur 1986), and the acorn barnacle, *Megabalanus coccopoma* (Newman and McConnaughey 1987).

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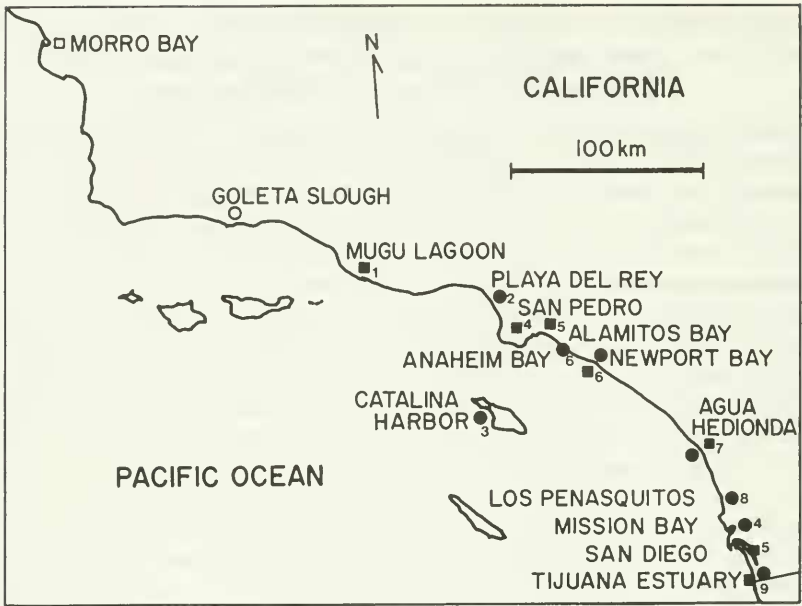


FIGURE 1. Occurrence of the fiddler crab, *Uca crenulata* (●), and the burrowing crab, *Malacoplax californiensis* (■), in southern and central California. Open symbols indicate our new observations for each species. References for each record are indicated by number as follows: 1) MacGinitie and MacGinitie 1969, 2) Garth and Abbott 1980, 3) personal observation 1985, 4) Johnson and Snook 1927, 5) Rathbun 1918, 6) Ricketts *et al.* 1985, 7) Bradshaw *et al.* 1976, 8) Gross 1961, 9) Zedler and Nordby 1986.

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## OBSERVATIONS ON SALT CREEK PUPFISH MORTALITY DURING A FLASH FLOOD

Salt Creek is a small stream in southeastern California that originates at McClean Spring in Death Valley National Monument. The stream is characterized by large fluctuations in temperature, salinity, and flow. During winter, Salt Creek may extend 5 or 6 km downstream of the headspring. During the hot summer, reduced spring flow and high evaporation rates restrict surface water to 1 or 2 km downstream of the spring. Reduced flows and hypersaline conditions of remaining pools result in substantial mortality of Salt Creek pupfish, *Cyprinodon s. salinus*, during the summer (Miller 1943, Stuenkel and Hillyard 1981). No reports of pupfish mortality during high water conditions exist.

During 15–18 April 1988, we observed mortality of Salt Creek pupfish because of a flash flood. Although average annual rainfall at the town of Furnace Creek (18 km SE of Salt Creek) is only 5.16 cm, rainfall amounts at Furnace Creek were 3.73 cm, 0.51 cm, and a trace on 15, 16, and 17 April, respectively. On the same dates, rainfall at Scotty's Castle (57 km NW of Salt Creek) measured 4.45 cm, 0.76 cm, and 0.15 cm. Rains were so severe on 15 April that State Highway 190 was closed between Stovepipe Wells and Furnace Creek in numerous places. Salt Creek flows extended many km below their usual terminus during 15–18 April.

As the initial flood flows receded in the afternoon of 15 April, we collected 12 dead Salt Creek pupfish by hand from desiccating pools along the margin of the creek near the interpretive natural history display and boardwalk. These specimens are now housed at the California Academy of Sciences (CAS 63183). We returned on 18 April when flows were greatly reduced but still substantially above normal. On that date, three people searched downstream of the boardwalk (below the extent of normal flow for that time of year) for dead pupfish and a second group of three people searched the Creek near the boardwalk. An additional 64 dead pupfish were found in two hours of searching. The downstream party found only four pupfish (range 12–30 mm total length (TL),  $\bar{x}$  = 21.5), whereas 60 pupfish (range 23–45 mm TL,  $\bar{x}$  = 35.9) were found along 395 m of the Creek next to the boardwalk. These fish were then measured to the nearest mm total length (TL) and returned to the location in which they were found. Our observations include only a small portion of pupfish killed during the flood. By 18 April, many scavengers (especially birds) were feeding on the dead pupfish. Tracks could be traced from dry pool to dry pool as one coyote fed on dead pupfish. Many additional live pupfish were observed on 18 April isolated in pools that would soon dry.