Image A

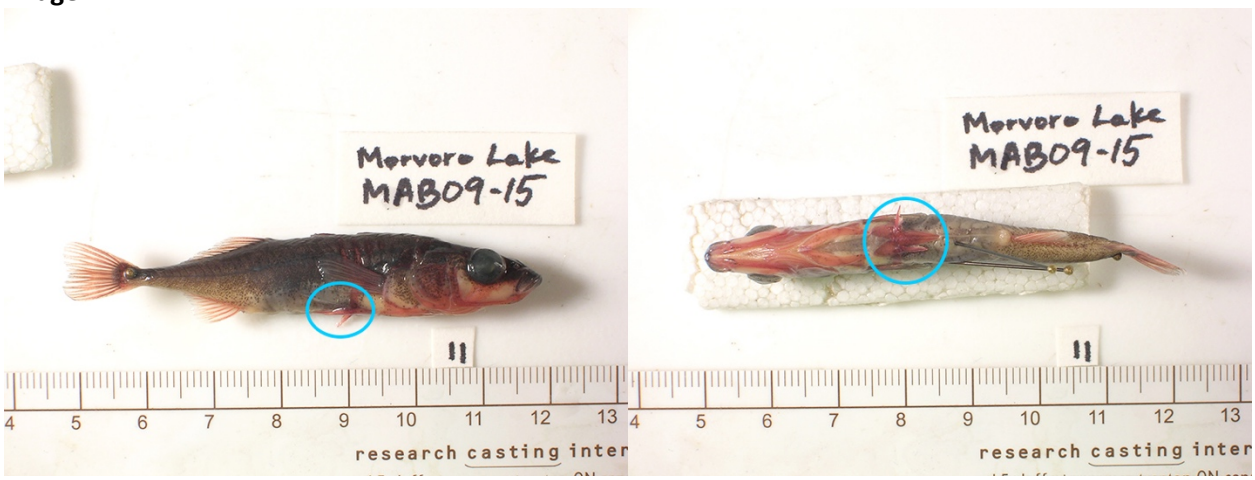


Image B

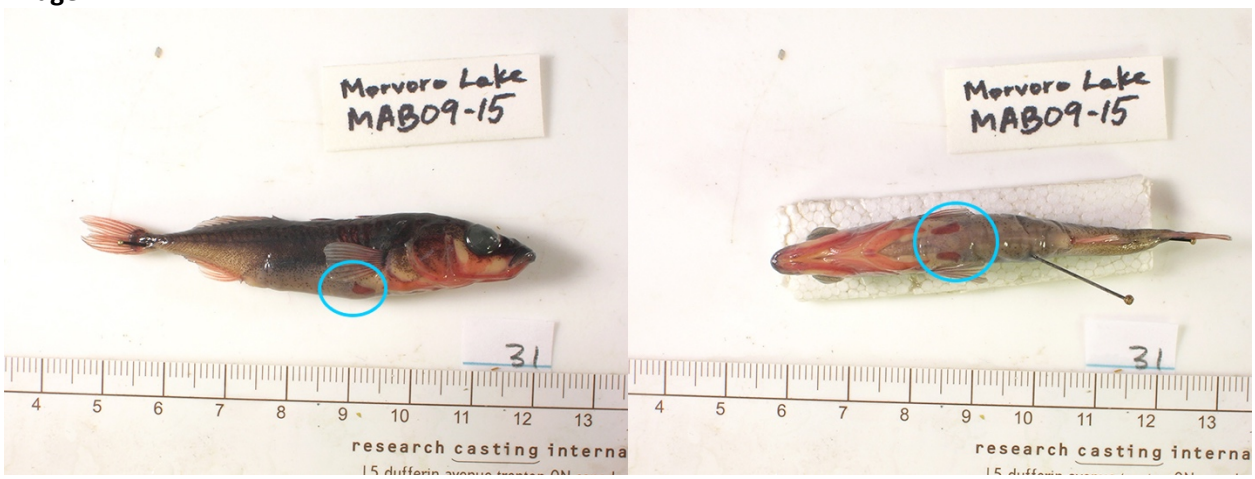


Image C

Image D

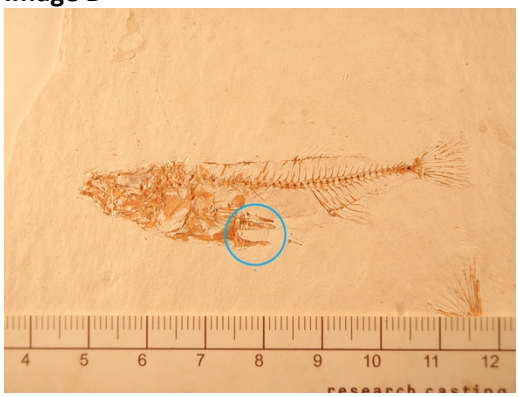
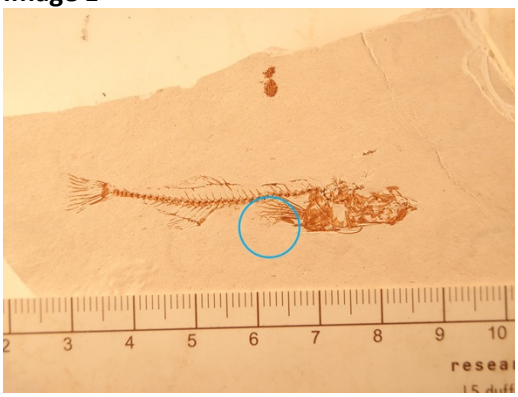


Image E



BACKGROUND INFORMATION

Threespine stickleback fish, sometimes called just **stickleback fish**, are a type of small fish found in the ocean, freshwater lakes, and some other bodies of water. Until about 10,000 years ago, most stickleback fish lived in the ocean. But when the last ice age ended, the melting ice sheets created many new lakes. Some stickleback fish from the ocean swam into these lakes. Later, connections between the ocean and some lakes dried up. As a result, the stickleback populations in some lakes were trapped there for thousands of years.

Over time, certain traits became less common among the stickleback populations in lakes compared to the populations in the ocean. For example, most stickleback fish in the ocean have pointed, bony structures called **pelvic spines** on their underside surface. The pelvic spines make it hard for large predators to swallow stickleback fish. However, stickleback fish in some lakes lack pelvic spines.

The presence of pelvic spines, like many physical features, is determined by genetics. In stickleback fish, a gene called ***Pitx1*** controls the development of the pelvis and pelvic spines. *Pitx1* is not active in the **pelvic area**, where the pelvis and pelvic spines would develop, in lake stickleback fish without pelvic spines. However, *Pitx1* is still active in other areas, where it controls the development of other body structures in *all* stickleback fish. This finding has led scientists to wonder how a gene can affect structures in one area of the body but not in others.

The images show several stickleback specimens. The pelvic area is circled in each image.

- Images **A, B, and C** show modern-day stickleback fish from a population in a lake. This population has considerable variation for pelvis-related traits. The pelvic structures have been stained red using a special dye. Each image shows a side view and an underside view of the same fish.
  - Image A is of a fish with a complete pelvis and pelvic spines.
  - Image B is of a fish with a reduced pelvis and no pelvic spines.
  - image C is of a fish with no pelvis or pelvic spines.
- Images **D** and **E** show fossils of two different stickleback fish that lived thousands of years ago.