BIOLOGY

Shrinking sheep

A. OZGUL / © SCIENCE/AAAS

Science doi:10.1126/science.1173668 (2009)
Wild sheep in Scotland are shrinking in part because of climate change, say scientists. The Soay sheep on the island of Hirta in the St Kilda archipelago have become five per cent smaller on average since 1985, despite evolutionary advantages favouring larger sheep.

Tim Coulson of Imperial College London and colleagues analysed female

sheep's body weights and life histories over the last 24 years on the isolated island, which serves as a simple natural laboratory for environmental change and evolution. They found that although larger lambs with substantial fat supplies had better chances of surviving Hirta's harsh winters, the sheep's average size could not increase because of a counteracting 'young mum' effect: the youngest ewes bore lambs smaller than they themselves had been at birth. On top of that, more spindly lambs have been making it through to adulthood — probably because winters on Hirta have become shorter and milder, say the authors.

As warming has lifted selection pressure, population density has risen, leaving less grass to go around and lowering growth rates and body weights. The findings shed light on how climate change can play a role in altering animals' traits over a very short time.

Anna Barnett

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previously proposed that GPS data could potentially be used as a universal correction method for tide-gauge data. Now they have used GPS data collected from 227 global stations over a ten-year period to adjust global estimates of sea level rise. Their modified estimate of global mean sea level rise over the last century — 1.61 millimetres per year — is in good agreement with the most recent estimates made from altimetry and gravity observations. The scatter associated with regionally averaged trends is significantly reduced, however, when changes in land elevation are taken into account.

The authors say that their geodetic approach can be used to considerably improve estimates of sea level rise.

Anna Armstrong

CRYOSPHERE

Thin times for Arctic

NASA

J. Geophys. Res. **114**, C07005 (2009)
Thin sea ice is becoming increasingly common in the Arctic Ocean, according to the most comprehensive satellite survey of the region yet. The findings add to the slew of evidence that Arctic sea ice is rapidly shrinking in all dimensions.

A research team led by Ron Kwok of NASA's Jet Propulsion Laboratory in

ATMOSPHERIC SCIENCE

Bridging the gap

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A one-year gap in the middle of the record perturbs the trend more than a one-year gap at the beginning of the record, for example. Despite this variability, a gap of any length, anywhere in the record, prevents comparison of data collected before and after the gap because of potential calibration shifts, lengthening the time required to detect trends.

The researchers suggest that an overlap of at least six months between successive instruments is needed to avoid the adverse effects of gaps in the radiation record.

Anna Armstrong

OCEAN SCIENCE

Gauging elevation

Geophys. Res. Lett. **36**, L12607 (2009)

A new study verifies the merit of using Global Positioning System (GPS) data to reduce uncertainty in measuring sea level rise. Most estimates of sea level rise over the past century are based on long tide-gauge records, which must be corrected for the vertical displacement of land from sedimentation and other causes. In the past, a variety of correction methods have been tried, yielding estimates with a range of one to three millimetres per year.

Guy Wöppelmann of the University of La Rochelle, France, and colleagues

J. Geophys. Res.-Atmos.

doi:10.1029/2008JD011183 (2009)

Cloud-climate feedbacks are a major source of uncertainty in climate change projections. Satellites can monitor how clouds affect Earth's overall energy balance. But gaps in the data set owing to instrument failure substantially increase the amount of time needed to detect trends, finds a new study.

Norman Loeb of the NASA Langley Research Center in Virginia and colleagues simulated a 30-year record of cloud radiative effects — based on five years of satellite observations — and examined the impact of data gaps on the ability to detect long-term trends above natural variability. They show that the extent to which a data gap distorts trends depends on its positioning and length.

Pasadena, California, estimated changes in the thickness and volume of the Arctic's perennial blanket of sea ice over a five-year period. Their analysis of data collected by the space agency's Ice, Cloud and land Elevation Satellite (ICESat) reveals that between 2003 and 2008, Arctic multi-year sea ice thinned by about seven inches a year. Over this period, the total area covered by multi-year ice also shrank to just 42 per cent of its former size. The overall area of sea ice lost is equal in size to Alaska's entire land surface.

The changes are so dramatic that seasonal ice, averaging six feet in thickness, now constitutes a greater proportion of Arctic sea ice than the typically chunkier multi-year ice, which usually approaches nine feet in thickness.

Olive Heffernan

BIODIVERSITY AND ECOLOGY

Expanding ain't easy

JASON DZURISIN

Proc. Natl Acad. Sci. USA **106**, 11160–11165 (2009)
It is often assumed that species will shift their populations poleward as temperatures rise with climate change. Now a study has tested this hypothesis for two butterflies, *Erynnis propertius* and *Papilio zelicaon*, that have an overlapping coastal distribution in North America.

A team of researchers led by Jessica Hellmann at the University of Notre Dame in Indiana switched a central population of each species with a peripheral, poleward population of the same species. For each translocation, they tested whether host plants and local climate would affect range expansion. While the peripheral population of *E. propertius* thrived in the relatively high summer temperatures of the central location, this benefit was probably negated by the extra energy expended under warmer winter conditions, found the researchers. In contrast, translocated peripheral populations of *P. zelicaon* suffered under the relatively high summer temperatures. The ability of the species to shift their populations poleward was hampered by the availability and suitability of host plants.

The study suggests that enhancing peripheral populations is unlikely to facilitate simple poleward range shifts, at least for these two butterfly species. The findings have important implications for efforts to conserve species affected by climate change.

Olive Heffernan

BIODIVERSITY AND ECOLOGY

Small story

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Proc. Natl Acad. Sci. USA

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Aquatic creatures ranging from fish to phytoplankton become smaller as their watery environments warm, scientists report. In rivers and oceans, dwindling body sizes may be as common a response to climate change as migration to higher latitudes and shifting seasonal life cycles.

Martin Daufresne and colleagues at Cemagref in France analyzed reports of fish body size in French rivers and northern oceans for the past three decades. Not only were fish communities increasingly made up of smaller species, but in the French rivers, fish of the same species were about 50 per cent smaller than twenty years ago. The team ruled out commercial fishing as the sole cause of the shrinking trend, noting that the freshwater areas studied have not been heavily fished. They also found that warming affects the size of even the tiniest aquatic denizens, the zooplankton, phytoplankton and bacteria that form the base of the food web. After being kept at higher temperatures in lab experiments, these organisms tended to be smaller than their counterparts living in cooler waters.

The researchers have not been able to pinpoint the link between warming and smaller body size, but they suggest that temperature may be affecting organisms' size by influencing their metabolism.

Alicia Newton

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