huemul population through translocation and habitat restoration with both exotic and native species. Management activities are urgent because random events as environmental catastrophe and genetic drift could have this time irreversible results.

Acknowledgements

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Huemul *(Hippocamelus bisulcus*) ecology research: conservation planning in Chilean Patagonia

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Resumen

El huemul (*Hippocamelus bisulcus*) es una especie que habita el sur de la cordillera de los Andes de Chile y Argentina. Se encuentra actualmente en peligro de extinción (IUCN) y su población se estima en menos de 1000 individuos en grupos aislados y fragmentados. En Chile, el huemul se encuentra protegido en 13 Parques y Reservas Nacionales, manejadas por la Corporación Nacional Forestal (CONAF). La conservación del huemul es prioridad para CONAF, sin embargo su protección se considera inadecuada debido al pequeño tamaño de las áreas protegidas y a su baja conectividad. Las principales amenazas para la especie son: pérdida y alteración de los hábitats naturales por incendios forestales, tala de bosques y ganadería, caza furtiva y predación por perros, enfermedades trasmitidas por ganado doméstico y predación natural por puma (*Puma concolor*).

El año 2000, con financiamiento de la Iniciativa Darwin, comenzó este proyecto de tres años. El objetivo principal fue abordar algunos aspectos de la ecología del huemul. Se seleccionaron tres sitios de estudio y se capturaron diecisiete animales (10 machos y 7 hembras) los cuales fueron marcados con radio collares durante este período. Se ha recolectado información sobre patrones de movimientos, ámbito de hogar, mortalidad y uso de hábitat.

Introduction and status

The huemul (*Hippocamelus bisulcus*) inhabits the southern Andes of Chile and Argentina (Figure 1). Historical accounts suggest that huemul were abundant between Central Chile (34° S) and the Magellan Strait (54° S) but now the geographical range has become reduced and fragmented, and the species is classified as endangered (Wemmer at al 1998). Huemul are now protected in 13 Chilean National Parks and Reserves, which are managed by CONAF (National Forest Service). Conservation of the huemul is considered a high priority for CONAF, but there are concerns that protection is inadequate, due to insufficient habitat within the protected areas and poor connectivity among them. The main threats to the species are: habitat loss and degradation due to forest fires (mainly during the 1930-40's), logging and farming, diseases from livestock, poaching, disturbance and predation by domestic dogs, as well as natural predation by puma (*Puma concolor*).

In 2000, a three-year project funded by the Darwin Initiative was started. The project was developed jointly between CONAF, Raleigh International, the Forest Research Agency, the Macaulay Institute and the Universidad Católica de Chile, (with support from the Wellcome Trust). The main emphasis of the project was to obtain information on the ranging behaviour of huemul, particularly in relation to the two main land uses in the area, logging and livestock grazing. In addition, we wanted to develop capture and handling methods for huemul and obtain preliminary information on survival rates and sources of mortality. We also promoted

Figure1. Adult huemul at Tamango National Reserve, Chile (Photography by C. Galaz).

environmental education and huemul conservation issues in schools and local communities.

Methods

Three study sites were used for the project. One protected area, Tamango National Reserve (47° 11'S, 72° 29'W), with an area of 6,925 ha and two unprotected areas, La Baguala (47° 08'S, 72° 12'W; 1,600 ha) and Candonga (46° 14'S, 72° 26'W; 1,300 ha), providing opportunities to assess the effects of logging and livestock. The animals were captured by darting using anaesthetic drugs. As a result of trying different protocols, a combination of Medetomidine and Ketamine, reversed with Atipamezole proved the most satisfactory. During each capture, samples were taken for genetic analyses, and to assess condition of the animals (blood, tissue, faeces, and hair). Seventeen animals were captured and fitted with radio-collars (14 VHF, 2 GPS, and 1 satellite transmitter). We also established pellet count transects, and vegetation plots for plant composition and coverage.

Results

We found that adult huemul have a relatively small and stable home range, and usually associate in small groups. For those individuals which did not undertake long-distance movements (the majority), mean home range area was approximately 400 ha. Analysis of habitat selection revealed a preference for lenga (*Nothofagus pumilio*) forest and rocky cliffs, and avoidance of grassland and steppe.

Previous observations have suggested that huemul make altitudinal migrations, moving up slope in summer and down in winter. However only some of the radio-collared animals in our study areas made such movements, revealing considerable differences between individuals, but a tendency for greater movement in some sites than others. Most animals made only relatively small seasonal movements (if at all) indicating that year-round habitat needs are normally met within a relatively small and stable home range.

Animals were found to be affected by logging operations, in one case making a long distance (9 km) movement to avoid disturbance. Huemul also tended to avoided areas grazed by livestock.

Several deaths of marked animals occurred during the study, from a variety of causes. Taking account of known births and deaths to marked animals, the net rate of increase was only 0.98, suggesting that populations were barely able to maintain their numbers. Given that most of marked animals were living in protected areas, this is not encouraging. The low rate of growth was due to a combination of mortality to both fawns and adult females. The causes of death included puma predation (2 cases on adults), fox (*Pseudalopex culpaeus*) predation on fawns (4cases), drowning (1 collared deer), poaching (1case), and attack by dogs (3cases on adults). We did not find evidence that huemul are affected significantly by infections or parasitic diseases,

including those typical of domestic livestock.

During the project attacks or chases by dogs were observed on two occasions and we received many anecdotal reports of similar attacks to huemul in the region. It is believed that many instances of poaching are motivated by the need to feed dogs owned by subsistence livestock farmers.

In addition to ecological research on huemul, the project was also involved in publicity and education, to raise awareness of the need for conservation of the species. Talks were given to farmers, forestry companies and schools, as well as radio and television programs and support given to sponsored events. The project has attracted interest from political leaders, particularly following publicity over the illegal killing of one of the radio-collared animals by a local farmer.

Final Conference

The end of the project was marked by a conference, presenting the results obtained from field research. The workshop involved 50 participants from different countries and was held in Cochrane (Aysén Region, Chile), in October 2003. The abstracts and presentations hold at the conference are available in English and Spanish in a CD. For information please contact Cristián Saucedo.

Conclusions & Recommendations

This project has developed methods of capture for huemul which will prove useful for future research projects and possible re-introduction programs, in areas where huemul have become scarce or locally extinct.

The little information we have on population dynamics suggests that huemul numbers are limited by a combination of high adult and juvenile mortality. Clearly, efforts to reduce illegal hunting through public education programmes need to continue. In the meantime, more evidence for causes of fawn mortality needs to be sought.

Huemul occur at low densities in all environments in Region XI, and adult home ranges are relatively small and stable. This suggests that effective breeding sizes may be low, unless augmented by occasional immigration. Conservation planning is needed to identify and if possible maintain corridors to reduce the risk of isolation in the future.

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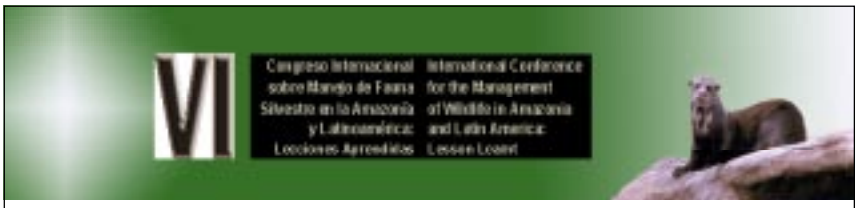

La Universidad Nacional de la Amazonía Peruana (UNAP), el Durrell Institute of Conservation and Ecology (DICE) de la University of Kent, Canterbury y la Wildlife Conservation Society (WCS) se sienten muy complacidos de anunciarles la realización del VI Congreso Internacional sobre Manejo de Fauna Silvestre en la Amazonía y Latinoamérica. El mismo, a llevarse a cabo entre el 05 al 10 de setiembre del 2004 en la ciudad de Iquitos, capital Amazónica del Perú.

En tal sentido, los organizadores de este VI Congreso les dan la mas cordial bienvenida invitándoles a participar de este gran evento que cada vez va creciendo en número de participantes y en calidad.

Durante este congreso se pondrá especial énfasis en la presentación de lecciones aprendidas. Es por ello, que las áreas temáticas deberán incidir en las lecciones aprendidas, para poder ser aplicadas según cada caso. Es decir, se dará oportunidad de presentar y discutir los logros alcanzados a la fecha sobre las acciones de manejo de fauna silvestre y en base a las lecciones aprendidas poder aplicarlas en el diseño, formulación, implementación, evaluación de metodologías y de planes de manejo de fauna silvestre.

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