

## Future food depends on ecosystem-based agriculture

Jen Fela

To provide enough food for a projected world population of 9 billion by 2050, planners and policy makers must focus on supporting healthy ecosystems, according to a report released in late August by the United Nations Environment Programme (UNEP; Nairobi, Kenya) and the International Water Management Institute (IWMI; Colombo, Sri Lanka), in cooperation with 19 additional organizations. The report, *Ecosystems for Water and Food Security* ([www.unep.org/pdf/dep-ecosystems-food-secur.pdf](http://www.unep.org/pdf/dep-ecosystems-food-secur.pdf)), addresses the need to “produce approximately 70% more food [by 2050] to cope with growing population and dietary changes” and the “paradox of having to grow more food with less water”, as written in the foreword by Colin Chartres, IWMI Director General.

Eline Boelee, Senior Researcher of Water and Health at IWMI and Scientific Editor of the report, says “Our publication brings authors from the environmental sector together with agricultural scientists in all disciplines (crop, livestock, aquaculture, and agroforestry) to produce a coherent message. Where other publications have focused on water and environment, food and water, or environment and food, our document focuses on the three-way interdependence [among] ecosystems, water, and food security, demonstrating how ecosystem management can be improved to ensure water availability and avoid future food crises.”

Boelee continues, “Agriculture needs to change to provide food security in the long term without degrading its own resource base – to grow food and

encourage healthy, natural and agricultural ecosystems. In a farming context, nature essentially supports nurture (for example, with pollination, soil health, water quality, and biodiversity). We need to think about ecosystems plus (not versus) agriculture, or conservation plus (not versus) cultivation.”

The report contains specific recommendations to encourage and sustain the health of farmland, drylands, wetlands, fisheries, and livestock systems, including planting diverse crops and species of trees on farmland that will ensure soil health and conserve water; managing the collection of rainfall and runoff; and educating people on appropriate livestock-grazing practices – even children, who in many parts of the world are responsible for this task.

Directed toward policy makers and mid-level professionals, the report will “help them take up their responsibility in enhancing food security in a sustainable way”, says Boelee. “The sooner people start managing agro-ecosystems, the higher the chance for success in reducing degradation and enhancing production and productivity.” ■

## A fish out of water: adapting to life on land

Jane Bradbury

A field study that quantifies the behavior of the Pacific leaping blenny (*Alticus arnoldorum*), a largely terrestrial fish, provides new insights into some of the adaptations that may have been necessary for the colonization of land by aquatic creatures in the late Devonian period. “Our study gives us a glimpse into the past”, says Tonia Hsieh (Temple University, Philadelphia, PA), “and can help us understand one of the most critical ecological transitions that vertebrates had to make during evolution”.

The Pacific leaping blenny is a small marine fish (3–5 cm in length) that lives along rocky coastlines in Micronesia, including the island of Guam. Although the fish needs to stay moist to enable it to breathe through its skin, it is almost entirely terrestrial and is extremely agile on land, where



A female *Alticus* perched on a rock above water.

it uses a combination of tail-twisting and expanded pectoral and tail fins to move.

During their investigation, Hsieh and behavioral scientist Terry Ord (University of New South Wales, Kensington, Australia) made detailed observations of the abundance, behavior, and morphology of *A. arnoldorum* on the eastern side of Guam during the breeding season (*Ethology* 2011; doi:10.1111/j.1439-0310.2011.01949.x). The researchers report that the blennies – despite eating and breeding on land, and defend-

ing terrestrial territories as part of a complex social behavior – were heavily constrained by the tidal cycle and temperature. “Even though these fish spend their whole adult life on land, they are still very tightly connected with the aquatic realm”, explains Hsieh, “and are only active during a brief period at mid-tide”.

“This well-conducted study quantifies aspects of the terrestrial behavior of *A. arnoldorum* in a way that has not been done before”, comments intertidal fish researcher John Green of Memorial University (St John’s, Newfoundland and Labrador, Canada), “but probably adds little to our knowledge of the role of ecology in evolution”. Both Green and Hsieh note, however, that comparative studies of members of the family Blenniidae that exhibit different degrees of “terrestriality” and that live around Guam have the potential to reveal fundamental insights into the transition of vertebrates from water to land. ■