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THE DISTRIBUTION OF *ISCHNURA GEMINA* (KENNEDY) AND A DESCRIPTION OF THE ANDROMORPH FEMALE (ZYGOPTERA: COENAGRIONIDAE)

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The distribution of *I. gemina* includes small, shallow ponds, marshes, and canals in the San Francisco Bay Area from Pt. Reyes, Marin Co., south to Santa Cruz Co., California, United States. All but one of the habitats discovered after 1978 are in urban areas and are liable to habitat alteration. The previously unknown andromorph female is described and compared with the male and heteromorph female. A key for the identification of female *Ischnura* from the San Francisco Bay Area is provided.

INTRODUCTION

The San Francisco Bay region is an area of significant endemism of both plants and animals. Many of these endemics have restricted ranges and narrow habitat requirements. Increasing development and urbanization along the California coast have caused extinction of some species and greatly reduced populations of others. The effects of habitat alterations on insects are probably best documented for the San Francisco Bay area, where urbanization has caused extinction of two butterflies, the satyr *Cercyonis s. sthenele* (Boisduval) and the Xerces Blue, *Glaucopsyche xerces* (Boisduval). Three other butterflies, the San Bruno Elfin, *Callophrys mossii bayensis* Brown, the Mission Blue, *Plebejus icarioides missionensis* Hovanitz, and Lange's Metalmark, *Apodemia mormo langei* Comstock, are now listed as endangered.

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Although the effects of man's activities on insects are best known for butterflies, members of other groups have doubtlessly also been detrimentally affected. The damselfly, *Ischnura gemina* (Kennedy) appears to be endemic to the San Francisco Bay area and probably has the most limited distribution of any Western species of Odonata. We have recently performed quantitative studies on the biology of this species in order to determine whether it should be included on the list of endangered or threatened species. This paper documents the known distribution and describes the previously unknown andromorph female of *I. gemina.*

HISTORY

Until recently, *Ischnura gemina* was known from few specimens. KENNEDY (1917) based his description on two males and one female (one pair in copula) from Coyote Creek, San Jose, Santa Clara Co., California (the type locality), and on one additional male from Sharon Pond, Santa Clara Co. Kennedy did not recognize this species in the field, because it was similar in coloration to the common *I. denticollis* (Burmeister). Thus, he briefly described the collection sites but was unable to offer any biological data on the specimens. He described the female as "similar to . . . the male", but his figure and description ("Mesothorax and metathorax olive on . . . sides . . .") refer to a heteromorphic female. BYERS (1929) and SMITH & PRITCHARD (1956) differentiated female *I. gemina* from *I. denticollis* by the lack of blue spots on the dorsum of abdominal segment 10. These authors probably referred to differences depicted in figures given by KENNEDY (1917). PAULSON & GARRISON (1977) remarked that *I. gemina* was poorly known and "may be on the verge of extinction". No further published information has appeared on the species since the original description 63 years ago.

DISTRIBUTION

Searches in various museums and correspondence with our colleagues have yielded an additional 21 males and 16 females and new localities. With one exception, all were collected by entomologists who were not specialists in the Odonata. We include an annotated list of all specimens alphabetically by museum or private collection under the following abbreviations: CAS (California Academy of Sciences), San Francisco, California), CC (Carl Cook collection, Center, Kentucky), CIS (California Insect Survey, University of California, Berkeley, California), DRP (Dennis R. Paulson Collection, Seattle, Washington), FSCA (Florida State Collection of Arthropods, University of Florida, Gainesville, Florida), MCZ (Museum of Comparative

Zoology, Harvard University, Cambridge, Massachusetts), UMMZ (University of Michigan, Museum of Zoology, Ann Arbor, Michigan), USNM (United States National Museum, Washington, D.C.). All collection localities are in California.

CAS: San Francisco Co., San Francisco. 6 Nov. 1910. "Presented by J.C. Huguenin." 1 ♂. Santa Cruz Co., Santa Cruz. 3 June 1919. E.P. Van Duzee. 1 ♂.

CC: Santa Clara Co., Stanford University. 23 Aug. 1949. 2 ♂. These are part of 6 ♂ sent to Carl Cook (pers. comm. 16 Sept. 1978) by the CAS. The whereabouts of the other 4 ♂ is unknown.

CIS: Alameda Co., Berkeley. Oct. 1914. 1 ♀. San Mateo Co., South San Francisco. 2 Oct. 1915. A.E. Michelbacher. 3 ♂.

DRP: Santa Cruz Co., Santa Cruz. 3 June 1919. E.P. Van Duzee. 1 ♂.

FSCA: Marin Co., 1 mi. S. of Pt. Reyes Station. 29 June 1969. John Heppner. 1 ♂.

MCZ: San Mateo Co., Baden [= South San Francisco, GUDDE, 1969]. 21 Aug. 1897, 8 ♂, 13 ♀. 24 Aug. 1897, 2 ♂ 1 ♀. A.P. Morse.
There are also 2 ♂ and 1 ♀ labelled, "San Mateo, A. Agassiz." One of the males was determined as *I. denticollis* by P.P. Calvert, 1902.

UMMZ: Santa Clara Co., Coyote Creek, San Jose. 15 May 1915. C.H. Kennedy. 1 ♀. Kennedy's paratype.

USNM: Santa Clara Co., Coyote Creek, San Jose. 15 May 1915. C.H. Kennedy. 1 ♂, 1 ♀ (in copula). Kennedy's holotype and allotype.
The single male from Sharon Pond, Stanford University campus, in May, 1914, by C.H. Kennedy, is also here (pers. comm. Oliver S. Flint, 19 Aug. 1980).

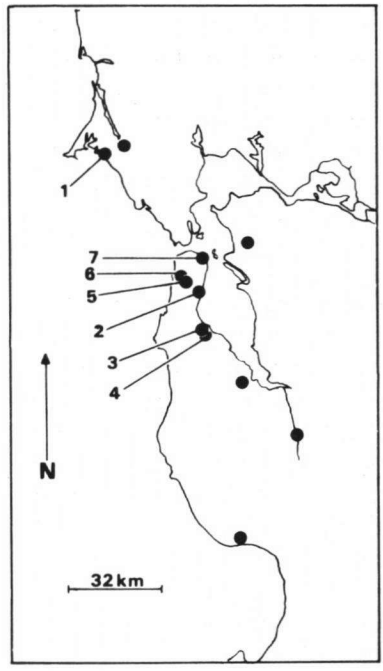

Fig. 1. Distribution of *Ischnura gemina*. Numbers refer to localities discovered since 1978 and are discussed in the text. 1 = small marsh and pond at end of Limantour Rd., Pt. Reyes National Seashore, Marin Co.

We first became aware of the presence of this species when a male was included in a student's insect collection for a general entomology course at the University of California, Berkeley, in the spring of 1978. One of us (RWG), after talking with the collector, found the population at a small marsh and pond at the end of Limantour Rd., Pt. Reyes National Seashore, Marin Co. We have discovered the following additional localities supporting *I. gemina* (cf. Fig. 1):

(2) San Mateo Co.: Brisbane, Bayshore Blvd, marsh at industrial area near Southern Pacific

Railroad yard;

(3) San Mateo Co.: Burlingame, Sports Center Ditch behind 1744 Rollins Rd;

(4) San Mateo Co.: Laurel Creek off Laurie Meadows Dr., by Bayshore Freeway (just across from Foster City);

(5) San Francisco Co.: Glen Park Canyon;

(6) San Francisco Co.: Lake Merced at Winton Drive (one specimen only);

(7) San Francisco Co.: small seepage at base of Telegraph Hill.

With the exception of Limantour Pond, all of these sites are within city limits, often adjacent to buildings or factories, and are liable to habitat destruction, pollution, or other human activity. The small deme at Telegraph Hill (7) is extinct due to new construction at that locality. The site was a small seepage with large stands of *Typha* sp. Glen Park (5) is within a city park but experiences heavy foot and motorbike traffic. During the summer of 1979, the insects were confined to a small (28 m by 12 m) mostly open seepage area covered with clumps of rush (*Juncus* sp.) and a few isolated willows (*Salix* sp.). Another site 150 m uphill from the seepage was a small, linear asphalt channel 0.3 m wide and 100 m long, consisting of mostly open standing water with a little watercress (*Nasturtium officinale* R. Br.) and a 5 m stretch of cattails (*Typha* sp.). The channel supported larvae of *I. gemina*, but was recently (spring, 1980) dredged, resulting in a drastic reduction in numbers of adults. We visited Sharon Pond, Palo Alto, one of the original localities for the species, but found the habitat to be a concrete-lined pond supporting no emergent vegetation or *I. gemina*. The Limantour Pond and Bayshore Boulevard marsh area (2) support the largest populations of *I. gemina*, but neither is larger than a hectare. Both water areas are shallow, often experience water level fluctuations due to changes in precipitation, and are mostly covered with duckweed (*Lemna* sp.), and water fern (*Azolla filiculoides* Lam.). Adults are found resting horizontally on these plants. One specimen was found at Lake Merced (6) and may represent a stray from an undiscovered nearby deme. The Burlingame (3) and Laurel Creek (4) sites are altered streams about 3-5 m wide and appear to be moderately to heavily polluted. Few adults were found at these sites. Figure 1 summarizes the known distribution of *I. gemina*. Numbers refer to localities we have discovered since 1978.

DESCRIPTION OF ANDROMORPH FEMALE

Material. — 3♀, San Mateo Co., Brisbane, Bayshore Blvd., marsh at industrial area, near Southern Pacific Railroad yard; 29 April 1979.

Andromorphic females have been collected at Limantour Pond, Bayshore Blvd. industrial marsh and Glen Canyon. At Glen Canyon, we found only two andromorphs out of 197 females captured during a 36-day biological study, but percentages of female andromorphs appeared to be greater at the other

two sites, where this species was sympatric with at least one other *Ischnura* species.

Andromorph female (Figs. 2a-b): head coloration same as for male and as described by KENNEDY (1917: 498), but with black on rear of vertex not as extensive; pale area behind head approaching rear margin of vertex, giving appearance of thin, pale marginal line, but not confluent with postocular spots. Prothorax as described for male (KENNEDY, 1917). Synthorax with dorsum entirely black (Fig. 2a) or with small pairs of blue spots on upper end of mesepisternum and at base directly dorsad to mesenfraepisternum (Fig. 2b). These spots are possible remnants of pale antehumeral stripe present on heteromorph female (Fig. 2c). Sides of thorax pale blue with black markings shown in Figures 2a, b. Upper margins of coxae with more extensive black markings than in heteromorphic female, black extending over rear margins of femora; otherwise, legs as described by Kennedy. Abdomen as described by Kennedy for heteromorphic female except for variable pale blue dorsal spots on segments 8 and 9. These are large and conspicuous or small and almost absent. Minute spine present on apex of sternite 8.

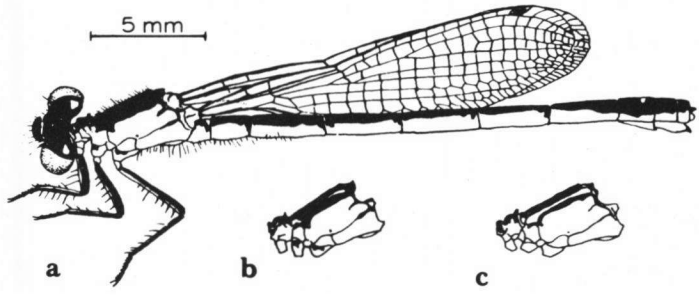

Fig. 2. *Ischnura gemina* females, lateral views: (a) andromorph; — (b) thorax of andromorph with pale dorsal thoracic spots; — (c) thorax of heteromorph.

Comparison with heteromorphic female — Besides the obvious differences of the black markings on the dorsum of the thorax, andromorphic females have more extensive black markings on the head, thorax, and legs. A pale spot is absent on the dorsum of abdominal segment 10, as compared to the description of Kennedy's female, but heteromorphic females may also lack spots on segments 8, 9, and 10. Pale coloration in andromorphs is blue, similar to the male, while old heteromorphs are olive green, or bronze-green, and young heteromorphs are bronze.

BYERS (1929) and SMITH & PRITCHARD (1956) distinguished females of *I. gemina* from *I. denticollis* by a blue dorsal spot on abdominal segment 10 in *I. gemina*. However, several heteromorphic female *I. gemina* we have

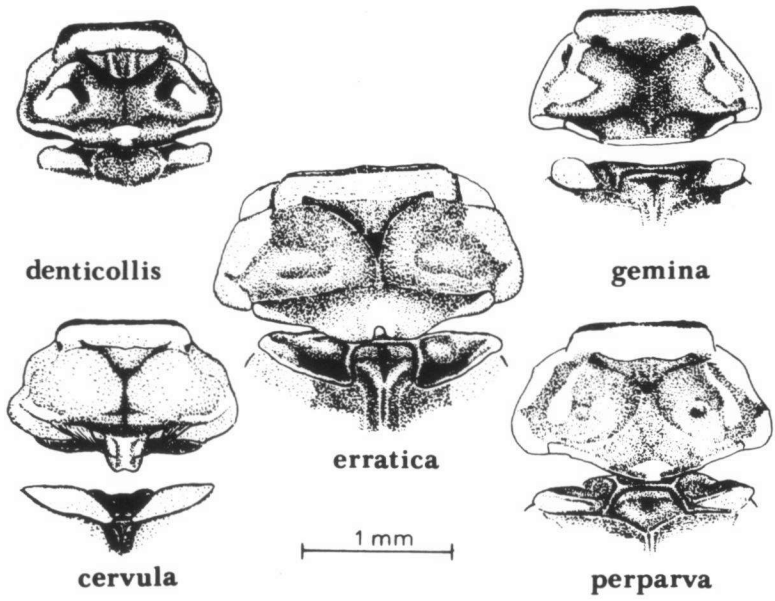

Fig. 3. Dorsal view of prothorax and mesostigmal plates.

examined lack the spot. The differences between the prothoracic structures as described and figured by KENNEDY (1917) are better diagnostic features. Dorsolateral nodes are absent on the middle prothoracic lobe of female *I. gemina* and specimens will not key out correctly in the keys of BYERS (1929) or SMITH & PRITCHARD (1956). A key to the females of *Ischnura* found in the San Francisco Bay area is presented below.

1	Prothorax with a dorsal projection on each mediolateral lobe (Fig. 3) ..... **denticollis**
1'	Prothorax without dorsal projections 2
2 (1')	Prothorax with curved, pointed cluster of hairs arising from hind margin (Fig. 3) **cervula**
2'	Prothorax without pointed cluster of hairs arising from hind margin 3
3 (2')	Mesostigmal plate flat, slightly elevated dorsally but with no elevated ridge along its entire length. A small spine present on sternum of abdominal segment 8 (Fig. 3) ... **gemina**
3'	Mesostigmal plate with a distinct elevated ridge along its entire length. Sternal spine on segment 8 lacking 4
4 (3')	Mesostigmal plate with transverse ridge extending from anterodistal to posteromesal margin. Mesal margin of elevated ridge without a mesally pointed ridge (Fig. 3) **perparva**
4'	Mesostigmal plate with elevated ridge along hind margin. Mesal margin of elevated ridge enlarged, forming a mesally pointed lobe (Fig. 3) ..... **erratica**

CONCLUSIONS

Ischnura gemina is apparently confined to small, mostly open seepages, ponds, or canals in the coastal region of the San Francisco Bay Area. All but one of the known localities are in highly disturbed sites within urban areas, tying the future of *I. gemina* closely to man's future activities. *I. gemina* has probably always been confined to the San Francisco Bay area and has successfully adapted to rapid alteration of habitat. *I. gemina* has survived these changes, while other endemic insects (*Cercyonis s. sthenele* and *Glaucopsyche xerces*) did not. However, all populations of *I. gemina* we have found are small, may become extinct from time to time, and must be considered threatened. We feel that *I. gemina* will be found in several more areas within the Bay Area, but doubt if its range extends much north of Point Reyes or south of Santa Cruz.

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