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Spotlight on Science at the Smithsonian

Bi-Weekly Newsletter | Vol. 4, No. 13 | 30 June 2006

- Introduction from Dr. David Evans, Smithsonian Under Secretary for Science

- Neptune-like Planets May Be Common

- New Information from Old Drawings

- Tigers Born at the National Zoo

- Túngara Frog Vocal Anatomy

- Print, Podcast, Download MP3

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Spotlight on Science at the Smithsonian is a bi-weekly electronic newsletter about Science at the Smithsonian. It is produced for the Smithsonian community by the Office of the Under Secretary for Science. To subscribe to the newsletter or Podcast, visit science.si.edu.

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Introduction from the Under Secretary for Science

In this installment of Spotlight on Science, we look at the research of an astronomer from the Center for Astrophysics. He is part of an international team which has discovered a Neptune-sized planet orbiting a star nine thousand light-years from Earth. This is significant because most planets discovered orbiting other stars have been significantly larger. Next, a researcher from the National Museum of Natural History has been studying pencil drawings from a Spanish expedition in the late 18th century. Two of the four drawings probably represent species that are now extinct and otherwise unknown. We'll then take a look at the third litter of tigers to be born at the National Zoological Park. Finally, researchers from the Smithsonian Tropical Research Institute are studying the mating calls of Túngara frogs. These small, bumpy-skinned frogs make a long frequency whine, followed by up to seven short chucks.

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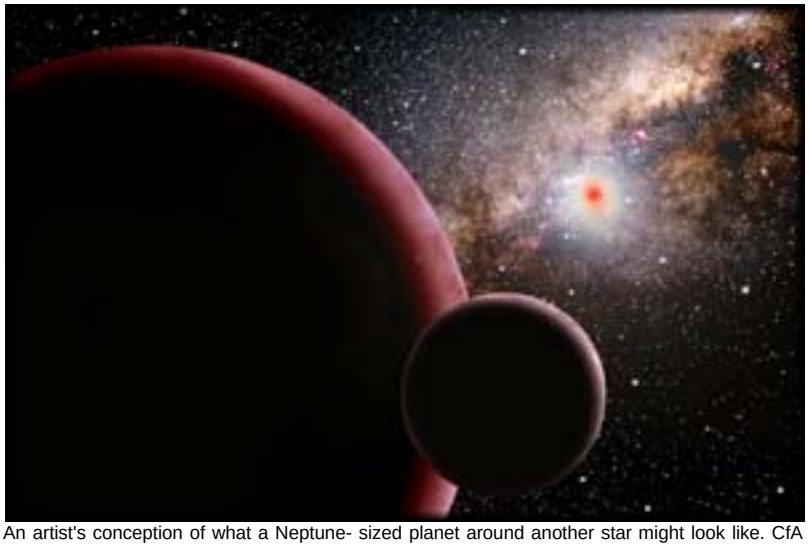

An artist's conception of what a Neptune- sized planet around another star might look like. CfA astronomer Scott Gaudi and his colleagues have just published their discovery of a Neptune-sized planet orbiting a smallish star about nine thousand light-years from Earth.

Neptune-like Planets May Be Common

Reference

A. Gould et al., "Microlensing OGLE-2005-BLG-169 Implies that Cool Neptune-Like Planets are Common" (2006), *The Astrophysical Journal Letters*, 644, L37.

Over 150 planets are now known to orbit stars other than our Sun. Most of these extrasolar planets are Jupiter-sized and lie close to their star, within about one astronomical unit (one "AU" corresponds to the mean distance of the Earth from the Sun), in part because the common discovery techniques are most sensitive to these planets and orbits. There are only a few known Neptune-sized extrasolar planets, the mass of Neptune being about 5% of the mass of Jupiter. Like most other extrasolar planets they lie much closer to their star than Neptune does to the Sun (a mean distance of 30 AU) or even than Jupiter does (a mean distance of 5 AU). Astronomers are trying to determine to what extent, if any, our solar system is unusual in the sizes and placements of its planets, and so they have been searching for smaller extrasolar planets located more than a few AU away from their stars.

An international team of thirty-six astronomers including CfA astronomer Scott Gaudi has just published its discovery of a Neptune-sized planet orbiting a smallish star about nine thousand light-years from Earth. These scientists made their discovery by taking advantage of a feature of gravity predicted by Einstein: if distant starlight traveling toward Earth happens to pass by an intervening star, the mass of that intervening star can act as a "gravitational lens," bending the light's path to refocus (although in a distorted way) the image of the more distant object. When the so-called "lensing star" is not alone but has a companion planet, the nature of this distortion is slightly modified in a predictable way. The team had previously identified a set of lensing stars, and when one of them began to brighten as normal stellar motions brought it into alignment with the more distant object, the team began a careful program to monitor the light flux. They discovered that the lensing star was orbited by a planet of mass about thirteen Earth-masses, slightly less than Neptune's, and located about 2.7 AU from the star. A statistical analysis based on their discovery suggests that Neptune-sized planets are probably very common. Although the results do not allow any conclusions to be drawn about extrasolar Earths, the discovery is a step in the direction of finding more small planets at distances from their star comparable to the distances we see for planets in our solar system.

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Pencil drawings made on a Spanish expedition in 1793 have allowed the identification of two now extinct species.

New Information from Old Drawings

In the past few decades, evidence of many new species of extinct birds has been found on islands of the Pacific and elsewhere. Usually this is in the form of bones found in fossil and archeological deposits, but in a recently published paper, Storrs Olson of the Museum of Natural History, has shown that two of four pencil drawings made on a Spanish expedition that stopped at Vava'u. Kingdom of Tonga, in 1793 probably represents species that are now extinct and otherwise unknown.

The Spanish voyage known as the Malaspina expedition, sailed around the world in the 1780s. Upon returning to Spain, however Malaspina fell into disfavor and all documents from the expedition were locked up and it was forbidden to mention the expedition in print. In recent years, however, documents from this expedition have become available for study.

Dr. Olson examined four drawings from the expedition and found that while two of the sketches clearly represented common species that still occur on Vava'u, the other two did not seem to fit with any existing species. One of these was rail, probably flightless and related to a flightless rail recently described from bones from 'Eua, Tonga, but because the islands were never attached, they would be expected to have different species of flightless birds.

More exciting was the sketch of a parrot that was described as "all green," quite unlike the beautiful multicolored parakeet known in Tonga today. But once again the fossil record holds a clue to what this drawing may represent as a new species of *Eclectus* parrot has just been described from the bones from 'Eua and two other Tongan islands. The living *Eclectus* parrot occurs no further east than the Solomon Islands but is renowned for its extreme sexual differences in color. The females are nearly all red, whereas the males are nearly all green. They were originally thought to be different species. So the bird sketched on the Malaspina expedition is likely to have been the male of the extinct species just described from the bones, suggesting that the rail and the parrot persisted in Tonga until at least the end of the 18th century.

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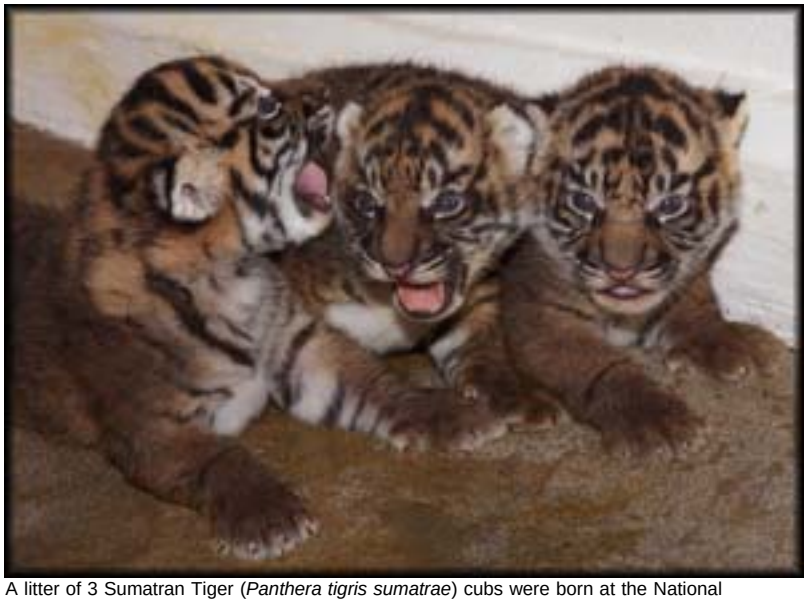

A litter of 3 Sumatran Tiger (*Panthera tigris sumatrae*) cubs were born at the National Zoo.

Tigers Born at the National Zoo

On May 24, 2006 a litter of 3 Sumatran Tiger (*Panthera tigris sumatrae*) cubs were born at the National Zoo. The parents are Rokan, a male who was born on September 6, 1990 at the San Antonio Zoo and Soyono, who was born at the National Zoo on June 14, 1993. This is the third litter born to the pair. At the cub's first physical exam on June 8, it was learned that the litter consists of one 6.8 lb. male and two females, 5.8 and 4.8 lbs. As adults, Sumatran tigers range in weight between 165-242 pounds for females and 220-310 pounds for males. The cubs will make their exhibit debut in several months. Previous litters have left the zoo to participate in the Sumatran Tiger Species Survival Plan.

Tigers are generally solitary. Females live with their cubs for the first two years of life. Male and female tigers come together only to mate. After a gestation of 100-112 days, blind, helpless cubs who weigh about 2 lbs are born. Cubs are generally nursed for about six months. Females have a litter of 2-3 cubs every two years.

Sumatran tigers are listed as endangered on the U.S. Endangered Species List. There are only about 500 left in the wild. The Zoo participates in conservation efforts with the Save the Tiger Fund. Tigers are the largest member of the cat family and the largest carnivorous land mammal. Tigers are the top predator in the areas where they live. Top predators keep prey populations in check, which is essential for maintaining a balance between herbivores and the vegetation that they eat. The loss of the top carnivore can be devastating to the ecosystem. Securing their future is a key component of maintaining biodiversity in these regions.

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A male Túngara frog (*Physalaemus pustulosus*) calling to mate.

Túngara Frog Vocal Anatomy

Animals use many special techniques to attract mates. Túngara frogs (*Physalaemus pustulosus*) are small, bumpy-skinned frogs that produce a characteristic mating call. These calls consist of a long frequency whine that may be followed by up to seven short chucks. Females prefer to mate with males who use a more complex call.

Túngara frogs have a unique structure on their vocal cords. This fibrous mass determines whether the male produces the chuck sound in addition to the whine.

To determine if the chuck sound is produced by the mass, Smithsonian Tropical Research Institute scientists surgically removed the mass and compared the amplitude and frequency of their calls to pre-surgery calls. They found that with removal of the structure, the chuck sound is eliminated. In addition, frogs without the mass still try to produce the sound, but cannot. They have recently published their findings in a report in *Nature* describing the vocal anatomy that allows the frogs to produce these calls.

Reference

M. Gridi-Papp, A.S. Rand, and M.J. Ryan, “Complex call production in the tungara frog” (2006), *Nature*, Vol. 441.

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