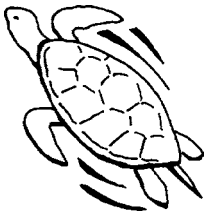
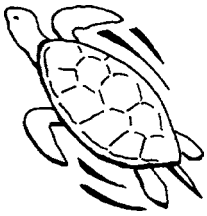


The Anchialine Pond Detective Worksheet

Solve the following mysteries using the information your teacher will present to you. Like a detective, your job is to piece together observations or clues to arrive at a conclusion.

Mystery #1: The water in the ponds is both fresh water and salt water. Where does this water come from?

Mystery #2 What makes the water turn red each spring at Wai‘ānapanapa?



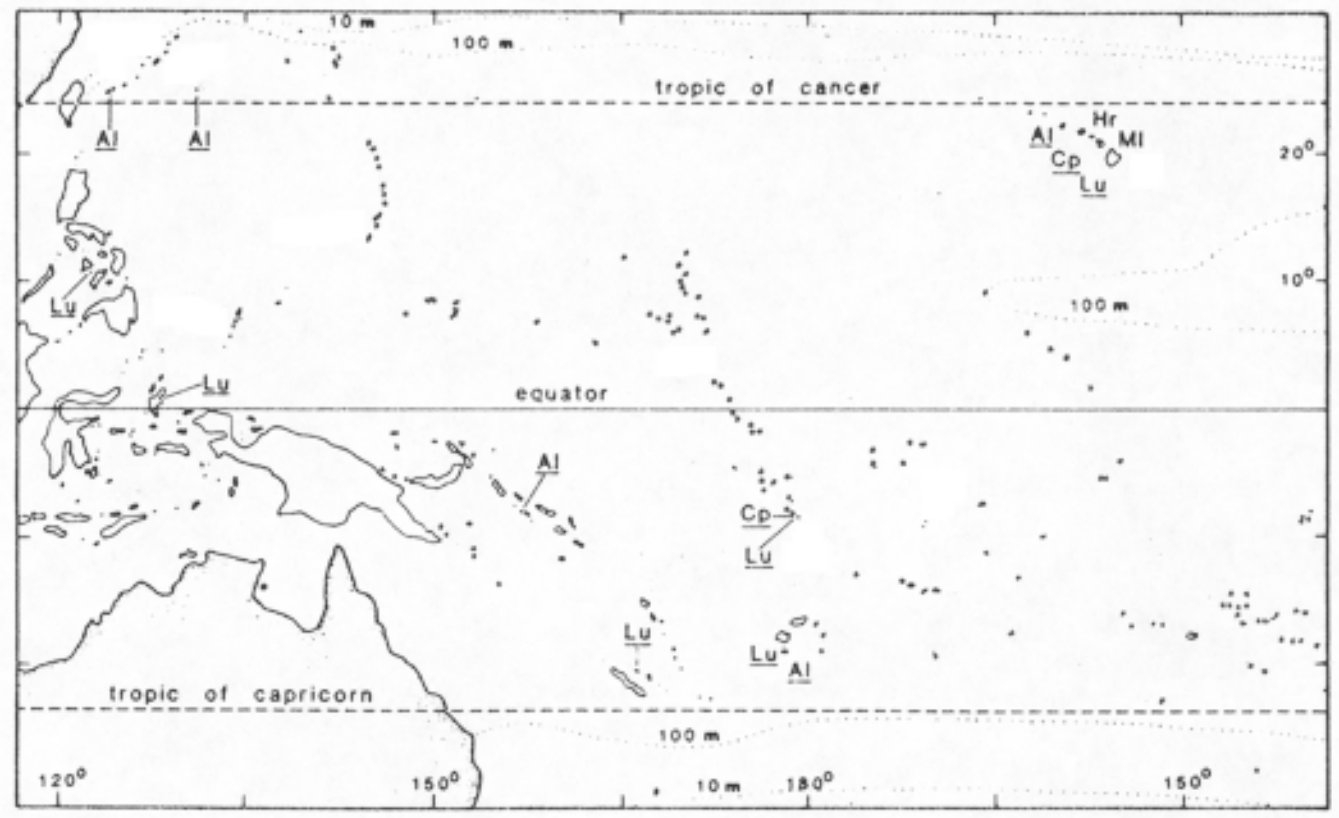
Mystery #3 You often see small, red shrimp in the anchialine ponds. If all the water goes out of the ponds at low tide, the shrimp disappear. Where do they go?

Mystery #4 The same species of shrimp that live in the Maui ponds also live in similar ponds on the Kona coast of Hawai‘i and holes in the ancient (and dry) coral reef that is now the ‘Ewa plain of O‘ahu. How did the shrimp travel between the islands?

Mystery #5 The larvae reach the shorelines of the other islands. How do they get into the ponds?

Information Interlude

Shrimp Distribution Map: Central and Western Pacific Ocean

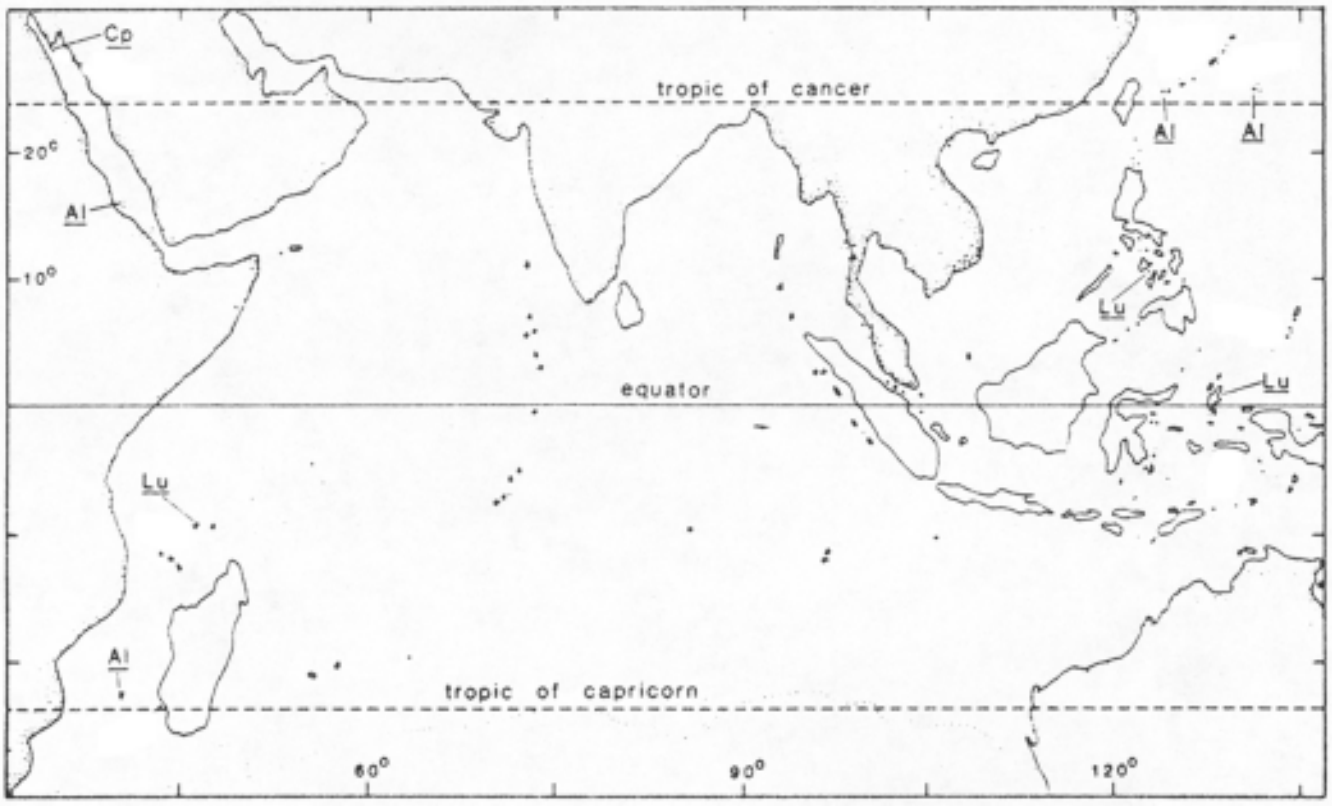


Distribution of insular hypogeal shrimps in the central and western Pacific Ocean (Adapted from John A. Maciolek, "Distribution and Biology of Indo-Pacific Insular Hypogeal Shrimps," Bulletin of Marine Science, *Vol. 33, No. 3, p. 610.)*

Key

Antecaridina lauensis (Al)
Calliasmata pholidota (Cp)
Halocaridina rubra (Hr)
Ligur uveae (Lu)
Metabetaeus lohena (Ml)

Shrimp Distribution Map: Western Pacific and Indian Oceans



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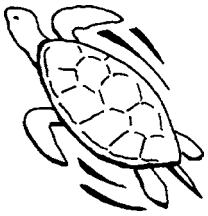
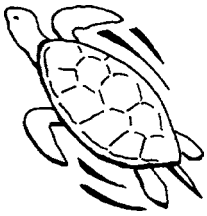


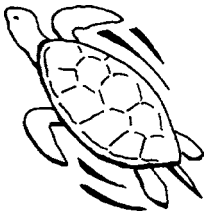
Distribution of Indo-Pacific Caridean Hypogeal Shrimp Species (the small, red shrimp in anchialine ponds) Found in Hawai'i

Family, Genus, Species	**Locality**	**Island(s)**
Alpheidae		
Metabetaeus lohena (Ml)	Hawaiian Islands	Hawai'i, Maui
Atyidae		
Antecaridina lauensis (Al)	Fiji Islands	Namuka, Wangava
	Mozambique Channel Is.	Europa
	Red Sea-Dahlak	Entedibir
	Hawaiian Islands	Maui, Hawai'i
	Daito Islands	Minami
	Ryukyu Islands	Kuro
	Solomon Islands	Uipi
Halocaridina rubra (Hr)	Hawaiian Islands	Hawai'i, O'ahu, Maui, Moloka'i
Hippolytidae		
Calliasmata pholidota (Cp)	Red Sea-Sinai	Ras Muhammad
	Ellice Islands	Funafuti
	Hawaiian Islands	Maui, Hawai'i
Ligur uveae (Lu)	Molucca Islands	Halmahera
	Loyalty Islands	Uvea/Sayawa
	West Indian Ocean	Aldabra
	Fiji Islands	Vanua Levu, Vanua Vatu, Vatulele
	Ellice Islands	Funafuti
	Philippine Islands	Tiniguiban
	Hawaiian Islands	O'ahu, Hawai'i, Maui
Procarididae		
Procaris hawaiana	Hawaiian Islands	Maui, Hawai'i

Based on John A. Maciolek, "Distribution and Biology of Indo-Pacific Insular Hypogeal Shrimps," Bulletin of Marine Science*, 1983, Vol. 33, No. 3, pp. 606-618.*



Mystery #6 Theories about isolation and speciation hold that shrimp species that live thousands of miles apart should have evolved into separate species. What can explain the fact that populations of the same shrimp species are found thousands of miles apart?



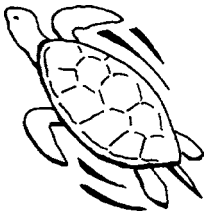
Hypothetically Speaking

1) In 1983 a scientist named Dr. John Maciolek offered a hypothesis to explain the widely scattered populations of the small, red shrimp species found in anchialine ponds. Based on the evidence, he thinks that the shrimps' habitat is much broader than is commonly thought. Instead of occuring only in association with a scattering of anchialine ponds and their porous substrates, Maciolek hypothesizes that "the shrimps could occur in the groundwaters of many . . . islands where they have not yet been found, in shallow reefs and seamounts, and possibly in suitable rock of continental shelves." (John A. Maciolek, "Distribution and Biology of Indo-Pacific Insular Hypogeal Shrimps," *Bulletin of Marine Science*, 1983, Vol. 33, No. 3, pp. 606-618.)

   In other words, these shrimp could be hiding out in all kinds of submerged nooks and crannies—reducing the distances between what now seem to be separate populations.

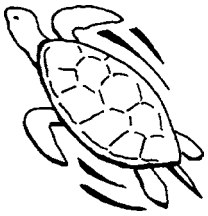
   Dr. Maciolek goes on to say he thinks the distribution would be restricted by water temperature. There is evidence to suggest that the shrimp do not survive in water colder than 20° C. In the tropics, that generally means that the shrimp could survive in waters no deeper than 100 m (328 ft).

   Do you think Dr. Johan Maciolek offers a reasonable hypothesis? Why or why not?



2) State the hypothesis you or your group developed during class and compare it to Dr. Maciolek's hypothesis.

3) If this were the year 2100 and you could test Dr. Maciolek's hypothesis with new types of equipment, including miniaturized robots, how would you test it?



4) Assuming that you were unable to look directly for shrimp in underwater rock crevices, how would you study the shrimp themselves to determine whether the shrimp would be physiologically able to live in these underwater habitats? Keep in mind that these underwater habitats would have the consistent salinity of sea water and may be darker or cooler than exposed or near-surface waters depending on their depth.