Are monarch butterflies true navigators? The jury is still out

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Are monarch butterflies true navigators? The jury is still out

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Mouritsen et al. (1) used a flight-simulator experiment and recapture data to examine two hypotheses: whether monarchs use true navigation or a vector-navigation strategy. In the flight-simulator experiment, flight directions of wild-captured, migratory butterflies were assessed near their capture location, and then ~2,500 km west. The authors’ finding that monarchs flew southwest in both locations does not rule out true navigation because: (i) the experiment did not include reciprocal translocations and therefore lacked controls; (ii) experimental monarchs were moved to a location that an Ontario monarch would never traverse and where monarchs are only rarely found, and thus tell us little about monarchs following a normal migratory trajectory; and (iii) the experiment did not adequately allow for acclimation of a circadian clock or potential cognitive map to Alberta. Physiological—not chronological—time applies to insects, and the claim that animals “adjust their inner clock” by “approximately 1 time-zone hour per day” (1) is based solely on avian studies.

Mouritsen et al. (1) tested their conclusion from the displacement experiment using recapture data. Curiously, the authors only determined whether the data conformed to the vector-navigation strategy without testing a true-navigation strategy. Rejecting hypotheses that do not explain the data is as important as corroborating preferred hypotheses.

Tagging locations were displaced to a “mean tagging location,” making analysis of a true-navigation strategy impossible, and ignoring the possibility that monarchs originating in different locations experience different conditions that might affect their long-distance flight ability. It is possible that some of the scatter in figure 4B of ref. 1 is explained by location; indeed, the fact that the data were more scattered than predicted by the vector model could be taken as support for an alternative hypothesis.

Mouritsen et al. (1) suggest that geography and wind funnel monarchs using southwest-vector navigation into southern Texas. The geography component of this suggestion might apply to monarchs flying from the mean location in this study or farther east. However, most monarchs originate farther to the west in the United States Corn Belt (2). There is no evidence that butterflies from this region move toward the Rockies (3), as suggested by Mouritsen et al.’s (1) model. The suggestion that “monarch autumn migration is supported by dominant northeasterly winds that push the butterflies in westerly directions” makes little sense. Indeed, figure S3 of ref. 1 shows dominant southwest, south, or southeast winds throughout most of the migrating range.

The single-minded focus on the vector-navigation hypothesis is illustrated by the authors’ explanation of a previous finding (4) that monarchs in the western and eastern part of their breeding range fly south and southwest, respectively, as expected from a true-navigation strategy. Mouritsen et al. (1) state that this “apparent significantly different mean orientation” could be the result of a bias in recovery distributions, rejecting the more parsimonious explanation that the monarchs were actually flying in different directions.

We do not know whether monarchs have a true map sense or not, and the question of how they navigate from their northern breeding grounds to a relatively small wintering area remains unanswered. The results presented by Mouritsen et al. (1) do not rule out true navigation.

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